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Technical Basis for Chemistry Control Program

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Technical Basis for Chemistry Control Program

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EXECUTIVE SUMMARY

This report documents the evaluations was undertaken to establish the sampling and analysis requirements for the Double-Shell Tank (DST) waste based on a review of the chemical composition of the waste, mechanisms for chemistry change, and operations and waste transfers in the tanks. A sampling schedule for the DST waste has been established previously and is documented in the Technical Sampling Basis – Waste Information Requirements Document (TSB-WIRD). However, the TSB-WIRD was based on programmatic drivers for the collection of waste samples rather than on the specific needs of a chemistry control program. The focus of this evaluation is to ensure that the sampling requirements of the TSB-WIRD meet the needs of the DST chemistry control program defined in Tank Farms Technical Safety Requirements (TSR) Administrative Control (AC) 5.15, and to provide adjustments, if necessary, to those sampling requirements to account for known mechanisms for changes in chemistry of the tanks.

DST waste composition data for nitrite, nitrate, and hydroxide was compiled from sample data and best basis liquid composition data extracted from the Tank Waste Information Network System (TWINS) database. Operations in the tanks up to January 1, 2001, were reviewed. Three free hydroxide depletion models were used to predict the future tank liquid hydroxide concentration over the next five year period and trend historical sample results where possible. This data was used as the method to provide priority to the sampling requirements provided in the TSB-WIRD. The effort looked at identifying those tanks that could become caustic deficient prior to the next scheduled tank specific sampling event, and recommended appropriate actions for those tanks that may not comply with the waste chemistry limits defined in AC 5.15. .

The evaluation validated previous findings that tanks 241-AN-102, 241-AN-107, 241-AY-101, and 241-AY-102 should be currently under corrosion control surveillance and corrective actions. It was projected that tank 241-AN-106 could already be caustic deficient and it is recommended that the sample scheduled for June 2001 be given a high priority designation. Free hydroxide predictions for tanks 241-AW-104 and 241-AW-105 were shown to be of concern and are not currently scheduled to be sampled in fiscal year (FY) 2001. It is recommended that the caustic concentration in these two tanks be adjusted as the preferred action rather than sampled this fiscal year. It is projected that tanks 241-AP-108 and 241-AZ-102 could become

hydroxide deficient in two years and tank 241-AW-102 in the next three years. It is also projected that tank 241-AP-103 could become caustic deficient in the next three years. Based on current analyses, the sampling of tank 241-AP-103 is recommended prior to 2005 (i.e., in FY 2004) based on the mean concentration values or a year earlier based on the 95% lower limit concentrations. The sampling of tank 241-AP-103 could be postponed if the caustic concentration in the tank is adjusted either by planned waste transfer or caustic addition. All other DSTs were found to remain compliant with the chemistry control limits of AC 5.15, under the then current conditions, for at least the next five years.

The current TSB-WIRD sampling schedule, including other programmatic needs, will not satisfy the needs and requirements for the Chemistry Control Program. An adjustment to the sampling schedule has been developed and will be incorporated into the next annual update of the TSB-WIRD. Actions for this fiscal year are being negotiated with the Characterization Program Office.

This report will be updated at least annually to ensure the sampling and analysis requirements for the DST waste as contained in the TSB-WIRD continue to meet the needs of the Chemistry Control Program.

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LIST OF ACRONYMS

AC	Administrative Control
ALARA	As low as reasonably achievable
AWF	Aging Waste Facility
CC	Complexant Concentrate Waste
CP	Concentrated Phosphate Waste
DC	Dilute Complexed Waste
DN	Dilute supernatant
DOE	Department of Energy
DSS	Double shell slurry
DSSF	Double shell slurry feed
DST	double shell tank
FY	Fiscal Year
Gal	Gallon
NCAW	Neutralized Current Acid Waste
%	Percent
SRL	Savannah River Laboratory
SST	single-shell tank
TSB-WIRD	Technical Sampling Basis and Waste Information Requirements Document
TSR	Technical Safety Requirements
TWINS	Tank Waste Information Network System

1.0 INTRODUCTION

Administrative Control 5.15, "Chemistry Control Program," of the Tank Farm Technical Safety Requirements, HNF-SD-WM-TSR-006, implements a program to maintain and control double-shell tank (DST) waste chemistry to minimize corrosion of the primary tank. One element of this program is to verify the waste remains in compliance with the waste corrosion concentration limits to ensuring the waste containment integrity of the DSTs. This verification requires waste sampling occur at a frequency dictated by the changes occurring in the waste. For this document the term DST includes the Aging Waste Facility (AWF) tanks for waste chemistry limits for corrosion control apply to all DSTs.

As part of the DST Chemistry Control Program, periodic assessments of the nitrite, nitrate, and hydroxide concentrations are necessary to ensure that the waste within the DSTs stays within the established chemistry control limits of AC 5.15. This assessment includes predicting the caustic consumption rate of the wastes. When predictions indicate that waste compositions are approaching the chemistry control limits, administrative actions are necessary to ensure continued compliance. Planning of sampling frequencies for each DST is one method of monitoring waste chemistry.

The original corrosion control and the associated waste composition specifications for DSTs were based on Savannah River Laboratory (SRL) stress corrosion cracking investigations (RHO 1982). The SRL studies determined that the corrosion of low carbon steels was dependent on nitrite, nitrate, and hydroxide ion concentrations. The addition of minor constituents, such as carbonate, phosphate, sulfate, silicate, fluoride, or chloride in low concentrations were found to have little effect on corrosion potential.

Findings in 1980 showed that the available corrosion data did not adequately portray all wastes proposed for storage in the DSTs. At that time, an experimental data development task was undertaken to provide the necessary corrosion data to define safe and acceptable operating specifications for the DSTs. This experimental data development task consisted of several thousand corrosion coupon tests performed by Pacific Northwest Laboratory (now Pacific Northwest National Laboratory). All the coupon tests were performed in simulated waste compositions consistent with the waste chemistry specifications. The results of these coupon tests (RHO 1984, PNL 1985) showed that for temperatures within the normal DST operating range (at or below 100 °C), no corrosion rates were observed above the design limits and there was no stress corrosion cracking observed. In general, corrosion outside the design limits was observed in very dilute nitrite and hydroxide solutions, and in concentrated hydroxide solutions at high temperatures. Stress corrosion cracking was observed only on highly stressed U-bend coupons in solutions with high nitrate and low hydroxide concentrations and in solutions that were high in hydroxide concentrations at elevated temperatures. Supplemental work in 1994 identified that even at low nitrate concentrations, some presence of nitrite was important to protect against pitting and stress corrosion cracking (PNL 1994). The results of these tests and tests performed at the Savannah River Laboratory (Ondrejcin 1978) form the technical basis for the DST corrosion control requirements. In 1994, a corrosivity factor, within the compositional limits indicated by the corrosion specifications, was developed (Anantatmula et al. 1994) to

verify if a given DST waste is benign or aggressive toward the carbon steel containment. This factor was subsequently included in the corrosion specifications.

In 1992, Savannah River Laboratory developed correlations (Zapp and Hobbs 1992), based on experimental studies, between nitrate and nitrite concentrations to inhibit pitting corrosion in carbon steel exposed to dilute radioactive waste slurries. The 1994 report by Anantatmula et al., on single-shell tank corrosion concluded that Microbiologically Induced Corrosion is not a viable mechanism for Hanford waste tanks. In 1996, laboratory tests at the Hanford Site (Anantatmula 1996) indicated that waterline corrosion might not be a viable corrosion mechanism for the DST wastes. In 1997, the Department of Energy (DOE) issued guidelines for the development of structural integrity programs for high-level waste storage tanks (BNL 1997). These guidelines provided information on significant corrosion based mechanisms for degradation of the tank steel liners. Five potentially significant mechanisms were identified:

- General Corrosion (Bulk, Uniform)
- Pitting/Crevice corrosion
- Stress Corrosion Cracking
- Microbiologically Induced Corrosion
- Concentration Cell/Waterline Corrosion

The DST waste chemistry specifications were developed to protect against general corrosion, pitting corrosion and stress corrosion cracking.. In addition, these specifications are consistent with the guidance for protection against pitting/crevice corrosion provided by BNL (1997). It is noted that crevice corrosion is of concern in conditions where settled solids create a stagnant condition that potentially allow localized high corrosion rates to occur.

2.0 PURPOSE

The purpose of this evaluation is to establish sampling and analysis requirements for DST waste to ensure continued adherence to the waste chemistry limits provided in the AC 5.15, Chemistry Control Program. The sampling requirements are based on a review of chemical composition, mechanisms for chemistry changes, and operations in the tanks.

3.0 APPROACH

The approach undertaken to determine the DST sampling schedule changes needed to ensure compliance with AC 5.15 is comprised of three steps. The first step was to query the Tank Waste Information Network System (TWINS) database that tracks the nitrite, nitrate, and hydroxide liquid phase concentrations in all the DSTs. The second step was to input this analytical and process knowledge information into a spreadsheet that baselines the sample data and chemical constituents to the sample date and forecasts the projected hydroxide concentration based on predicting analytical models. The third was to assess the information summarized in the spreadsheet against a sampling criteria and compare the currently planned DST sampling schedule with the bounding case (95% lower confidence interval concentration) from applying the hydroxide consumption prediction models. From this assessment, sampling recommendations were formulated based on a ranking criteria.

3.1 SOURCE OF DATA

Data used as the basis for the evaluation was extracted from the Tank Characterization Database and Best-Basis Inventory within TWINS.

From the TWINS database, a caustic limits report was generated for the waste liquids (comprised mostly of supernatant constituent values, but in some cases includes the statistical mean of the drainable liquids). This report lists the nitrite, nitrate, hydroxide, Total Organic Carbon, aluminum, specific gravity, liquid volume, sample start date, sample end date, the hydroxide limit (upper and lower limits), nitrite limit (upper and lower limits), nitrate/(hydroxide + nitrite) ratio, and sum of hydroxide and nitrite for all the DSTs. Best-basis inventory data were updated to ensure that the concentrations were current and to ensure that the hydroxide concentration data was based on a sample result that was determined analytically, not calculated from the charge balance. For this evaluation, the hydroxide sample date was assumed to be the same as the sample end date reported in TWINS and this date was used as the base date for the start of the hydroxide depletion calculation. Appendix A contains the summary table that includes this information. If the free hydroxide is a sample result, it is flagged "s" for sample result date. If the result is an inventory calculation, the date is flagged "c" for inventory calculation data.

At low hydroxide concentrations, insufficient free hydroxide exists to enable its reliable measurement by titration due to the presence of interfering ions. Therefore, for those tanks with a pH of less than 12.5 and/or a direct hydroxide ion concentration less than 0.3 M as reported in TWINS, the free hydroxide concentration used for this evaluation was calculated from the reported pH value. At higher hydroxide concentrations, sodium effects the measurement of pH. Therefore, for tanks with pH greater than 12.5, the direct hydroxide measurement report in TWINS was used as the basis of this evaluation.

The TWINS database caustic limits report includes the same information as above for the interstitial liquid of the saltcake and/or sludge in the DSTs. This interstitial liquid is included as supernatant in the report. The total volume of the saltcake/sludge and interstitial liquid is

provided. The concentration of chemicals in the interstitial liquid is assumed the same as the supernatant unless data is available for the solids layer. If the data were available, it was reviewed to ensure that it represented the mean concentration values or was within the 95% lower confidence level concentration as a method of bounding the determinations.

The mean nitrite and nitrate concentrations were used in all the model determinations. A lower bounding limit was not established. The limit values are presented in the Appendix A table. If no value is applicable or available, then NA appears.

All calculations were independently verified.

3.2 MECHANISMS FOR HYDROXIDE DEPLETION

The DST waste chemistry specifications were developed to protect against general corrosion and stress-corrosion cracking. The specifications are based on free nitrate, nitrite, and hydroxide ion concentrations of the liquid phase. Maintaining a minimum specified free hydroxide concentration within the DST waste is central to the chemistry control program. However, the waste contains several sodium salt compounds that undergo chemical reaction during interim storage and thereby consume free hydroxide.

The important chemical reactions for free hydroxide consumption are by absorption of carbon dioxide from forced air ventilation of the tanks, oxidation of sodium salts of organic species, and reaction with hydrated aluminum oxide. These reactions are listed as follows.

$$OH^- + CO_2 \rightarrow HCO_3^- \tag{1}$$

$$HCO_3^- + OH^- \rightarrow CO_3^{-2} + H_2O \tag{2}$$

$$HOCH_2CO_2^- + NO_3^- + OH^- \rightarrow O_2CCO_2^{-2} + NO_2^- + H_2O \tag{3}$$

$$Al(OH)_3 + OH^- \rightarrow Al(OH)_4^- \tag{4}$$

Equations (1) and (2) show the direct absorption of CO_2 from air and subsequent reaction to form bicarbonate and carbonate ions. The rate of the second-order reaction (1) is dependent on the hydroxide concentration of the waste and the ventilation rate of air through the DST, i.e., the CO_2 available for reaction. These reactions continue until steady-state conditions are reached as established by hydroxide, bicarbonate, and carbonate equilibria in solutions and the CO_2 concentrations in air. This steady state occurs at a pH of 10.34 in a water-carbon dioxide-hydroxide system (Pourbaix 1974).

Equation (3) shows consumption of hydroxide ion by oxidation of a sodium salt organic anion. The glycolate ion is oxidized to oxalate ion and the nitrate ion is reduced to nitrite ion. The sodium salts of organic complexants and solvents are oxidized through long sequences of chemical reactions to form volatile compounds as the inorganic oxidants are reduced to form

nitrogen-containing gases and hydrogen. Organic oxidation reactions are much slower than the CO_2 absorption reaction due to the low temperatures of the waste.

Equation (4) shows the dissolution of hydrated aluminum oxide (Gibbsite) sludge by hydroxide ion to form aluminate ion. Equation (5) shows the reaction between aluminate ion and CO_2 to form insoluble Dawsonite sludge.

$$Na^+ + Al(OH)_4^- + CO_2 \rightarrow NaAlCO_3(OH)_2 + H_2O \quad (5)$$

3.3 MODELS FOR EVALUATING TRENDS IN WASTE CHEMISTRY

The consumption of free hydroxide ion from the radioactive liquid waste stored in tanks at the DOE Savannah River Site and the Hanford Site prompted the development of models for calculating the time dependent concentration of free hydroxide ion in the waste.

3.3.1 Absorption of Carbon Dioxide in Waste Tanks

A model for hydroxide depletion due to carbon dioxide absorption was developed from data collected at the Savannah River Site. The model was developed from data collected by Hobbs (1987) and based on washed sludge and washed precipitate that were stored in tanks. Regular measurements were taken of the flow rates of air through the waste tanks, levels of hydroxide and carbonate in the waste solutions, and the carbon dioxide concentrations in the air entering and exiting the waste tank. Measured carbon dioxide absorption in ventilation airflow through the tanks was 40 % to 70 % for pH 12 to pH 14 respectively. Because of significant excess hydroxide at pH 14, the tanks of concern were in the range of pH 12 to pH 13, where approximately 50% of the carbon dioxide was absorbed.

The OH depletion model used for this evaluation is derived as shown below:

$$[OH]_t = [OH]_i - [OH]_r \quad (6)$$

where: $[OH]_t$ is OH concentration (mol/l) at time t
$[OH]_i$ is OH concentration (mol/l) at starting time
$[OH]_r$ is OH concentration (mol/l) depleted by chemical reaction

$[OH]_t = [OH]_i - [(Fr, CO_2 \text{ absorbed/total } CO_2)\ (2 \text{ mol OH consumed/mol } CO_2 \text{ absorbed})$
$(350 \text{ mol } CO_2/10^6 \text{ mol air})(\text{vent rate V, ft}^3\text{/min})\ (1 \text{ mol air/22.4 l})$
$(28.317 \text{ l/ft}^3)(\text{t, days})(1440 \text{ min/day})]/(\text{waste volume, l})$ (7)

$$[OH]_t = [OH]_i - 1.27(Fr, CO_2 \text{ absorbed/total } CO_2)(V, ft^3/min)(t, days)/(\text{waste volume, l}) \quad (8)$$

where: t is reaction time, days
waste volume is tank liquid waste volume, liters
V is nominal tank ventilation rate, ft^3/min
Fr is average fraction CO_2 absorbed (Hobbs 1987) =
$(0.165 (\text{Log } [OH]_i + \text{Log } [OH]_t + 28) - 3.138)/2$

3.3.2 Hydroxide Depletion in Complexed Waste Tanks

At the Hanford Site, the kinetics of hydroxide ion depletion was studied for complexed concentrate waste stored in DSTs 241-AN-102 and 241-AN-107. The studies were based on observations of actual phenomena in the waste. There was no attempt to postulate a reaction mechanism. The studies include any hydroxide consumption by CO_2 absorption, complexant oxidation, and hydrated aluminum oxide reactions. Carothers (2000) developed the below kinetic equation for hydroxide depletion in tank AN-102 based on the first order kinetics equation.

$$[OH]_t = [OH]_i \, e^{-(0.0003t)} \quad (9)$$

where: $[OH]_t$ is OH concentration (mol/l) at time t
$[OH]_i$ is OH concentration (mol/l) at starting time
t is reaction time, days

Reynolds (1989) developed the below kinetic equation for hydroxide depletion in tank 241-AN-107 based on a fit of data to second order kinetics equation.

$$1/[OH]_t = 1/[OH]_i + 4.43E\text{-}04 \ (t, \text{days}) \quad (10)$$

where: $[OH]_t$ is OH concentration (mol/l) at time t
$[OH]_i$ is OH concentration (mol/l) at starting time
t is reaction time, days

3.4 SAMPLING SCHEDULE

A DST waste sampling schedule is developed each year to accommodate several Hanford site programmatic needs and requirements. Sampling priority is negotiated between the programs and reflected in the annual update of the TSB-WIRD. The TSB-WIRD ensures that the planned sampling efforts address all tank waste chemistry programmatic needs and requirements. Table 3-1 lists the current near term schedule in the TSB-WIRD for core and grab sampling and priority ranking of the DSTs (Adams et al 2000). Implementation of AC 5.15, "Chemistry Control Program," requires that sampling of DST waste for nitrite, nitrate, and free hydroxide concentrations be integrated into the sampling schedule.

3.4.1 Criteria for Assigning Chemistry Control Program Sample Priority

The sampling events addressed in the TSB-WIRD (Adams et. al 2000) encompass all the operational and programmatic needs for DST waste characterization information on the Hanford site. Characterization information is required for activities necessary to maintain regulatory compliance, perform operations and maintenance, resolve safety issues, and assist in the evaluations to prepare the waste for disposal.

Tank waste compatibility assessments are performed for waste transfers and subsequent interim storage. The assessment estimates and evaluates the concentrations of key chemicals and radionuclides against an established set of criteria, which include waste chemistry. The waste compatibility assessment uses all available sampling information and sometimes requires interpolation of waste sampling data to bound waste compositions and conditions. It is possible that chemical reactions in the waste since the last sampling, change the waste chemistry. For this reason, waste compatibility assessments bound the tank compositions to assure criteria compliance at the time the waste is transferred. This is done by using the lowest hydroxide value from sampling data or the lower 95% limit of the hydroxide sample mean determination.

Free hydroxide ion is the most rapidly changing waste chemical. The rate of hydroxide depletion by chemical reactions is variable and the method of hydroxide depletion for each DST is not available at this time. Hydroxide depletion is not included in the waste compatibility assessment or the best basis inventory calculations. An updated sample schedule is necessary to confirm waste chemistry and ensure compliance with the DST waste chemistry control limits.

Sample priority for the DST Chemistry Program include the following attributes:

- Time since last DST sampling
- Concentration (average and 95% lower limit confidence level or standard deviation) of free hydroxide ion in liquid at sampling time
- Amount of waste liquid and interstitial liquid in tank
- Estimated time for free hydroxide ion depletion to near waste chemistry limit based on available modeling results
- Future plan(s) for waste tank

Table 3-1. Current Double-Shell Tank Ranking and Near Term Sample Schedule

TANK	RANKING	SAMPLING DATE
AN-101	M	Grab Sample-Jun 09
AN-102	H	Grab Sample-Jun 00 (complete) Grab Sample-Aug 01, Grab Sample-Sep 01, Grab and Core Sample-Sep 02
AN-103	L	Core Sample-Aug 02*, Grab Sample-Mar16
AN-104	L	Core Sample-Nov 02*, Grab Sample-May 09
AN-105	L	Core Sample-Feb 03*, Grab Sample-Dec 13
AN-106	L	Grab Sample-Jun 01
AN-107	H	Grab Sample-Feb 01 (complete) Grab Sample-Jun 01, Grab Sample-Jul 01, Grab and Core Sample-Jun 02
AP-101	L	Grab Sample-Feb 00 (complete) Grab Sample-May 03
AP-102	L	Grab Sample-Feb 01
AP-103	L	None currently planned
AP-104	L	Grab Sample-Mar 03
AP-105	L	Grab Sample-Oct 02
AP-106	L	Grab Sample-Feb 05
AP-107	L	Grab Sample-Sep 01, Grab Sample-May 02, Grab Sample-May 03
AP-108	L	Grab Sample-Oct 02
AW-101	L	Grab Sample-Jun 17
AW-102	L	EVAPORATOR FEED TANK
AW-103	L	Core Sample-Aug 02*
AW-104	M	Core Sample-Feb 05
AW-105	L	None currently planned
AW-106	L	EVAPORATOR RECEIVER TANK
AY-101	H	Grab Sample-Feb 01 Grab Sample-Aug 01 Grab and Core Sample-Mar 02
AY-102	H	Grab Sample-Nov 2000(complete) Grab and Core Sample-Mar 01 Grab Sample-Aug 01 Grab and Core Sample-Feb 02
AZ-101	L	Core Sample-Oct 02*, Core sample-Jun 05
AZ-102	L	Core Sample-Dec 02*
SY-101	L	None currently planned
SY-102	L	Grab Sample-Mar 01
SY-103	L	Grab Sample-Mar 10

* ICD-23 sample. Coordination is needed to achieve needed analysis.

4.0 TANK SPECIFIC FINDINGS

The following is a summary of the assessment of each DST against the sample priority attributes. Additional information on each tank is given in Appendix B on the sample history, estimated depletion time for free hydroxide ion concentration to reach waste chemistry limits, and reprioritization of tank sampling. The time predicted to depletion of the free hydroxide ion concentrations to the limiting value is referenced to March 2001.

Tank 241-AN-101

The Hobbs model predicted the most rapid depletion of free hydroxide ion of the three models. An estimated 15 years of waste storage would be required to deplete the free hydroxide ion to the limiting concentration. Tank AN-101 was grab sampled in September 1995 and April 1998. The current schedule is to grab sample tank 241-AN-101 waste in June 2009.

Tank 241-AN-102

Hydroxide ion depletion trending of October 1994 waste samples was compared to sample results from 1995 and 1998. The Carothers model closely agreed with sample results while the Hobbs and Reynolds estimates gave slightly higher results. The Carothers model was developed from data collected from tank 241-AN-102 and would be expected to give good trending results.

Caustic additions to tank 241-AN-102 are scheduled for August 2001 in order to meet the free hydroxide ion requirement. Grab and core sampling of the waste is planned through September 2002 to confirm that corrosion specification limits have been met. There is no plan to sample tank 241-AN-102 beyond September 2002.

Tank 241-AN-103

The Carothers and Reynolds models predicted that about 25 years of waste storage would be required to deplete the free hydroxide ion to the limiting value. Tank 241-AN-103 was core sampled in September 1996. The current schedule is to core sample waste in August 2002 and grab sample waste in March 2016.

Tank 241-AN-104

The Carothers and Reynolds models predicted that 14 to 20 years of waste storage would be required to deplete the free hydroxide ion to the limiting value. Tank 241-AN-104 was core sampled in August 1996. The current schedule is to core sample waste in November 2002 and grab sample waste in December 2013.

Tank 241-AN-105

The Carothers and Reynolds models predicted that 15 to 18 years of waste storage would be required to deplete the free hydroxide ion to the limiting value. Tank 241-AN-105 was core sampled in June 1996. The current schedule is to core sample waste in February 2003 and grab sample waste in December 2013.

Tank 241-AN-106

The Hobbs model predicted that free hydroxide ion was depleted to the limiting value in October 1998. The Carothers model predicted that limiting value would not be reached for another 9 years. Tank 241-AN-106 was sampled in April 1989 and grab sampled in March 1995. The tank is scheduled to be grab sampled in June 2001. This schedule should be accelerated in order to confirm tank waste chemistry. Best Basis Inventory information shows that tank 241-AN-106 waste compositions have been developed by calculation.

Tank 241-AN-107

Hydroxide ion depletion trending of the tank waste did not appear to closely follow sample results for all three models. Tank 241-AN-107 was grab sampled in April 1998 and February 2001. Plans are to add sodium hydroxide solution to tank 241-AN-107 in June 2001, grab sample the waste in July 2001 and August 2001, and then grab and core sample the tank waste in August 2002.

Tank 241-AP-101

The Carothers and Reynolds models predicted that 21 to 26 years waste storage would be required to deplete the free hydroxide ion to the limiting value. Tank 241-AP-101 was grab sampled in February 2000. The current schedule is to grab sample tank 241-AP-101 waste in May 2003.

Tank 241-AP-102

The Carothers and Reynolds models predicted that 4 to 9 years of waste storage would be required to deplete the hydroxide ion to the limiting value. Tank 241-AP-102 waste was grab sampled in February 2001. Further samples are not scheduled at this time.

Tank 241-AP-103

The Hobbs and Carothers models predicted that 3 to 7 years waste storage would be required to deplete the hydroxide to the limiting value. Tank AP-103 waste was grab sampled in August 1999. No samples are scheduled for tank 241-AP-103 at this time.

Tank 241-AP-104

The Carothers model predicted that 13 years of waste storage would be required to deplete the hydroxide ion to the limiting value. Tank 241-AP-104 was grab sampled in January 1996 and October 1997. Tank 241-AP-104 is currently scheduled to be grab sampled during March 2003.

Tank 241-AP-105

The Carothers and Reynolds models predict that 7 to 11 years would be required to deplete the hydroxide ion to the limiting value. Tank 241-AP-105 was grab sampled in September 1996 and core sampled in August 1997. The current sample schedule is to grab sample the tank waste during October 2002.

Tank 241-AP-106

The Carothers model predicts that 14 years of waste storage would be required to deplete the hydroxide ion to the limiting value. Tank 241-AP-106 was grab sampled in November 1994, September 1996, August 1997, and in May 1998. Tank 241-AP-106 is currently scheduled to be grab sampled during February 2005.

Tank 241-AP-107

The Carothers model predicts 12 years of waste storage would be required to deplete the hydroxide ion to the limiting value. Tank 241-AP-107 was grab sampled in August 1993, February 1995, May 1999, and in August 1999. Tank 241-AP-107 is currently scheduled to be grab sampled in September 2001, May 2002 and May 2003.

Tank 241-AP-108

The Hobbs model predicts that two years of waste storage would be required to deplete the hydroxide ion to the limiting value. Tank 241-AP-108 was grab sampled in January 1996, October 1997, September 1999, and in March 2000. Tank 241-AP-108 is currently scheduled to be grab sampled during October 2002.

Tank 241-AW-101

The Carothers and Reynolds models predict that 19 to 25 years would be required to deplete the hydroxide ion to the limiting value. Tank 241-AW-101 was grab sampled in June 1990 and in May 1998. The tank is currently scheduled to be grab sampled during June 2017.

Tank 241-AW-102:

The Hobbs and Carothers models predict that 1 to 3 years of waste storage would be required to deplete the hydroxide ion to the limiting value. Tank 241-AW-102 was grab sampled in January 1998 and in January 1999. Tank 241-AW-102 is the evaporator feed tank. Waste compatibility and process knowledge calculations are performed as needed.

Tank 241-AW-103

The Carothers and Reynolds models predict that 14 to 16 years would be required to deplete the hydroxide ion to the limiting value. Tank 241-AW-103 was sampled in September 1994 and in September 1999. Tank 241-AW-103 is currently scheduled to be core sampled in August 2002.

Tank 241-AW-104:

The pH based-sample results show that the free hydroxide ion has depleted below limits. Tank 241-AW-104 was grab sampled in July 1999 and is currently scheduled to be core sampled during February 2005. The schedule for sampling of tank 241-AW-104 waste should be revised or the caustic concentration adjusted.

Tank 241-AW-105

The Hobbs and Carothers models predicted that less than -4 years to +4 year from March 2001 would be required to deplete the hydroxide ion to the limiting value. Tank 241-AW-105 was grab sampled in August 1995 and August 1996, and core sampled in July 2000. Tank 241-AW-105 is not currently scheduled for sampling. The current sample schedule should be revised to include sampling of tank 241-AW-105 to confirm tank waste chemistry or the caustic concentration adjusted.

Tank 241-AW-106

The Carothers and Reynolds models predicted that 7 to 14 years would be required to deplete the hydroxide ion to the limiting value. Tank 241-AW-106 is currently the receiver tank for the 242-A Evaporator bottoms. It was grab sampled in August 1991, August 1995, and in January 1998. Tank 241-AW-106 is not currently scheduled for sampling.

Tank 241-AY-101

Hydroxide ion depletion trending of June 1987, July 1988 and February 1996 waste samples was compared to sample results from February 1996 and February 2000 results. Best results were obtained for the modeling between February 1996 and February 2000. The Carothers and Reynolds models closely agreed with sample results while the Hobbs estimates gave much lower results. Caustic addition to the tank was completed in January 2001. Tank 241-AY-101 is scheduled to be grab sampled in August 2001, and grab and core sampled in March 2002.

Tank 241-AY-102

Hydroxide ion depletion trending of the January 1998 waste sample was compared to sample results from October 1999 and January 2000. The Carothers and Reynolds models closely agreed with 199 sample results while the Hobbs model more closely agreed with 2000 sample results. Caustic addition to the tank was started in February 2001. Tank 241-AY-102 was grab and core sampled in March 2001, and will be grab sampled in August 2001, and grab and core sampled in February 2002.

Tank 241-AZ-101

The Carothers model predicted that 15 years would be required to deplete the hydroxide ion to the limiting value. Tank 241-AZ-101 was core sampled in March 1995 and in November 1999. Tank 241-AZ-101 is scheduled to be core sampled in October 2002 and in June 2005.

Tank 241-AZ-102

The Hobbs and Carothers models predicted that 2 to 9 years would be required to deplete the hydroxide ion to the limiting value. Tank 241-AZ-102 was grab sampled in February 1995 and core sampled in September 1999. Tank 241-AZ-102 is scheduled to be core sampled in December 2002. Hydroxide depletion models indicate that tank 241-AY-102 could be out of specification by the time the analysis is received from the December 2002 sampling event. An earlier sample date could relieve this situation.

Tank 241-SY-101

The Hobbs and Carothers models predicted that 15 to 17 years would be required to deplete the hydroxide ion to the limiting value. Tank 241-SY-101 was grab sampled in March 1999 and in April 2000. Tank 241-SY-101 is not currently scheduled for sampling. Sampling of the tank waste should be performed by 2014.

Tank 241-SY-102

The Hobbs and Carothers models predicted that 15 to 17 years would be required to deplete the hydroxide ion to the limiting value. Tank 241-SY-102 was grab sampled in October 1995, January 1997, March 1998, September 1998, September 1999 January 2000, and in October 2000. Tank 241-SY-102 is the cross-site transfer tank from 200 West Area to 200 East Area. The tank is scheduled to be grab sampled during March 2001.

Tank 241-SY-103

The Hobbs and Carothers models predicted that 8 to 12 years would be required to deplete the hydroxide ion to the limiting value. Tank 241-SY-103 was grab sampled in September 1994. Tank 241-SY-103 is currently scheduled to be grab sampled during March 2010.

5.0 RECOMMENDATIONS

The waste chemistry evaluation validated previous findings that tanks 241-AN-102, 241-AN-107, 241-AY-101, and 241-AY-102 should be currently under corrosion control surveillance and corrective actions. It is projected that tank 241-AN-106 could already be caustic deficient and it is recommended that the sample scheduled for June 2001 be given a high priority designation.

Free hydroxide predictions for tanks 241-AW-104 and 241-AW-105 were shown to be of concern and it is recommended that these two tanks be adjusted by have caustic additions or receiving waste, in compliance with the Tank Farms Waste Transfer Compatibility Program, as the preferred action rather than sampled this fiscal year.

It is projected that tanks 241-AP-108 and 241-AZ-102 could go hydroxide deficient in two years and tank 241-AW-102 in the next three years. It is also projected that tank 241-AP-103 could become caustic deficient in the next three years. The sampling of tank 241-AP-103, under current conditions, is recommended prior to 2005 (i.e., in FY 2004) based on the mean concentration values and a year earlier based on the 95% lower limit concentrations. The sampling of tank 241-AP-103 could be postponed if the planned waste transfer takes place to increase the free hydroxide concentration.

All DSTs other than those specifically identified above were found to remain compliant, under the current conditions, for at least the next five years. The current TSB-WIRD sampling schedule, including other programmatic needs, will not satisfy the needs and requirements for the Chemistry Control Program. Proposed changes to the TSB-WIRD are presented in table 5-1.

Table 5-1. Proposed New Double-Shell Tank Ranking for Near Term Sample Schedule

TANK	PROPOSED RANKING	PROPOSED RANKING CRITERIA
AN-101	M	Grab Sample-Jun 09
AN-102	H	Grab Sample-Jun 00 (complete) Caustic addition starting in August Grab Sample-Aug 01, Grab Sample-Sep 01, Grab and Core Sample-Sep 02
AN-103	L	Core Sample-Aug 02*, Grab Sample-Mar16
AN-104	L	Core Sample-Nov 02*, Grab Sample-May 09
AN-105	L	Core Sample-Feb 03*, Grab Sample-Dec 13
AN-106	H	Grab Sample-Jun 01
AN-107	L	Grab Sample-Feb 01 (complete) Caustic addition starting in June. Grab Sample-Jul 01, Grab Sample-Aug 01, Grab and Core Sample-Aug 02
AP-101	L	Grab Sample-Feb 00 (complete) Grab Sample-May 03
AP-102	L	Grab Sample-Feb 01
AP-103	M	Grab sample Jan 2004
AP-104	L	Grab Sample-Mar 03
AP-105	L	Grab Sample-Oct 02
AP-106	L	Grab Sample-Feb 05
AP-107	L	Grab Sample-Sep 01, Grab Sample-May 02, Grab Sample-May 03
AP-108	M	Grab Sample-Oct 02
AW-101	L	Grab Sample-Jun 17
AW-102	L	EVAPORATOR FEED TANK
AW-103	L	Core Sample-Aug 02*
AW-104	H	Core Sample-Oct 2001
AW-105	H	Grab Sample FY 2001
AW-106	L	EVAPORATOR RECEIVER TANK
AY-101	H	Grab Sample Feb 01 (complete) Caustic addition has been completed. Grab Sample-Aug 01 Grab and Core Sample-Mar 02
AY-102	H	Grab Sample-Nov 2000(complete) Grab and Core Sample-Mar 01 Caustic addition has been completed. Grab Sample-Aug 01 Grab and Core Sample-Feb 02
AZ-101	L	Core Sample-Oct 02*, Core sample-Jun 05
AZ-102	M	Core Sample-September 02*
SY-101	L	None currently planned
SY-102	L	Grab Sample-Mar 01
SY-103	L	Grab Sample-Mar 10

* ICD-23 sample. Coordination is needed to achieve needed analysis.

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APPENDIX A

WASTE CHEMISTRY LIMITS EVALUATION

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Table A-1 Summary of Waste Tank Chemistry Conditions For Chemistry Control Program

Tank	Waste Analysis Basis		OH mol/l			Mean mol/l		Mean Based [NO2] Limits [NO2]≤1.0 mol/l		1.0≤[NO2]≤3.0	[NO2]>3.0	Lower [OH] Limit	Lower [OH] Limit Based [NO2] Limits [NO2]≤1.0 mol/l		1.0≤[NO2]≤3.0	[NO2]>3.0	Vent Rate	Waste Vol	Estimated Time from 3/01 to OH Depletion Based on Average OH, yr			Based on 95% or Sdeviation LL OH, yr			Estimated OH Conc. at 1/06 or Earlier Based on Average OH, M						Based on 95% or Sdeviation LL OH, M						Tank Sample Schedule	
								[NO2]/([OH]+[NO2])	[NO2] mol/l	[OH] + [NO2] mol/l			[NO2]/([OH]+[NO2])	[NO2] mol/l	[OH] + [NO2] mol/l																								
241-	Date	Sample/Calc.	Mean	Confidence Level Lower 95% Limit	Sdeviation Lower Limit	[NO2]	[NO2]	<2.5 Limit	≥0.011 to ≤5.5	≥0.4([NO2])	≥ 1.2 mol/l	mol/l	<2.5 Limit	≥0.011 to ≤5.5	≥0.4([NO2])	≥ 1.2 mol/l	CFM	K Gal	Hobbs	Carothers	Reynolds	Hobbs	Carothers	Reynolds	Hobbs		Carothers		Reynolds		Hobbs		Carothers		Reynolds		Date(s)	
AN-101	9/1/95	Grab Sample	1.85	1.65	1.80	1.56	1.05	NA	NA	TRUE	NA	0.16	NA	NA	TRUE	NA	113	1010	NA	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA		NA	Jun-09	
	4/1/96	Grab Sample	1.30	0	0.83	0.98	0.65	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	113	155	NA	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA		NA		
	10/1/00	PK Calc	1.17	NA	NA	1.1	0.83	NA	NA	TRUE	NA	0.11	NA	NA	TRUE	NA	113	224	23	19	49	15	17	47	Jan-06	0.81	Jan-06	0.54	Jan-06	0.50	Jan-06	0.50	Jan-06	0.40	Jan-06	0.44		
AN-102	10/21/94	Sample	0.23	NA	NA	3.63	1.80	NA	NA	NA	TRUE	0.30	NA	NA	NA	TRUE	119	962	NA (caustic is being added during FY-2001)							NA		NA		NA		NA		NA		NA	Jun-00	
	11/30/95	Sample	0.192	NA	NA	NA	NA										119	962							Nov-95	0.22	Nov-95	0.20	Nov-95	0.22		NA		NA		NA	Aug-01	
	2/1/98	Sample	0.152	0.14	NA	3.78	2.02	NA	NA	NA	TRUE	0.30	NA	NA	NA	TRUE	119	962							Feb-98	0.20	Feb-98	0.16	Feb-98	0.20		NA		NA		NA	Sep-01	
																									Mar-01	0.123 - 0.169	Mar-01	0.11	Mar-01	0.14 - 0.185		NA		NA		NA	Sep-02	
AN-103	9/23/98	Sample	5.77	4.86	NA	1.87	2.87	NA	NA	TRUE	NA	0.19	NA	NA	TRUE	NA	100	499	301	27	27	243	25	27	Jan-06	5.57	Jan-06	2.09	Jan-06	0.80	Jan-06	4.47	Jan-06	1.69	Jan-06	0.58	Aug-02	Mar-16
AN-104	8/14/98	Sample	4.17	3.80	NA	3.33	2.84	NA	NA	NA	TRUE	0.30	NA	NA	NA	TRUE	100	603	250	20	15	225	19	14	Jan-06	4.01	Jan-06	1.49	Jan-06	0.57	Jan-06	3.64	Jan-06	1.36	Jan-06	0.56	Nov-02	Jan-00
AN-105	6/18/98	Sample	3.40	3.29	NA	2.87	2.38	NA	NA	TRUE	NA	0.29	NA	NA	TRUE	NA	100	639	215	18	15	207	17	15	Jan-06	3.25	Jan-06	1.20	Jan-06	0.54	Jan-06	3.14	Jan-06	1.16	Jan-06	0.54	Feb-03	Dec-13
AN-106	4/12/89	Sample	0.47	NA	NA	1.01	0.64	NA	NA	TRUE	NA	0.10	NA	NA	TRUE	NA	117	1030				NA	NA	NA													Jun-01	
	8/13/94	Use 96/97 Data	0.78	NA	NA	1.22	0.45	NA	NA	TRUE	NA	0.12	NA	NA	TRUE	NA										NA		NA		NA								
	4/01/1995	Calculation	1.13	NA	NA	1.31	0.48	NA	NA	TRUE	NA	0.13	NA	NA	TRUE	NA	117	418																				
	6/7/95	Rebaseline	0.75	NA	NA	NA	NA	NA	NA	NA	NA						117																					
	9/25/96	Calculation	0.77	NA	NA	1.22	0.45	NA	NA	TRUE	NA	0.12	NA	NA	TRUE	NA	117	415																				
	7/3/97	Calculation	0.78	NA	NA	1.34	0.49	NA	NA	TRUE	NA	0.13	NA	NA	TRUE	NA	117	21	-3	9	32	NA	NA	NA	Oct-98	0.13	Jan-06	0.23	Jan-06	0.32		NA		NA		NA		
AN-107	2/28/85	Sample	0.05	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA																					Feb-01	(completed)
	6/29/85	Sample	0.06	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA																					Jul-01	
	5/13/93	Sample	0.02	NA	NA	NA	NA	NA	NA	NA	NA	0.30	NA	NA	NA	NA	129	841	NA (caustic is being added during FY-2001)						May-93	0.00156	May-93	0.026	May-93	0.05		NA		NA		NA	Aug-01	
	4/14/98	Sample (pH)	0.00149	NA	NA	3.56	1.49	NA	NA	NA	TRUE	0.30	NA	NA	NA	TRUE	129	841							Apr-98	0.0000103	Apr-98	0.013	Apr-98	0.05		NA		NA		NA	Aug-02	
	4/14/98	Sample (pH)	0.00149	NA	NA	3.56	1.49	NA	NA	NA	TRUE	0.30	NA	NA	NA	TRUE	129	841							Apr-98	0.0000202	Apr-98	0.012	Apr-98	0.02		NA		NA		NA		
AP-101	11/13/95	Sample	2.91	2.68	NA	2.48	0.91	NA	NA	TRUE	NA	0.25	NA	NA	TRUE	NA																					Feb-00	(completed)
	2/8/00	Grab Sample	2.43	2.30	NA	2.12	0.91	NA	NA	TRUE	NA	0.21	NA	NA	TRUE	NA	108	1114	256	21	26	244	21	25	Jan-06	2.37	Jan-06	1.27	Jan-06	0.73	Jan-06	2.24	Jan-06	1.21	Jan-06	0.72	May-03	
AP-102	4/30/93	Grab Sample	0.54	0.48	NA	1.27	0.77	NA	NA	TRUE	NA	0.13	NA	NA	TRUE	NA	135	1098	34	5	29	27	4	27	Jan-06	0.41	Jan-06	0.13	Jan-06	0.26	Jan-06	0.33	Jan-06	0.11	Jan-06	0.24	Feb-01	
AP-103	9/24/91	Sample	0.06	NA	NA																																None Planned	
	8/21/97	Sample	0.000147	0.000852	NA	0.059	0.04	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA																						
	4/1/98	Sample	0.000145	0.0000991	NA	0.063	0.04	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA																						
	8/13/99	Sample	0.56	0.51	NA	2.18	2.31	NA	NA	TRUE	NA	0.22	NA	NA	TRUE	NA	200	282	4	7	16	3	6	14	Jul-05	0.22	Jan-06	0.27	Jan-06	0.35	Sep-04	0.22	Jan-06	0.25	Jan-06	0.33		
AP-104	1/24/96	Sample	0.03	0.03	NA	0.047	0.02	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA																					Mar-03	
	10/6/97	Sample	0.000138	0.0000709	NA	0.094	0.03	FALSE	NA	NA	NA	0.01	TRUE	TRUE	NA	NA																						
	5/1/00	PK Calc.	0.75	NA	NA	1.88	1.29	NA	NA	TRUE	NA	0.17	NA	NA	TRUE	NA	71	1109	145	13	28	NA	NA	NA	Jan-06	0.71	Jan-06	0.39	Jan-06	0.44		NA		NA		NA		
AP-105	9/3/96	Sample	1.97																																		Oct-02	
	8/17/97	Sample	2.46	NA	NA	2.98	1.29	NA	NA	TRUE	NA	0.30	NA	NA	TRUE	NA																						
	6/1/00	PK Calc.	0.70	NA	NA	3.85	2.22	NA	NA	NA	TRUE	0.30	NA	NA	NA	TRUE	176	1045	27	7	11	NA	NA	NA	Jan-06	0.62	Jan-06	0.38	Jan-06	0.43		NA		NA		NA		
AP-106	11/18/94	Sample	0.31	NA	NA																																Feb-06	
	9/12/96	Sample	0.72	NA	NA	0.87	0.29	TRUE	TRUE	NA	NA	0.08	TRUE	TRUE	NA	NA																						
	8/27/97	Sample	0.36	NA	NA	0.28	0.43	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA																						
	5/28/98	Sample	0.66	NA	NA	0.68	0.31	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA																						
	3/26/00	Calculation	0.76	NA	NA	1.54	1.61	NA	NA	TRUE	NA	0.15	NA	NA	TRUE	NA	111	622	41	14	31	NA	NA	NA	Jan-06	0.67	Jan-06	0.40	Jan-06	0.44		NA		NA		NA		
AP-107	8/13/93	Sample	0.01		NA																																Sep-01	
	2/1/95	Sample	0.32		NA																																May-02	
	5/18/99	Sample	0.36	0.12	NA	1.18	0.41	NA	NA	TRUE	NA	0.12	NA	NA	TRUE	NA																					May-03	
	8/31/99	Sample	0.57	0.55	NA	0.54	0.61	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA																						
	11/18/00	PK Calc.	0.81	NA	NA	1.58	1.31	NA	NA	TRUE	NA	0.16	NA	NA	TRUE	NA	342	984	23	15	31	NA	NA	NA	Jan-06	0.65	Jan-06	0.46	Jan-06	0.49		NA		NA		NA		
AP-108	1/4/96	Sample	0.16																																		Oct-02	
	10/10/97	Sample	0.56			0.81	0.29	TRUE	TRUE	NA	NA	0.04	TRUE	TRUE	NA	NA																						
	9/22/99	Sample	0.72	0.44	NA	1.44	0.70	NA	NA	TRUE	NA	0.14	NA	NA	TRUE	NA																						
	3/1/00	Sample	0.83	0.78	NA	1.47	0.71	NA	NA	TRUE	NA	0.15	NA	NA	TRUE	NA																						
	1/4/01	Calculation	0.43	NA	NA	0.85	0.38	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	129	38	2	34	803	NA	NA	NA	Nov-02	0.01	Nov-02	0.35	Nov-02	0.38		NA		NA		NA		
	11/30/02	Calculation	0.66	NA	NA	1.1	0.55	NA	NA	TRUE	NA	0.11	NA	NA	TRUE	NA	129	376	20	16	47	NA	NA	NA	Jan-06	0.57	Jan-06	0.47	Jan-06	0.50		NA		NA		NA		

Table A-1 Summary of Waste Tank Chemistry Conditions For Chemistry Control Program

Tank	Waste Analysis Basis		OH mol/l			Mean mol/l		Mean Based [NO2] Limits				Lower [OH] Limit	Lower [OH] Limit Based [NO2] Limits				Vent Rate	Waste Vol
								[NO2]≤1.0 mol/l		1.0<[NO2]≤3.0	[NO2]>3.0		[NO2]≤1.0 mol/l		1.0<[NO2]≤3.0	[NO2]>3.0		
								[NO2]/([OH]+[NO2])	[NO2] mol/l	[OH] + [NO2] mol/l			[NO2]/([OH]+[NO2])	[NO2] mol/l	[OH] + [NO2] mol/l			
241-	Date	Sample/Calc.	Mean	Confidence Level Lower 95% Limit	Sdeviation Lower Limit	[NO2]	[NO2]	<2.5 Limit	≥0.011 to ≤5.5	≥0.4([NO2])	≥ 1.2 mol/l	mol/l	<2.5 Limit	≥0.011 to ≤5.5	≥0.4([NO2])	≥ 1.2 mol/l	CFM	K Gal
AW-101	6/28/90	Sample	5.06	NA	NA	3.46	2.20	NA	NA	NA	TRUE	0.30	NA	NA	NA	TRUE		
	4/28/98	Sample	5.59	5.53	NA	2.74	2.61	NA	NA	NA	TRUE	0.27	NA	NA	TRUE	NA	100	751
AW-102	6/5/91	Sample	0.18	0.15	NA	0.23	0.06	TRUE	TRUE	NA	NA	0.04	TRUE	TRUE	NA	NA		
	5/25/95	Sample	0.60															
	1/14/96	Sample	0.29	NA	NA	0.54	0.51	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA		
	1/29/99	Sample	0.44	0.41	NA	0.28	0.15	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA		
	12/19/00	PK Calc	0.41	NA	NA	0.99	0.41	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA		
	1/25/01	Calculation	0.07	NA	NA	0.24	0.05	TRUE	TRUE	NA	NA	0.05	TRUE	TRUE	NA	NA	292	866
AW-103	9/24/94	Sample	0.19	NA	NA													
	9/10/99	Sample	0.56	0.55	NA	0.066	0.04	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	134	145
	2/26/01	Calculation	1.39	NA	NA	3.18	1.05	NA	NA	NA	TRUE	0.30	NA	NA	NA	TRUE	134	625
AW-104	9/28/94	Sample	0.20									0.01						
	7/15/99	Sample (Sup)	0.21	0	0.09	0.27	0.12	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	141	882
	8/23/00	Grab Sample (pH Sup	0.01	0.000023	NA	0.14	0.04	FALSE	TRUE	NA	NA	0.02	TRUE	TRUE	NA	NA	141	862/85
	8/23/00	Core Liq SC (pH)	0.01	0.000023	NA	2.4	2.18	NA	NA	TRUE	NA	0.24	NA	NA	TRUE	NA	NA	36
	8/23/00	Core Liq Sludge (pH)	0.01	0.000023	NA	1.89	1.51	NA	NA	TRUE	NA	0.19	NA	NA	TRUE	NA	NA	16
AW-106	8/29/95	Sample	0.23	NA	NA	0.27	0.02	TRUE	TRUE	NA	NA	0.09	TRUE	TRUE	NA	NA		
	8/27/96	Sample	0.21	0.16	NA	0.417	0.03	TRUE	TRUE	NA	NA	0.14	TRUE	TRUE	NA	NA	194	172
	5/14/97	Sample	0.37	0.06	NA	0.52	0.05	TRUE	TRUE	NA	NA	0.16	TRUE	TRUE	NA	NA	194	172
	7/13/00	Calculation	0.21	NA	NA	0.42	0.03	TRUE	TRUE	NA	NA	0.14	TRUE	TRUE	NA	NA	194	172
AW-108	8/21/91	Sample	0.58															
	8/24/95	Sample	1.63															
	5/1/97		0.58	0.51	NA	1.94	2.14	NA	NA	TRUE	NA	0.19	NA	NA	TRUE	NA		
	1/12/98	Sample	0.58	0.50	NA	1.94	2.13	NA	NA	TRUE	NA	0.19	NA	NA	TRUE	NA		
	5/5/00	Sample	0.66	NA	NA	1.37	3.16	NA	NA	TRUE	NA	0.14	NA	NA	TRUE	NA		
	3/21/01	PK Calc	0.65	NA	NA	2.87	1.28	NA	NA	NA	TRUE	0.29	NA	NA	TRUE	NA	158	500
AY-101	2/28/85	Sample	0.30	NA	NA													
	3/14/85	Sample	0.88	NA	NA													
	6/23/87	Sample	0.13	NA	NA												250	800
	7/20/88	Sample	0.47	NA	NA												250	800
	2/28/96	Sample (pH)	0.0000596	0.0000562	NA	0.42	0.77	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	250	800
	4/22/97	Sample (pH)	0.0000286	0.0000104	NA	0.36	0.85	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA		
	2/15/00	Sample IL (pH)	0.0000505	NA	NA	0.158	1.43	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA		37
		Core Liq Sludge	0.0135	NA	NA	0.108	1.42	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA		16
AY-102	10/8/98	Sample Sup	0.15	NA	NA	0.007	0.02	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	250	
	1/16/98	Sample Sup	0.07	NA	NA	0.106	0.05	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	250	
	7/7/98	Sample Sup	0.58	NA	NA	0.008	0.03	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	250	
	10/14/99	Sample Sup	0.09	0.02	NA	0.007	0.16	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	250	
	1/6/00	Sample Sup (pH)	0.00851	0.0079	NA	0.0056	0.15	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	250	395
	1/6/00	Sample Sup	0.081	0.05	NA	0.01	0.11	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	250	395
AZ-101	3/3/96	Sample	0.67	0.61	NA	1.08	1.23	NA	NA	TRUE	NA	0.11	NA	NA	TRUE	NA		
	11/19/99	Sample	0.68	0.67	NA	0.95	1.60	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	150	865
AZ-102	2/23/95	Sample	0.11	0.08	NA	0.36	0.38	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA		
	9/24/99	Sample DL (pH)	0.04	0.03	NA	0.3	0.77	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA		NA
	2/15/01	Calculation	0.04	NA	NA	0.36	0.44	TRUE	TRUE	NA	NA	0.01	TRUE	TRUE	NA	NA	112	892
SY-101	3/30/99	Push Sample	3.25	NA	NA													
	4/6/00	Grab Sample	1.55	1.35	NA	2.27	1.91	NA	NA	TRUE	NA	0.23	NA	NA	TRUE	NA	461	888
SY-102	10/20/95	Grab Sample	0.25		NA													
	1/14/97	Grab Sample	0.35		NA													
	3/10/98	Grab Sample	0.07		NA													
	9/23/98	Grab Sample	0.18	0.09	NA	0.84	0.29	TRUE	TRUE	NA	NA	0.05	TRUE	TRUE	NA	NA		
	9/9/99	Grab Sample	1.03	0.97	NA	2.05	1.02	NA	NA	TRUE	NA	0.21	NA	NA	TRUE	NA		
	1/10/00	Grab Sample	0.98	0.25	NA	1.96	1.26	TRUE	TRUE	NA	NA	0.20	NA	NA	TRUE	NA		
	11/28/00	Push Sample	1.06	0.48	NA	2.05	1.84	NA	NA	TRUE	NA	0.21	NA	NA	TRUE	NA	363	811
	1/1/01	PK Calc	0.81	NA	NA	1.48	1.39	NA	NA	TRUE	NA	0.15	NA	NA	TRUE	NA	363	759
SY-103	9/19/94	Sample Sup	1.7	1.42	NA	2.83	3.06	NA	NA	TRUE	NA	0.28	NA	NA	TRUE	NA	118	369

Tank	Date	Estimated Time from 3/01 to OH Depletion: Based on Average OH, yr			Based on 95% or Sdeviation LL OH, yr			Estimated OH Conc. at 1/06 or Earlier: Based on Average OH, M						Based on 95% or Sdeviation LL OH, M						Tank Sample Schedule
		Hobbs	Carothers	Reynolds	Hobbs	Carothers	Reynolds	Hobbs		Carothers		Reynolds		Hobbs		Carothers		Reynolds		Date(s)
AW-101	6/28/90																			Jun-17
	4/28/98	428	25	19	423	25	19	Jan-06	5.51	Jan-06	2.96	Jan-06	0.91	Jan-06	5.45	Jan-06	2.96	Jan-06	0.91	
AW-102	6/5/91																			Evaporator Feed Tank
	5/25/95																			
	1/14/96																			
	1/29/99																			
	12/19/00																			
	1/25/01	1	3	35	NA	NA	NA	Jan-02	0.05	Aug-04	0.05	Jan-06	0.07		NA		NA		NA	
AW-103	9/24/94																			Aug-02
	9/10/99	9	37	607	9	37	607	Feb-01	0.45	Feb-01	0.48	Feb-01	0.50	Feb-01	0.45	Feb-01	0.48	Feb-01	0.50	
	2/26/01	58	14	16	NA	NA	NA	Jan-06	1.29	Jan-06	0.82	Jan-06	0.67		NA		NA		NA	
AW-104	9/28/94																			Feb-05
	7/15/99																			
	8/23/00	Waste Does Not Meet Lower OH Limit			Waste Does Not Meet Lower OH Limit				NA		NA		NA		NA		NA		NA	
	8/23/00	NA																		
	8/23/00	NA																		
AW-106	8/29/95																			None Planned
	8/27/96	-4	-1	11	-4	-3	1	Jun-97	0.14	Oct-00	0.14	Jan-06	0.16	Nov-96	0.14	Mar-98	0.14	Oct-03	0.14	
	5/14/97	-1	4	18	NA	NA	NA	Jul-99	0.16	May-05	0.16	Jan-06	0.25		NA		NA		NA	
	7/13/00	0	3	14				May-01	0.14	Jul-03	0.14	Jan-06	0.18							
AW-108	8/21/91																			Evaporator Receiver Tank
	8/24/95																			
	5/1/97																			
	1/12/98																			
	5/5/00																			
	3/21/01	14	7	12	NA	NA	NA	Jan-06	0.52	Jan-06	0.38	Jan-06	0.43		NA		NA		NA	
AY-101	2/28/85																			Feb-01
	3/14/85																			Aug-01
	6/23/87							Feb-96	0.00058	Feb-96	0.05	Feb-96	0.11							Mar-02
	7/20/88							Feb-96	0.28	Feb-96	0.21	Feb-96	0.30							
	2/28/96							Feb-00	0.000012	Feb-00	0.0000386	Feb-00	0.0000596							
	4/22/97																			
	2/15/00	NA (caustic is being added during FY-2001)																		
AY-102	10/8/98																			Nov-00 (completed)
	1/16/98																			Mar-01
	7/7/98							Oct-99	0.01	Oct-99	0.06	Oct-99	0.07							Aug-01
	10/14/99							Oct-99	0.25	Oct-99	0.26	Oct-99	0.27							Feb-02
	1/6/00	NA (caustic is being added during FY-2001)						Jan-00	0.005	Jan-00	0.08	Jan-00	0.07							
	1/6/00							Jan-00	0.06	Jan-00	0.09	Jan-00	0.09							
AZ-101	3/3/96																			Oct-02
	11/19/99	40	16	48	39	15	48	Jan-06	0.59	Jan-06	0.35	Jan-06	0.41	Jan-06	0.58	Jan-06	0.34	Jan-06	0.40	Jun-06
AZ-102	2/23/95																			Dec-02
	9/24/99	3	12	478	2	9	423	Aug-04	0.0103	Jan-06	0.02	Jan-06	0.04	Aug-02	0.01	Jan-06	0.02	Jan-06	0.03	
	2/15/01	4	13	467	NA	NA	NA	Jun-05	0.0103	Jan-06	0.02	Jan-06	0.04		NA		NA		NA	
SY-101	3/30/99																			None Planned
	4/6/00	29	17	22	23	15	22	Jan-06	1.40	Jan-06	1.11	Jan-06	0.86	Jan-06	1.21	Jan-06	0.97	Jan-06	0.82	
SY-102	10/20/95																			Mar-01
	1/14/97																			
	3/10/98																			
	9/23/98																			
	9/9/99																			
	1/10/00																			
	11/28/00																			
	1/1/01	17	15	34	15	12	22	Jan-06	0.81	Jan-06	0.47	Jan-06	0.49		NA		NA		NA	
SY-103	9/19/94	45	10	12	35	8	11	Jan-06	1.38	Jan-06	0.49	Jan-06	0.41	Jan-06	1.10	Jan-06	0.41	Jan-06	0.40	Mar-10

PK = Process Knowledge
DL = Drainable Liquid
IL = Interstitial Liquid
Sup = Supernatant
SC = Salt Cake
NA = Not Available or Not Applicable

CHECKLIST FOR INDEPENDENT REVIEW

Document: Technical Basis for Chemical Control Program, RPP-7795
Author: M. J. Klem, et. al.
Scope of Review: Review data and the associated compilation spreadsheet.

Yes	No	N/A	
[ ]	[ ]	[X]*	Previous reviews complete and cover analysis, up to scope of the review, with no gaps.
[X]	[ ]	[ ]	Problem completely defined.
[ ]	[X]	[ ]	Necessary assumptions explicitly stated and supported.
[X]	[ ]	[ ]	Computer codes and data files documented.
[X]	[ ]	[ ]	Data used in calculations explicitly stated in document.
[ ]	[X]	[ ]	Data checked for consistency with original source information as applicable.
[X]	[ ]	[ ]	Mathematical derivations checked including dimensional consistency of results.
[X]	[ ]	[ ]	Models appropriate and used within range of validity or use outside range of established validity justified.
[X]	[ ]	[ ]	Hand calculations checked for errors. *Spreadsheet results should be treated exactly the same as hand calculations.*
[ ]	[ ]	[X]	Software/Code input correct and consistent with analysis documentation.
[ ]	[ ]	[X]	Software/Code output consistent with input and with results reported in analysis documentation.
[X]	[ ]	[ ]	Limits/criteria/guidelines applied to analysis results are appropriate and referenced. Limits/criteria/guidelines checked against references.
[X]	[ ]	[ ]	Safety margins consistent with good engineering practices.
[X]	[ ]	[ ]	Conclusions consistent with analytical results and applicable limits.
[X]	[ ]	[ ]	Results and conclusions address all points required in the problem statement.
[X]	[ ]	[ ]	Format consistent with appropriate standards.
[X]		[ ]*	Review calculations, comments, and/or notes attached.
[ ]	[ ]	[X]	Document approved.

D. A. Reynolds D A Reynolds Date: March 29, 2001
Reviewer (Printed Name and Signature)

* Any calculation, comments, or notes generated as part of this review should be signed, dated, and attached to the checklist. Such material should be labeled and recorded in such a manner as to be intelligible to a technically qualified third party.

Comments:
Chemical concentrations were not reviewed against the characterization data. It was determined that previous work was reasonable. All spreadsheet blocks were not checked but those that had short hydroxide ion depletion times were checked. The two items checked as having not been provided were reviewed with the author and resolved.
Disposition: It is agreed with the author that these comments will be addressed in the next revision of the document.

ASSUMPTIONS

The following assumptions were used in the development of the spreadsheet, Table A-1.

- Convection and other natural forces mix the DST supernatant in the tank. Supernatant mixing maintains a near uniform concentration of waste constituents (as measure by the mean, lower 95 % confidence limit and standard deviation values).
- The free hydroxide ion concentration is determined from the analytical laboratory titration method when the pH is > 12.5.
- The free hydroxide ion concentration is determined from the analytical laboratory pH measurement when the pH of the waste is < 12.5.
- The tank corrosion control limits are based on a waste temperature of less than 167 °F.
- The end sampling date of the tank waste, process calculation date, or waste transfer date is used as start date for depletion the free hydroxide ion.
- The limiting hydroxide ion concentration for hydroxide ion depletion calculation is based on the corrosion control limitations and the mean concentration of nitrate and nitrite ions.
- Three empirical equations or models are used to predict or model the depletion of free hydroxide ion in each DST.
    - The Hobbs model is based on adsorption of carbon dioxide from forced air ventilation of the waste tank and uses a moving average value for fraction of carbon dioxide.
    - The Carothers model is based on observations of actual phenomena for complexed concentrate waste stored in tank 241-AN-102. There was no attempt to postulate a reaction mechanism. The model included any hydroxide consumption by CO_2 absorption, complexant oxidation, and hydrated aluminum oxide reactions.
    - The Reynolds model is based on observation of actual phenomena for complexed concentrate waste stored in tank 241-AN-107. There was no attempt to postulate a reaction mechanism. The model included any hydroxide consumption by CO_2 absorption, complexant oxidation, and hydrated aluminum oxide reactions.
- The number of estimated years needed to reach the limiting hydroxide ion concentration is referenced to March 2001. The concentration of free hydroxide ion is estimated for January 2006 or the date (month and year) when limiting hydroxide ion concentration is predicted.

APPENDIX B

TANK SPECIFIC ASSESSMENTS

APPENDIX B

TANK SPECIFIC ASSESSMENTS

This appendix summarizes the tank specific modeling of free hydroxide ion depletion in the DSTs. The modeling was based on DST sampling information and the best basis liquid waste concentration information for free hydroxide, nitrite, and nitrate ions extracted from the TWINS database. The free hydroxide ion concentration at the mean (average) and lower limit at the 95 % confidence level or lower limit at one standard deviation (SD) were used for starting values. The concentration of free hydroxide was determined from the pH measurement for pHs of less than 12.5. The mean concentrations were used for the nitrate and nitrite ions. Three free hydroxide depletion models were used to predict the future free hydroxide concentration over the next five-year period and trend historical sample results where possible. The modeling was based on equations (8), (9), and (10) of Sections 3.2.1 and 3.2.2. The low limit hydroxide concentration was based on the corrosion control guidelines for waste temperature of less that 167 °F.

B1.1 Tank 241-AN-101

Tank 241-AN-101 contains about 225 kgal of dilute supernatant waste and was grab sampled in April 1998. The tank was maintained near a surface level of approximately 50 inches from October 1996 to April 2000. Salt well liquid from tanks 241-A-101 and 241-AX-101 and possible small volume of supernatant from tank 241-AN-102 will be added and fill tank 241-AN-101 to approximately 85 inches (231 kgal) by August 2003. Future plans call for transferring the combined wastes in tank AN-101 to tank 241-AN-106. The tank will be cleaned out for use as an intermediate staging tank in FY 2005. The current schedule is to grab sample the tank 241-AN-101 waste in June 2009.

Table B-1 lists the estimated time to reach the hydroxide limit of 0.11 M at static waste conditions based on 1998 sample results that were depleted to October 2000 (process knowledge calculations) using both the average hydroxide and one SD concentrations. All three models predicted an end date of past January 2006 in order to reach the lower limit for free hydroxide ion. Table B-2 lists the estimated free hydroxide ion concentrations for an end date of January 2006.

Table B-1 Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AN-101

One SD OH Sample Result			Average OH Sample Result		
Start Date March 2001			Start Date March 2001		
Hobbs Yr	Carothers yr	Reynolds yr	Hobbs yr	Carothers yr	Reynolds yr
15	17	47	23	19	49

Table B-2. Projected Hydroxide Concentrations of Tank 241-AN-101 Based on Current Static Waste Storage Conditions

One SD OH Sample Result			Average OH Sample Result		
End Date Jan 2006			End Dates		
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
0.50	0.40	0.44	0.81	0.54	0.50

B.1.1 Tank 241-AN-102

Tank 241-AN-102 contains approximately 1,054 kgal of complexed concentrate (CC) waste. The tank was grab sampled in August 2000 for the WTP contract and no analytical results have not been entered into the TWINS database at this time. The tank was previously grab sampled in February 1998. The current plan for this tank is to transfer a small amount of waste to tank 241-AN-101, if necessary to test the pump transfer, add concentrated sodium hydroxide, grab sample the waste in August and September 2001 and then core and grab sample the waste in September 2002. The tank surface level decreased from approximately 395 inches in October 1994 to 385 inches in early February 2001. This liquid loss was by evaporation. There is no plan through FY 2006 to transfer the tank 241-AN-102 waste to another tank.

Table B-3 lists the estimated and measured free hydroxide concentrations for November 1995 and February 1998. Estimated hydroxide depletion values were developed from the average hydroxide concentration of waste samples taken in October 1994. The Hobbs and Reynolds estimates of hydroxide concentration give slightly higher results. The Carothers model closely agrees with sample results because it was based on data collected from tank 241-AN-102. The corrosion control specification limit for the tank waste is 0.3 M free hydroxide ion.

Table B-3. Comparisons of Modeled and Laboratory Results of Hydroxide Concentrations in Tank 241-AN-102

Oct. 1994 Average OH	Nov. 1995 Average OH				Feb. 1998 Average OH			
Lab OH M	Hobbs OH M	Carothers OH M	Reynolds OH M	Lab OH M	Hobbs OH M	Carothers OH M	Reynolds OH M	Lab OH M
0.23	0.22	0.20	0.22	0.19	0.20	0.16	0.20	0.15

B.1.3 Tank 241-AN-103

Tank 241-AN-103 contains approximately 500 kgal of double shell slurry (DSS) waste. The tank was core sampled in September 1996. Plans are to core sample in August 2002. There are no waste transaction plans for this tank through FY 2006.

Table B-4 lists the estimated time to reach the lower hydroxide limit of 0.19 M at static waste conditions using September 1996 sample results for both the tank average and the 95 % lower limit concentrations. A minimum 25 yr of storage is needed in order to deplete the hydroxide

concentration to the lower limit. Table B-5 lists the estimated free hydroxide ion concentration for an end date of January 2006. The current sample schedule is satisfactory.

Table B-4. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions in Tank 241-AN-103

95 % LL OH Sample Result			Average OH Sample Result		
Start Date March 2001			Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
243	25	27	301	27	27

Table B-5. Projected Hydroxide Concentrations of Tank 241-AN-103 Based on Current Static Waste Storage Conditions

Low OH Sample Result			Average OH Sample Result		
End Date Jan 2006			End Date Jan 2006		
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
4.47	1.69	0.58	5.57	2.09	0.60

B.1.4 Tank 241-AN-104

Tank 241-AN-104 contains approximately 600 kgal of double shell slurry feed (DSSF). The tank has maintained a surface level of approximately 385 inches since May 1985. The tank was core sample in August 1996 and scheduled to be core sample in November 2002. There are no waste transfer plans for the waste in this tank through FY 2006.

Table B-6 lists the estimated time to reach the hydroxide limit of 0.3 M at static waste conditions using August 1996 sample results for the 95 % lower limit and the tank average hydroxide concentration. A minimum 16 yr of storage is needed to reach the hydroxide limit. Table B-7 lists the estimated free hydroxide ion concentration for January 2006. The current sample schedule is satisfactory.

Table B-6. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AN-104

95 % LL OH Sample Result			Average OH Sample Result		
Start Date March 2001			Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
225	19	14	250	20	15

Table B-7. Projected Hydroxide Concentrations of Tank 241-AN-104 Based on Current Static Waste Storage Conditions

95 % LL OH Sample Result			Average OH Sample Result		
End Date Jan 2006			End Date Jan 2006		
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
3.64	1.36	0.56	4.01	1.49	0.57

B.1.5 Tank 241-AN-105

Tank 241-AN-105 contains 640 kgal of DSSF waste and was core sampled in June 1996. Plans are to core sample the waste in February 2003. The liquid level has remained at about 410 inch since June 1996. There are no waste transfer plans for this tank through FY 2006.

Table B-8 lists the estimated time to reach the hydroxide limit of 0.29 M at static waste conditions using June 1996 sample results for the 95 % LL and the tank average hydroxide concentration. Table B-9 lists the estimated free hydroxide ion concentration for January 2006. A minimum 15 yr of storage is needed to reach the hydroxide limit. The current sample schedule is satisfactory.

Table B-8. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AN-105

95 % LL OH Sample Result			Average OH Sample Result		
Start Date March 2001			Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
207	17	15	215	18	15

Table B-9. Projected Hydroxide Concentrations of Tank 241-AN-105 Based on Current Static Waste Storage Conditions

95 % LL OH Sample Result			Average OH Sample Result		
End Date Jan 2006			End Date Jan 2006		
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
3.14	1.16	0.54	3.25	1.20	0.54

B.1.6 Tank 241-AN-106

Tank 241-AN-106 contains approximately 21 kgal of CC waste and was grab sampled in April 1989, April 1995 and November 1995. There is no hydroxide ion data in the TWINS database for April 1995 and November 1995. Plans are to grab sample the waste in June 2001. A

hydroxide ion estimate was made in April 1995, re-base lined in August 1995 and re-estimated in July 1997.

Plans are to fill tank 241-AN-106 with salt well liquid transferred from tank 241-AN-101 and then transfer the waste to the evaporator. The tank will be refilled with DSSF starting in 2005 based on Strode and Bolyes (2000).

Table B-10 lists the estimated time to reach the hydroxide limit of 0.11 M at static waste conditions using July 1997 estimated results for the hydroxide ion concentration. Table B-11 lists the estimated free hydroxide ion concentration for January 2006 and earlier. The current sample schedule for this tank is satisfactory.

Table B-10. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AN-106

Basis July 1997 Estimated OH		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
-3	9	32

Table B-11. Projected Hydroxide Concentrations of Tank 241-AN-106 Based on Current Static Waste Storage Conditions

Basis July 1997 Estimated OH		
End Date Oct 1998	End Date Jan 2006	End Date Jan 2006
Hobbs OH M	Carothers OH M	Reynolds OH M
0.13	0.23	0.32

B.1.7 Tank 241-AN-107

Tank 241-AN-107 contains approximately 1,040 kgal of CC waste and was last grab sampled in April 1998 and February 2001. Plans are to add sodium hydroxide solution to tank 241-AN-107 in June 2001, grab sample the waste in June 2001 and July 2001, and then grab and core sample the waste in August 2002. The tank liquid level has dropped from about 400 inches in 1985 to 380 inches in February 2001. This liquid loss is believed to be a combination of solids settling and water evaporation. There is no waste transaction plan for this tank through FY 2006.

Table B-12 lists the estimated and measured free hydroxide concentrations in May 1993 and April 1998. These estimated values were based on the projections from the average hydroxide concentration from the June 1985 sample. The Carothers and Reynolds estimates of hydroxide concentration give higher results than the Hobbs model. The Carothers model was based on data collected from tank 241-AN-102. The Reynolds model was based on force fit of tank 241-AN-107 data to a second order kinetics equation. The corrosion control specification limit for the tank waste is 0.3 M free hydroxide ion.

Table B-12. Comparisons of Estimated and Laboratory Results of Free Hydroxide Concentrations in Tank 241-AN-107

June 1985 Average OH	May 1993 Average OH				April 1998 Average OH			
Lab OH M	Hobbs OH M	Carothers OH M	Reynolds OH M	Lab OH M	Hobbs OH M	Carothers OH M	Reynolds OH M	Lab[1] OH M
0.06	1.58E-03	0.03	0.05	0.02	1E-05	0.01	0.05	1.5E-03

Note:
[1]Hydroxide taken from Urie et al (1999) and based on pH measurement.

B.1.8 Tank 241-AP-101

Tank 241-AP-101 contains approximately 1114 kgal of DSSF waste and was grab sampled in November 1999 and February 2000. The tank was maintained near a surface level of approximately 405 inches from January 1997 to the current time. No transfers into or from this tank are planned prior to 2007 (Strode 2000). During that year, the waste is to be transferred to the Waste Treatment Plant for processing. The current schedule is to grab sample the tank 241-AP-101 waste in May 2003.

Table B-13 lists the estimated time to reach the hydroxide limit of 0.21 M at static waste conditions using February 2000 sample results for the hydroxide ion concentration. Table B-14 lists the estimated free hydroxide ion concentration for January 2006 and earlier. The current sample schedule of May 2003 for this tank is satisfactory.

Table B-13 Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AP-101

95 % LL OH Sample Result			Average OH Sample Result		
Start Date March 2001			Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
244	21	25	259	21	26

Table B-14. Projected Hydroxide Concentrations of Tank 241-AP-101 Based on Current Static Waste Storage Conditions

95 % LL OH Sample Result			Average OH Sample Result		
End Date Jan 2006			End Date Jan 2006		
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
2.24	1.21	0.72	2.37	1.27	0.73

B.1.9 Tank 241-AP-102

Tank 241-AP-102 contains approximately 1,098 kgal of CP waste and was grab sampled in April 1993, and was also grab sampled during February 2001. The results of the 2001 sample are not available at this time. The tank surface level has slowly decreased from approximately 402 inches to approximately 397 inches from January 1992 to the current time. The official baseline shows that no transfers into or from this tank are planned through 2006 (Strode 2000). However, recent changes to the schedule show that AP-102 waste will be moved to AP-106 in approximately May 2001. Then, tank 241-AP-102 will be used to receive salt well liquid from BY farm, miscellaneous waste, and waste that has been transferred from West area from June 2001 to December 2001. As stated previously, the current schedule was to grab sample the waste during February 2001. Further samples are not scheduled at this time.

Table B-15 lists the estimated time to reach the hydroxide limit of 0.13 M at static waste conditions using April 1993 sample results for the hydroxide ion concentration. Table B-16 lists the estimated free hydroxide ion concentration for January 2006.

Note that the sample results and calculations for tank 241-AP-102 would not be valid once the waste is transferred out and different waste is transferred into the tank during 2001.

Table B-15. Estimated Time to Reach Lower Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AP-102

95 % LL OH Sample Result			Average OH Sample Result		
Start Date March 2001			Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
27	4	27	34	5	29

Table B-16. Projected Hydroxide Concentrations of Tank 241-AP-102 Based on Current Static Waste Storage Conditions

95 % LL OH Sample Result			Average OH Sample Result		
End Date Jan 2006			End Date Jan 2006		
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
0.33	0.11	0.24	0.41	0.13	0.26

B.1.10 Tank 241-AP-103

Tank 241-AP-103 contains approximately 282 kgal of CC waste and was grab sampled in August 1999. The tank surface level has remained at approximately 103 inches from May 1999 to the current time. Tank 241-AP-103 is to be filled with CC waste by the end of fiscal year 2002. No additional transfers into or from this tank are planned during 2003-2006 (Strode 2000). No samples are scheduled for tank 241-AP-103 at this time.

Table B-17 lists the estimated time to reach the hydroxide limit of 0.22 M at static waste conditions using August 1999 sample results for the hydroxide ion concentration. Table B-18 lists the estimated free hydroxide ion concentration for January 2006 and earlier. If the planned transfers into tank 241-AP-103 do occur, the results stated below will become outdated at that time. Otherwise, sampling by April 2003 is recommended to verify the waste chemistry.

Table B-17. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AP-103

95 % LL OH Sample Result			Average OH Sample Result		
Start Date March 2001			Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
3	6	14	4	7	16

Table B-18. Projected Hydroxide Concentrations of Tank 241-AP-103 Based on Current Static Waste Storage Conditions

95 % LL OH Sample Result			Average OH Sample Result		
End Date Sept 2004	End Date Jan 2006		End Date July 2005	End Date Jan 2006	
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
0.22	0.25	0.33	0.22	0.27	0.35

B.1.11 Tank 241-AP-104

Tank 241-AP-104 contains approximately 1109 kgal of CC waste. It was grab sampled in January 1996 and October 1997. Waste compatibility and process knowledge estimates of the waste constituents have been made since March 2000, when waste was added to the tank. The most recent process knowledge estimate was in May 2000. The tank surface level has remained at approximately 403 inches from March 2000 to the current time. No additional transfers into or from this tank are planned through 2006 (Strode 2000). Tank 241-AP-104 is currently scheduled to be grab sampled during March 2003.

Table B-19 lists the estimated time to reach the hydroxide limit of 0.17 M at static waste conditions using the May 2000 estimate for the hydroxide ion concentration. Table B-20 lists the estimated free hydroxide ion concentration for January 2006. The schedule for sampling tank 241-AP-104 is satisfactory.

Table B-19. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AP-104

Based Upon May 2000 Estimated OH		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
145	13	28

Table B-20. Projected Hydroxide Concentrations of Tank 241-AP-104 Based on Current Static Waste Storage Conditions

Based Upon May 2000 Estimated OH		
End Date Jan 2006	**End Date Jan 2006**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M
0.71	0.29	0.44

B.1.12 Tank 241-AP-105

Tank 241-AP-105 contains approximately 1045 kgal of DSSF waste. It was grab sampled in September 1996 and in August 1997 and an estimate was made in June 2000, when waste was added to the tank. The tank surface level has remained at approximately 413 inches from June 2000 to the current time. No additional transfers into or from this tank are planned through 2006 (Strode 2000). Tank 241-AP-105 is currently scheduled to be grab sampled during October 2002.

Table B-21 lists the estimated time to reach the hydroxide limit of 0.3 M at static waste conditions using the June 2000 estimate for the hydroxide ion concentration. Table B-22 lists the estimated free hydroxide ion concentration for January 2006. The schedule for sampling tank 241-AP-105 is satisfactory.

Table B-21. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AP-105

Based Upon June 2000 Estimated OH		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
27	7	11

Table B-22. Projected Hydroxide Concentrations of Tank 241-AP-105 Based on Current Static Waste Storage Conditions

Based Upon June 2000 Estimated OH		
End Date Jan 2006	**End Date Jan 2006**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M
0.62	0.38	0.43

B.1.13 Tank 241-AP-106

Tank 241-AP-106 contains approximately 622 kgal of diluted CC waste transferred from tanks 241-SY-101 and 241-SY-102. It was grab sampled in November 1994, September 1996, August 1997, and in May 1998, and an estimate was made in March 2000, when waste was added to the tank. The tank surface level has remained at approximately 227 inches from March 2000 to the current time. The baseline schedule shows that the current waste is to be retrieved and evaporated during 2002. The tank will then be backfilled with DSSF waste (Strode 2000). Recent planning changes show that the waste in tank 241-AP-106 is to be transferred to tank 241-AP-108 in April 2001. The tank will then be used to receive waste from AP-102 in May 2001. Tank 241-AP-106 is currently scheduled to be grab sampled during October 2002.

Table B-23 lists the estimated time to reach the hydroxide limit of 0.15 M at static waste conditions using the March 2000 estimate for the hydroxide ion concentration. Table B-24 lists the estimated free hydroxide ion concentration for January 2006. The schedule for sampling tank 241-AP-106 is satisfactory.

Note that tank 241-AP-102 waste is to be transferred into this tank in May 2001 and is expected to remain in operation for at least 5 years.

Table B-23. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AP-106

Based Upon March 2000 Estimated OH		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
41	14	31

Table B-24. Projected Hydroxide Concentrations of Tank 241-AP-106 Based on Static Waste Storage Conditions

Based Upon March 2000 Estimated OH		
End Date Jan 2006	**End Date Jan 2006**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M
0.67	0.40	0.44

B.1.14 Tank 241-AP-107

Tank 241-AP-107 contains approximately 984 kgal of DN/DC waste. It was grab sampled in August 1993, February 1995, May 1999, and in August 1999. A process knowledge waste assessment estimate was made in November 2000, when waste was added to the tank. The tank surface level has remained at approximately 357 inches from November 2000 to the current time. Tank 241-AP-107 is used to store dilute waste transferred from tank 241-SY-102 and store it for use as evaporator feed. The level will fluctuate until June 2005, and then will remain stable through the end of 2006 (Strode 2000). Tank 241-AP-107 is currently scheduled to be grab sampled during September 2001, May 2002 and May 2003.

Table B-25 lists the estimated time to reach the lower hydroxide limit of 0.16 M at static waste conditions using the November 2000 estimate for the hydroxide ion concentration. Table B-26 lists the estimated free hydroxide ion concentration for January 2006. The schedule for sampling tank 241-AP-107 is satisfactory.

Table B-25. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AP-107

Based Upon November 2000 Estimated OH		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
23	15	31

Table B-26. Projected Hydroxide Concentrations of Tank 241-AP-107 Based on Current Static Waste Storage Conditions

Based Upon November 2000 Estimated OH		
End Date Jan 2006	**End Date Jan 2006**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M
0.65	0.46	0.49

B.1.15 Tank 241-AP-108

Tank 241-AP-108 contains approximately 38 kgal of DN waste. It was grab sampled in January 1996, October 1997, September 1999, and in March 2000. A waste compatibility assessment estimate was made in January 2001, for a waste addition to the tank (Lechelt 2001a). The tank surface level has remained at approximately 14 inches since May 2000. The tank liquid level will vary because tank 241-AP-108 is a dilute waste receiver for the East Area and waste will be added and transferred out for evaporation (Strode 2000). Recent planning shows that the salt well liquid from tank 241-BY-106 (Fort 2001a) and possibly waste from tank 241-AP-106 is to be transferred to AP-108. The completion of tank 241-BY-106 salt well pumping is scheduled

for November 2002. Tank 241-AP-108 is currently scheduled to be grab sampled during October 2002.

Table B-27 lists the estimated time to reach the lower hydroxide limit of 0.01 M at static waste conditions using the January 2001 estimate for the hydroxide ion concentration. By November 2002 addition of salt well liquid to tank 241-AP-108 is scheduled for completion. The waste compatibility assessment estimates the hydroxide concentration at 0.66 M after addition of tank 241-BY-106 waste.

Table B-27. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AP-108

Based Upon January 2001 Estimated OH		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
2	34	603

Table B-28 lists the estimated free hydroxide ion concentration in January 2006 based on addition of 119 kgal of tank 241-BY-106 salt well liquid and 88 kgal of other waste by November 2002 and recent waste compatibility assessment information (2001a). The hydroxide limit for corrosion control increases to 0.11 M. The current schedule for grab sampling tank 241-AP-108 in October 2002 is satisfactory.

Table B-28. Projected Hydroxide Concentrations of Tank 241-AP-108 Based on Static Waste Storage Conditions and Tank 241-BY-106 Addition

Based Upon November 2002 Estimated OH and Start Date		
End Date Jan 2006	**End Date Jan 2006**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M
0.57	0.47	0.50

B.1.16 Tank 241-AW-101

Tank 241-AW-101 contains approximately 751 kgal DSSF waste. It was grab sampled in June 1990 and in April 1998. The tank surface level has been maintained at approximately 409 inches from March 2000 to the current time. No transfers into or from the tank are planned through 2006 (Strode 2000). Tank 241-AW-101 is currently scheduled to be grab sampled during June 2017.

Table B-29 lists the estimated time to reach the lower hydroxide limit of 0.27 M at static waste conditions using the April 1998 sample for the hydroxide ion concentration. Table B-30 lists the estimated free hydroxide ion concentration for January 2006. The current sample schedule for this tank is satisfactory.

Table B-29. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AW-101

95 % LL OH Sample Result			Average OH Sample Result		
Start Date March 2001			Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
423	25	19	428	25	19

Table B-30. Projected Hydroxide Concentrations of Tank 241-AW-101 Based on Current Static Waste Storage Conditions

95 % LL OH Sample Result			Average OH Sample Result		
End Date Jan 2006			End Date Jan 2006		
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
5.45	2.96	0.91	5.51	2.99	0.91

B.1.17 Tank 241-AW-102

Tank 241-AW-102 contains approximately 866 kgal dilute waste. It was grab sampled in January 1998 and in January 1999. Waste compatibility and process knowledge assessment estimates of hydroxide ion were made in December 2000 and January 2001. The tank surface level is approximately 313 inches at the current time. Tank 241-AW-102 is the evaporator feed tank. Therefore, there will be many transfers into and from the tank (Strode 2000). Tank AW-102 is not currently scheduled for sampling.

Table B-31 lists the estimated time to reach the hydroxide lower limit of 0.01 M at static waste conditions using the waste compatibility assessment estimate of the hydroxide ion (Lechelt 2001). Table B-32 lists the estimated hydroxide ion concentration for January 2006 and earlier. The Hobbs model shows that CO_2 absorption depletes the hydroxide concentration to the corrosion limit by as early as February 2004. The current waste in Tank AW-102 will be transferred to the evaporator by July 2003.

Table B-31. Estimated Time to Reach Hydroxide Limit Lower Based on Current Static Waste Storage Conditions for Tank 241-AW-102

Based Upon January 2001 Estimated OH		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
1	3	35

Table B-32. Projected Hydroxide Concentrations of Tank 241-AW-102 and End Dates Based on Current Static Waste Storage Conditions

Based Upon January 2001 estimated OH		
End Date Jan 2004	**End Date Aug 2004**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M
0.05	0.05	0.07

B.1.18 Tank 241-AW-103

Tank 241-AW-103 contains approximately 508 kgal DSSF waste and PUREX plant decladding sludge. It was grab sampled in September 1994 and in September 1999. An estimate of hydroxide concentration was made before transfer of waste from tank 241-AW-106 (scheduled for February 2001). The tank surface level was approximately 184 inches before the transfer. The tank is to be filled with DSSF waste during 2001-2002 (Strode 2000). Tank 241-AW-103 is currently scheduled to be core sampled during August 2002.

Table B-33 lists the estimated time to reach the hydroxide lower limit of 0.3 M at static waste conditions using the waste compatibility assessment of the hydroxide ion concentration (Fort 2001b). Table B-34 lists the estimated free hydroxide ion concentration for January 2006. The current sample schedule for this tank is satisfactory.

Table B-33. Estimated Time to Reach Hydroxide Lower Limit Based on Static Waste Storage Conditions for Tank 241-AW-103

Based Upon February 2001 Estimated OH		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
58	14	16

Table B-34. Projected Hydroxide Concentrations of Tank 241-AW-103 Based on Static Waste Storage Conditions and Waste Compatibility Assessment

Based Upon February 2001 Estimated OH		
End Date Jan 2006	**End Date Jan 2006**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M
1.29	0.82	0.67

B.1.19 Tank 241-AW-104

Tank 241-AW-104 contains approximately 85 kgal DN waste. It was grab sampled in July 1999 and core sampled in August 2000. An estimate of hydroxide concentration has been made for waste to be transferred in during October 2002. The tank surface level is approximately 114 inches. The tank is to be filled with DSSF waste during 2000-2002 (Strode 2000). Tank 241-AW-104 is currently scheduled to be core sampled in February 2005.

The August 2000 grab sample shows a mean concentration of 0.11 M hydroxide ion from direct measurement by titration and a mean pH of 12.116. Based on the unreliability of direct hydroxide measurements at pH less than 12.5 discussed in Section 3.1, the pH has been used to determine the free hydroxide concentration (pH 12.116 = 0.013 M OH). At 0.013 M OH, the waste fails the limit test ($[NO_3] / ([OH] + [NO_2])$) <2.5 and requires the adjustment of hydroxide concentration as soon as possible either through the transfer of waste or caustic addition.

B.1.20 Tank 241-AW-105

Tank 241-AW-105 contains approximately 172 kgal DN waste and PUREX plant decladding sludge. It was grab sampled in August 1995 and August 1996, and core sampled in May 1997. The tank surface level is approximately 155 inches. The tank is to be filled with dilute waste from the 100 Area during 2002-2003 (Strode 2000). Tank 241-AW-105 is not currently scheduled for sampling.

Table B-35 lists the estimated time to reach the hydroxide limit of 0.01 M at static waste conditions using the 1996 and 1997 sample results for the hydroxide ion concentration. Table B-36 lists the estimated free hydroxide ion concentration for January 2006 and earlier.

There is no schedule for sampling tank 241-AW-105 at this time. Based on the Hobbs model, CO_2 absorption could have depleted the hydroxide ion to below corrosion limits. Grab sampling of tank 241-AW-105 is recommended and its sample ranking changed to medium. If grab sampling of the tank waste is not performed, it is recommended to adjust the caustic concentration in this tank as soon as possible to meet corrosion control requirements.

Table B-35. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AW-105

1996 95 % LL OH Sample Result			1996 Average OH Sample Result		
Start Date March 2001			Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
-4	-3	1	-4	-1	11

1997 Average OH Sample Result		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
-1	4	18

Table B-36. Projected Hydroxide Concentrations of Tank 241-AW-105 Based on Current Static Waste Storage Conditions

1996 95 % LLOH Sample Result			1996 Average OH Sample Result		
End Date Nov 1996	**End Date Mar 1998**	**End Date Oct 2003**	**End Date Jun 1997**	**End Date Oct 2000**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
0.14	0.14	0.14	0.14	0.14	0.16

1997 Average OH Sample Result		
End Date July 1999	**End Date Oct 2005**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M
0.16	0.16	0.25

Table B-37 lists estimated time to reach the lower hydroxide limit at static waste conditions based on the waste compatibility assessment (Fowler 2000). Table B-38 lists the estimated free hydroxide ion concentration results for January 2006 and earlier dates.

Table B-37. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AW-105 and July 2000 Waste Compatibility Assessment

Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
0	3	14

Table B-38. Projected Hydroxide Concentrations of Tank 241-AW-105 Based on Current Static Waste Storage Conditions and July 2000 Waste Compatibility Assessment

End Date May 2003	End Date Jul 2003	End Date Jan 2006
Hobbs OH M	Carothers OH M	Reynolds OH M
0.14	0.14	0.18

B.1.21 Tank 241-AW-106

Tank 241-AW-106 contains approximately 500 kgal DSSF waste. It is a receiver tank for the evaporator bottoms. Tank waste was grab sampled in August 1991, August 1995, January 1998 and May 2000. Waste compatibility assessment and process knowledge estimates of hydroxide concentration were made in May 2000, and March 2001(Lechelt 2001a) and March 2001. The tank surface level was approximately 368 inches during February 2001. Since the tank is the

evaporator bottoms receiver, the tank will receive bottoms from the evaporator on a regular basis, and the waste will then be transferred out to other tank (Strode 2000). Tank 241-AW-106 is not currently scheduled for sampling.

Table B-39 lists the estimated time to reach the hydroxide lower limit at static waste conditions using the March 2001 process knowledge estimate for the hydroxide ion concentration. Table B-40 lists the estimated free hydroxide ion concentration for January 2006 and earlier.

Table B-39. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AW-106

Based Upon Estimated OH after Bottoms Removal during March 2001		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
14	7	12

Table B-40. Projected Hydroxide Concentrations of Tank 241-AW-106 Based on Current Static Waste Storage Conditions

Based Upon Estimated OH after Bottoms are Removal during March 2001		
End Date Jan 2006	End Date Jan 2006	End Date Jan 2006
Hobbs OH M	Carothers OH M	Reynolds OH M
0.52	0.38	0.43

B.1.22 Tank 241-AY-101

Tank 241-AY-101 contains approximately 91 kgal DC waste. It was grab sampled in February 1996 and in February 2001 (sample analysis is not completed). There is also historical data from 1985 and 1987 for hydroxide analysis. The tank surface level is approximately 67 inches. The tank is scheduled for caustic addition during FY 2001. After the caustic addition, no further transfers into or from the tank are scheduled through 2006. The tank is reserved for emergency space through 2006. The tank is to receive waste from tank 241-C-104 SST retrieval starting in FY-2007 (Strode 2000). Tank 241-AY-101 is scheduled to be grab sampled in August 2001, and grab and core sampled in March 2002.

Table B-41 lists the estimated and measured free hydroxide ion concentrations in February 1996 based on modeling of historical sample results from June 1987 and July 1988 when the tank contained approximately 800 kgal of waste. The modeling of 1987 sample results compares closer to grab sample result of 1996. The Hobbs model under predicts the hydroxide results while the Carothers and Reynolds models over predict results.

Table B-42 compares the pH based free hydroxide ion concentrations in February 2000 with modeling of sample results from February 1996. The Carothers and Reynolds models both closely predict the laboratory result.

Table B-41. Comparison of Estimated and Laboratory Results of Hydroxide Concentrations of Tank 241-AY-101 Based on Past Static Waste Storage Conditions

Based Upon June 1987 OH Sample Results				Based on July 1988 OH Sample Results				Grab Sample Lab Result Feb 1996
Lab Result (Start) OH M	End Date Feb 1996 Hobbs OH M	End Date Feb 1996 Carothers OH M	End Date Feb 1996 Reynolds OH M	Lab Result (Start) OH M	End Date Feb 1996 Hobbs OH M	End Date Feb 1996 Carothers OH M	End Date Feb 1996 Reynolds OH M	OH M
0.13	5.8E-04	0.05	0.11	0.47	0.28	0.21	0.30	5.9E-05

Table B-42. Comparison of Estimated and Laboratory Results of pH Based Hydroxide Concentrations of Tank 241-AY-101 Based on Past Static Waste Storage Conditions

Modeling of February 1996 OH Sample Results				pH Based Lab Results
pH Based Lab Result (Start)	End Date Feb 2000			Feb 2000
OH M	Hobbs OH M	Carothers OH M	Reynolds OH M	OH M
5.9E-05	1.2E-05	3.9E-05	6.0E-05	5.0E-05

B.1.23 Tank 241-AY-102

Tank 241-AY-102 contains approximately 390 kgal DC waste. It was grab sampled in October 1996, January, July, November, and December of 1998, March, April, May, and June and October 1999, and November 2000 (all available as of February 2001). The tank surface level is approximately 208 inches. The tank is scheduled for caustic addition during FY 2001. After the caustic addition, no further transfers are planned into or from the tank through 2006 (Strode 2000). Tank 241-AY-102 is scheduled to be grab and core sampled in March 2001, grab sampled in August 2001, and grab and core sampled in February 2002.

Table B-43 lists the estimated and measured free hydroxide ion concentrations for end dates of October 1999 and January 2000 based on a start date of October 1999. The Carothers and Reynolds models give better results.

Table B-43. Comparison of Modeled and Laboratory Results of Hydroxide Concentrations of Tank 241-AY-102 Based on Static Waste Storage Conditions

Modeling of January 1998 OH Sample Results								Sample Lab Result[1] Jan 2000
Lab Result (Start) OH M	End Date Oct 1999 Hobbs OH M	End Date Oct 1999 Carothers OH M	End Date Oct 1999 Reynolds OH M	Lab Result Oct 1999 OH M	End Date Jan 2000 Hobbs OH M	End Date Jan 2000 Carothers OH M	End Date Jan 2000 Reynolds OH M	OH M
0.07	0.01	0.06	0.07	0.09	-	0.005	0.07	0.06

Notes:

[1]Based on pH measurement

B.1.24 Tank 241-AZ-101

Tank 241-AZ-101 contains approximately 865 kgal NCAW waste. It was core sampled in March 1995 and in November 1999. The tank surface level is approximately 336 inches. The tank is not scheduled to have any transfers into or out of it through 2005. The supernatant from tank 241-AZ-101 is scheduled for transferred to the Waste Treatment Plant as LAW feed as batch 2. However, that my not occur until after 2006 (Strode 2000). Tank 241-AZ-101 is scheduled to be core sampled in October 2002 and in June 2005.

Table B-44 lists the estimated time to reach the hydroxide lower limit at static waste conditions using the November 1999 sample for the hydroxide ion concentration. Table B-45 lists the estimated free hydroxide ion concentration for January 2006.

Table B-44. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AZ-101

95 % LL OH Sample Result			Average OH Sample Result		
Start Date March 2001			Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
39	15	48	40	16	48

Table B-45. Projected Hydroxide Concentrations of Tank 241-AZ-101 Based on Current Static Waste Storage Conditions

95 % LL OH Sample Result			Average OH Sample Result		
Start Date Nov 1999			Start Date Nov 1999		
End Date Jan 2006			End Date Jan 2006		
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
0.58	0.34	0.40	0.59	0.35	0.41

B.1.25 Tank 241-AZ-102

Tank 241-AZ-102 contains approximately 892 kgal NCAW waste. It was core sampled in February 1995 and core sampled in September 1999. An estimate of the hydroxide concentration was performed for a transfer in February 2001. The tank surface level is approximately 363 inches. The tank is not scheduled to have any transfers into or from the tank through 2006. The supernatant from tank 241-AZ-102 is scheduled for transfer to the Waste Treatment Plant as LAW as feed batch 3 (Strode 2000). Tank 241-AZ-102 is scheduled to be core sampled in December 2002.

Table B-46 lists the estimated time to reach the hydroxide lower limit of 0.01 M at static waste conditions using the September 1999 sample result and the February 2001 estimate for the

hydroxide ion concentration. Table B-47 lists the estimated free hydroxide ion concentrations calculated to January 2006.

Table B-46. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-AZ-102

Based on 1999 95 % LL Sample OH			Based on 1999 Avg Sample OH		
Start Date March 2001					
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
2	9	423	3	12	478

Based on 2001 Estimated OH		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
4	13	467

Table B-47. Projected Hydroxide Concentrations of Tank 241-AZ-102 Based on Current Static Waste Storage Conditions

Based on 1999 95 % LL Sample OH			Based on 1999 Avg Sample OH		
End Date Aug 2002	**End Date Jan 2006**	**End Date Jan 2006**	**End Date Aug 2004**	**End Date Jan 2006**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
0.01	0.02	0.03	0.01	0.02	0.04

Based on 2001 Estimated OH		
End Date Jul 2005	**End Date Jan 2006**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M
0.01	0.02	0.04

B.1.26 Tank 241-SY-101

Tank 241-SY-101 contains approximately 888 kgal CC waste. It was grab sampled in March 1999 and in April 2000. The tank surface level is approximately 353 inches. The tank is not scheduled to have any transfers into or from the tank through 2006 (Strode 2000). Tank 241-SY-101 is not currently scheduled for sampling. Tank 241-SY-101 should remain as a low ranking. Sampling of the tank should be performed by 2017.

Table B-48 lists the estimated time to reach the hydroxide lower limit of 0.23 M at static waste conditions using the April 2000 sample for the hydroxide ion concentration. Table B-49 lists the estimated free hydroxide ion concentration for January 2006.

Table B-48. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-SY-101

Based on 2000 95 % LL Sample OH			Based on 2000 Avg Sample OH		
Start Date March 2001					
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
23	15	223	29	17	22

Table B-49. Projected Hydroxide Concentrations of Tank 241-SY-101 Based on Current Static Waste Storage Conditions

Based on 2000 95 % LL Sample OH			Based on 2000 Avg Sample OH		
End Date Jan 2006			End Date Jan 2006		
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
1.21	0.97	0.82	1.40	1.12	0.88

B.1.27 Tank 241-SY-102

Tank 241-SY-102 contains approximately 811 kgal CC waste. It was grab sampled several times, most recently January 2000. The tank surface level is approximately 324 inches. The tank receives salt well pumping waste, PFP waste, 222-S lab waste, and will receive waste from SST retrieval (Strode 2000). Although the current schedule does not show received SST waste entering tank 241-SY-102 prior to 2006, the tank will have to receive waste from two SSTs prior to that date to allow the TPA milestones for retrieval of tanks 241-S-112 and 241-S-102 to be met. Tank 241-SY-102 is scheduled to be core sampled during March 2001.

Table B-50 lists the estimated time to reach the hydroxide lower limit of 0.15 M at static waste conditions using the October 2000 sample for the hydroxide ion concentration. Table B-51 lists the estimated free hydroxide ion concentration in January 2006. The current schedule for sampling the tank is satisfactory.

Table B-50. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-SY-102

Based Upon October 2000 OH Sample Results		
Start Date March 2001		
Hobbs, yr	Carothers, yr	Reynolds, yr
7	15	34

Table B-51. Projected Hydroxide Concentrations of Tank 241-SY-102 Based on Static Waste Storage Conditions

Based Upon October 2000 OH Sample Results		
End Date Jan 2006	**End Date Jan 2006**	**End Date Jan 2006**
Hobbs OH M	Carothers OH M	Reynolds OH M
0.61	0.47	0.49

B.1.28 Tank 241-SY-103

Tank 241-SY-103 contains approximately 376 kgal CC waste. It was grab sampled in September 1994. The tank surface level is approximately 270 inches. The tank is not scheduled to have any transfers into or from the tank through 2006 (Strode 2000). Tank 241-SY-103 is currently scheduled to be grab sampled during March 2010.

Table B-52 lists the estimated time to reach the hydroxide limit of 0.28 M at static waste conditions using the September 1994 sample for the hydroxide ion concentration. Table B-53 lists the estimated free hydroxide ion concentration for January 2006. The current schedule for sampling tank SY-103 is satisfactory.

Table B-52. Estimated Time to Reach Hydroxide Lower Limit Based on Current Static Waste Storage Conditions for Tank 241-SY-103

Based on 1994 95 % LL Sample OH			Based on 1994 Avg Sample OH		
Start Date March 2001					
Hobbs, yr	Carothers, yr	Reynolds, yr	Hobbs, yr	Carothers, yr	Reynolds, yr
35	8	11	45	10	12

Table B-53. Projected Hydroxide Concentrations of Tank 241-SY-103 Based on Static Waste Storage Conditions

Based on 1994 95 % LL Sample OH			Based on 1994 Avg Sample OH		
End Date Jan 2006			End Date Jan 2006		
Hobbs OH M	Carothers OH M	Reynolds OH M	Hobbs OH M	Carothers OH M	Reynolds OH M
1.10	0.41	0.40	1.35	0.49	0.41

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