SRR-CWDA-2015-00123
Revision 2

Evaluation of Tc-99 Concentration Data to Improve Liquid Waste Inventory Projections

March 2018

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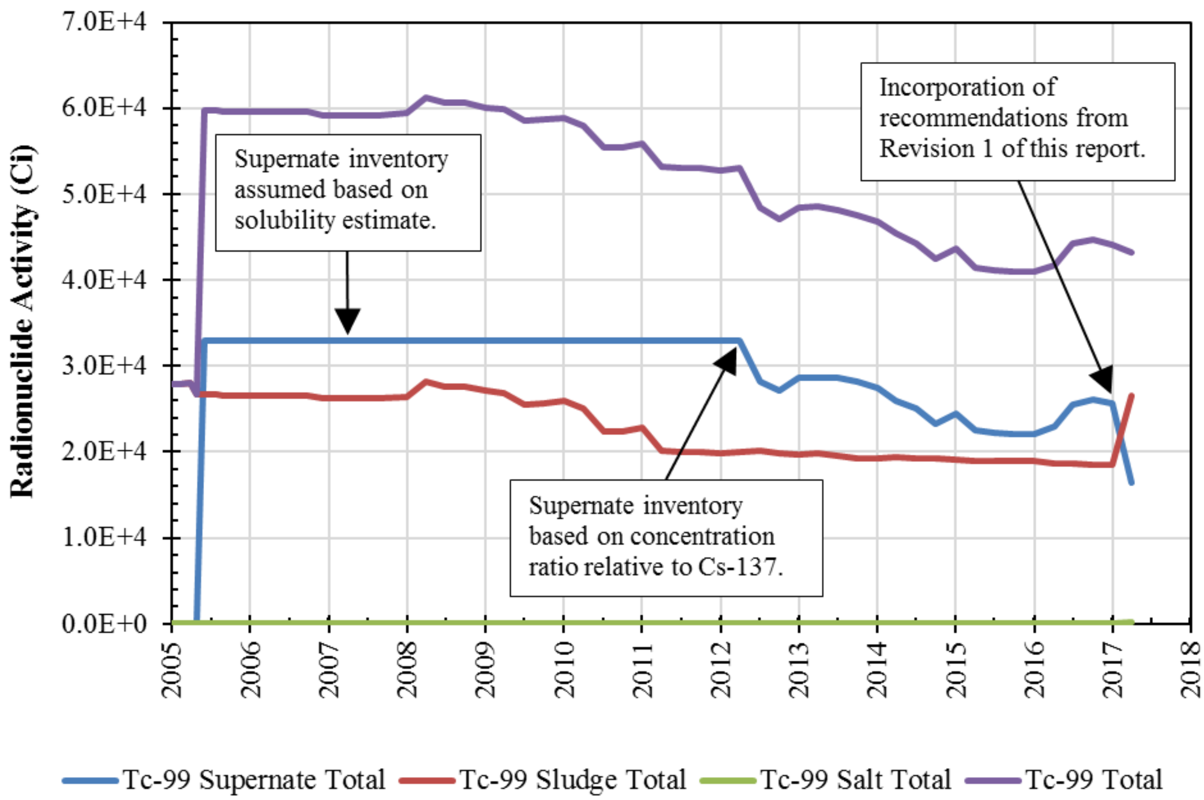
REVISION SUMMARY

REV. #	DESCRIPTION	DATE OF ISSUE
0	Initial Issue	November 2015
1	Incorporates additional data. Revises the approach for "adjustment factors" to use comparisons of logarithmic relationships rather than linear relationships.	January 2017
2	Incorporated data from 2017 sample analyses.	March 2018

EXECUTIVE SUMMARY

Performance Assessment (PA) and Special Analysis (SA) modeling of the Saltstone Disposal Facility (SDF) have demonstrated that the radionuclide Tc-99 is important for calculating potential future dose impacts. [SRR-CWDA-2009-00017, SRR-CWDA-2013-00062, SRR-CWDA-2014-00006, SRR-CWDA-2016-00072] Currently, the Waste Characterization System (WCS) is the primary input for periodic "Curie and Volumes Reports", which are used to estimate the Tc-99 inventory in the tank farms (see Figure ES-1), and thus what is available for transfer to the SDF. The WCS relied heavily on a series of assumptions to develop estimates of the Tc-99 inventory. Specifically, the inventory of Tc-99 in supernate was based on a constant fraction of the Cs-137 data. [SRR-LWP-2016-00045] For Tc-99 in sludge, the inventory was based on fresh waste receipt compositions. [WSRC-TR-94-0562] Most recently, WCS has updated their assumptions based on recommendations from Revision 1 of this report (i.e., SRR-CWDA-2015-00123).

Figure ES-1: Total Curies of Tc-99 within the Tanks Farms (per Curie and Volume Inventory Reports)



Relying on Cs-137 data provided inconsistent results because Cs-137 is a relatively short-lived isotope (with a half-life of approximately 30 years), whereas Tc-99 is a long-lived isotope (with a half-life of approximately 211,000 years). As such, the Tc-99 inventory projections showed an unrealistic year-to-year decline (see Figure ES-1) as the Cs-137 decays.

Given the importance of Tc-99 in estimating doses within SDF performance modeling, improved methods for projecting Tc-99 inventories to the SDF are necessary. This report examines sampled concentrations of Tc-99 (and associated Cs-137) to develop a recommendation for a more defensible basis for projecting SDF inventory values. Based on the revised methodology, the total Tc-99 inventory within the tank farms is projected to be 4.73+04 Ci (2.12E+04 Ci of soluble Tc-99 and 2.62E+04 Ci of insoluble sludge Tc-99). For the purpose of this report, "soluble inventory" refers to all inventory destined for SDF disposal (i.e., supernate, interstitial liquids, and salts), while "insoluble inventory" refers to the sludge solids, which are destined for vitrification at the Defense Waste Processing Facility (DWPF).

The 2009 SDF PA (SRR-CWDA-2009-00017) and the FY2013 SDF SA (SRR-CWDA-2013-00062) both assumed that approximately 3.5E+04 Ci of Tc-99 will be disposed within the SDF, while the FY2014 SDF SA (SRR-CWDA-2014-00006) and FY2016 SDF SA (SRR-CWDA-2016-00072) both assumed approximately 2.9E+04 Ci of Tc-99. This decrease is partially attributed to the impact of Cs-137 decay on the inventory projection.

For future modeling, this report recommends similar values: for "realistic" models 2.24E+04 Ci is recommended; this value represents Tc-99 already disposed at SDF plus the total soluble inventory within the tank farms. For "compliance" models an inventory of 3.30E+04 Ci is recommended; this value represents Tc-99 already disposed at SDF plus the total soluble inventory within the tank farms, increased by 50% to account for potential uncertainty. Finally, for "defense-in-depth" models an inventory of 3.55E+04 Ci is recommended; this value represents Tc-99 already disposed at SDF plus the total soluble inventory and half of the total insoluble inventory.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS/ABBREVIATIONS

CFR	Code of Federal Regulations
DF	Decontamination Factor
DOE	United States Department of Energy
DWPF	Defense Waste Processing Facility
FTF	F-Tank Farm
FY	Fiscal Year
HTF	H-Tank Farm
KA	Key Assumption
LWP	Liquid Waste Planning
MOP	Member of the Public
PA	Performance Assessment
SA	Special Analysis
SDF	Saltstone Disposal Facility
SDU	Saltstone Disposal Unit
SRS	Savannah River Site
SS	Sludge Solids
WCS	Waste Characterization System
WDA	Waste Disposal Authority

1.0 INTRODUCTION

This document provides an analysis of Tc-99 concentrations in liquid waste at the Savannah River Site (SRS). The purpose of this analysis is to estimate the amount (in curies (Ci)) of Tc-99 that is currently in the tank farms (i.e., F-Tank Farm (FTF) and H-Tank Farm (HTF)), and to use the estimate to project the total inventory (Ci) of Tc-99 for final disposal within the Saltstone Disposal Facility (SDF). A current tank farm inventory of 4.18E+04 Ci is recommended as the current Tc-99 tank farm inventory based on a set of analytically determined concentrations.

The general approach followed these steps:

(1) Quantify the relationship between Cs-137 and Tc-99 to provide a basis for using Cs-137 samples as a surrogate for estimating Tc-99 concentrations (Section 2);

(2) Use the current WCS-based concentrations for Cs-137 (Appendix A) and the relationship between Cs-137 and Tc-99 to estimate the Tc-99 concentrations (Sections 3.1, 3.2, and 3.3);

(3) Use the current tank farm volumes (Appendix A) and the estimated Tc-99 concentrations to provide a preliminary Tc-99 inventory estimate in the tank farms (Section 3.4); and

(4) For tanks with recent Tc-99 sample data, replace the estimated concentrations with the known values from recent sample data (Section 3.5); and

(5) Use the estimated and known concentration values with the current tank farm volumes to develop a recommended Tc-99 inventory estimate (Section 3.5).

Section 1.1 demonstrates that the inventories based on the Waste Characterization System (WCS) have shown substantial variability in the projected Tc-99 inventories for the tank farms. Section 1.2 demonstrates the importance of Tc-99 relative to meeting performance objectives in SDF modeling. Section 1.3 introduces intermediate data used within various analyses in later sections.

1.1 Variability in Tc-99 Estimates

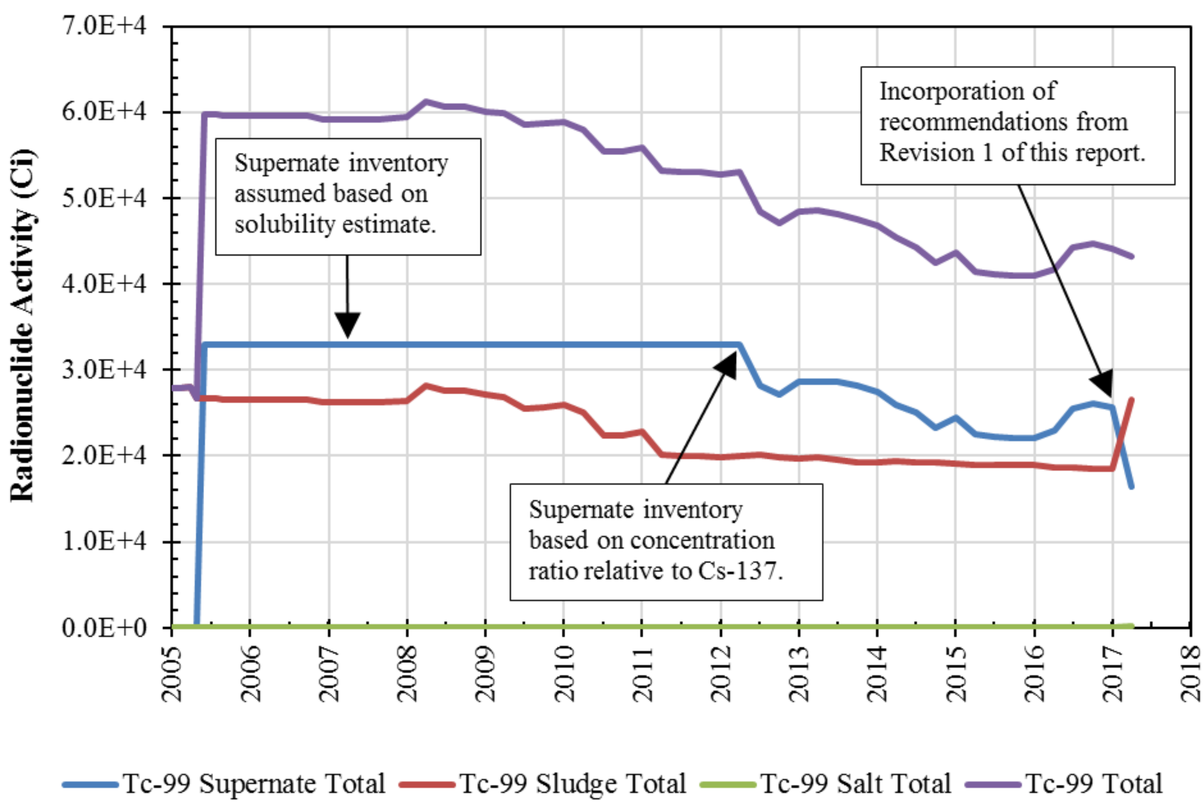
Historically, the Tc-99 inventory has varied, not as a function of sampled data, but as a function of the methods applied for projecting the values.

Prior to 2005, the WCS-based Curie and Volume Inventory Reports projected a small inventory of Tc-99 within supernate, such that the inventory was dominated by Tc-99 within waste tank sludge. [WSRC-TR-96-0264] In June 2005, the WCS incorporated a new method to estimate the Tc-99 inventories in supernate based on the report: *Soluble Phase Selenium-79, Technetium-99, and Tin-126 Inventories*. [CBU-PIT-2005-00132; CBU-PIT-2005-00127] This 2005 report evaluated two approaches for estimating the amount of Tc-99 in supernate. For the first approach, the theoretical fission yield relationship and an assumed solubility ratio of 53% resulted in an estimate of 3.3E+04 Ci of Tc-99 in tank farm supernate. For the second approach, 22 measured concentrations of Tc-99 were studied and compared to respective Cs-137 concentrations to generate a Tc-99 to Cs-137 ratio of 1.95E-04, which resulted in an estimate of 2.2E+04 Ci of Tc-99 in tank farm supernate. For conservatism, the higher of these two values (3.3E+04 Ci) was assumed for the Curie and Volume Inventory Reports. However, it should be noted that the assumed 53% solubility used to generate this estimate has uncertainty associated with it. For example, the *Chemical Differences Between Sludge Solids at the F and H Area Tank Farms* indicated that the soluble portions of technetium can range from 20% to 95% depending upon the chemical environment. [SRNL-STI-2012-00479]

This 3.3E+04 Ci supernate inventory value was held constant until 2012 when the Tc-99 to Cs-137 ratio was revised to 3.90E-04. [SRR-LWP-2012-00047] From July 2012 through 2016, WCS assumed that the Tc-99 inventory was a function of the Cs-137 inventory such that the estimated Tc-99 inventory in supernate showed an unrealistic, gradual decline as a function of the decay of Cs-137 (see Figure 1.1-1). [SRR-LWP-2017-00033] Finally, in 2017 recommendations from the previous revision of this report (Revision 1 of SRR-CWDA-2015-00123) were incorporated into the WCS estimates.

In the previous revision of this report (Revision 1 of SRR-CWDA-2015-00123), multiple measured concentrations from sampled waste were used to develop a new approach for estimating Tc-99 to mitigate this variability. For this current revision (i.e., this document), the recommendations from Revision 1 are updated to reflect recent sampling activities which targeted specific tanks to reduce inventory uncertainty.

Figure 1.1-1: Total Curies of Tc-99 within the Tanks Farms (per Curie and Volume Inventory Reports)

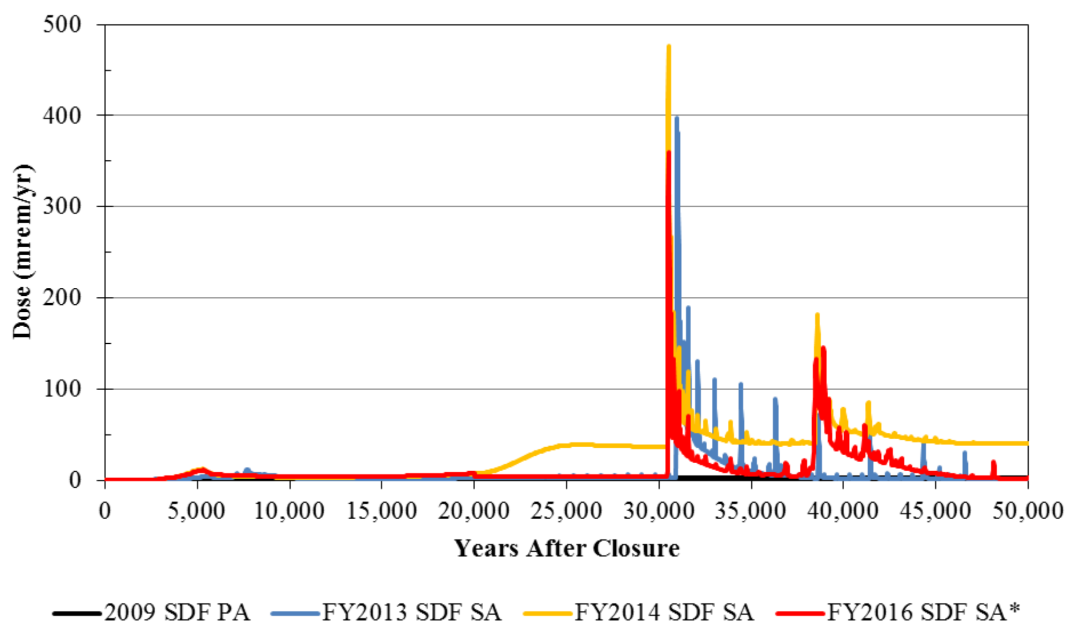


1.2 Importance of Tc-99 in Dose Modeling

The method used to project Tc-99 inventories is important because Tc-99 is an important dose contributor in performance modeling. Specifically, Performance Assessment (PA) and Special Analysis (SA) modeling of the SDF have demonstrated that Tc-99 is important relative to long term peak doses. [SRR-CWDA-2009-00017, SRR-CWDA-2013-00062, SRR-CWDA-2014-00006, SRR-CWDA-2016-00072] Note that the long-term dose peaks influenced by Tc-99 releases (as shown in Figure 1.2-1) are well beyond the time periods considered for performance objective comparison, which considers doses for 1,000 years and 10,000 years after facility closure. [DOE M 435.1-1; 10 CFR 61]

Figure 1.2-1 shows calculated doses to the member of the public (MOP) from SDF PA and SA modeling (i.e., the 2009 SDF PA, the Fiscal Year (FY) 2013 SDF SA, the FY2014 SDF SA, and the FY2016 SDF SA). [SRR-CWDA-2009-00017, SRR-CWDA-2013-00062, SRR-CWDA-2014-00006, SRR-CWDA-2016-00072] The 2009 SDF PA and the FY2013 SDF SA both assumed that approximately 3.5E+04 Ci of Tc-99 will be disposed within the SDF (based on the supernate inventory), while the FY2014 and FY2016 SDF SAs assumed only approximately 2.9E+04 Ci of Tc-99, reflecting the impact of Cs-137 decay on the inventory projection. [SRR-LWP-2013-00066] Despite the differences in the models (e.g., inventory values, facility layout), each of the SAs show peak doses around 350 to 450 mrem/yr 30,000 years after SDF closure. These peaks correspond to the releases of Tc-99.

Figure 1.2-1: Comparison of the 100-Meter MOP Peak All-Pathways Dose within 50,000 Years for the 2009 SDF PA, FY2013 SDF SA, FY2014 SDF SA, and FY2016 SDF SA

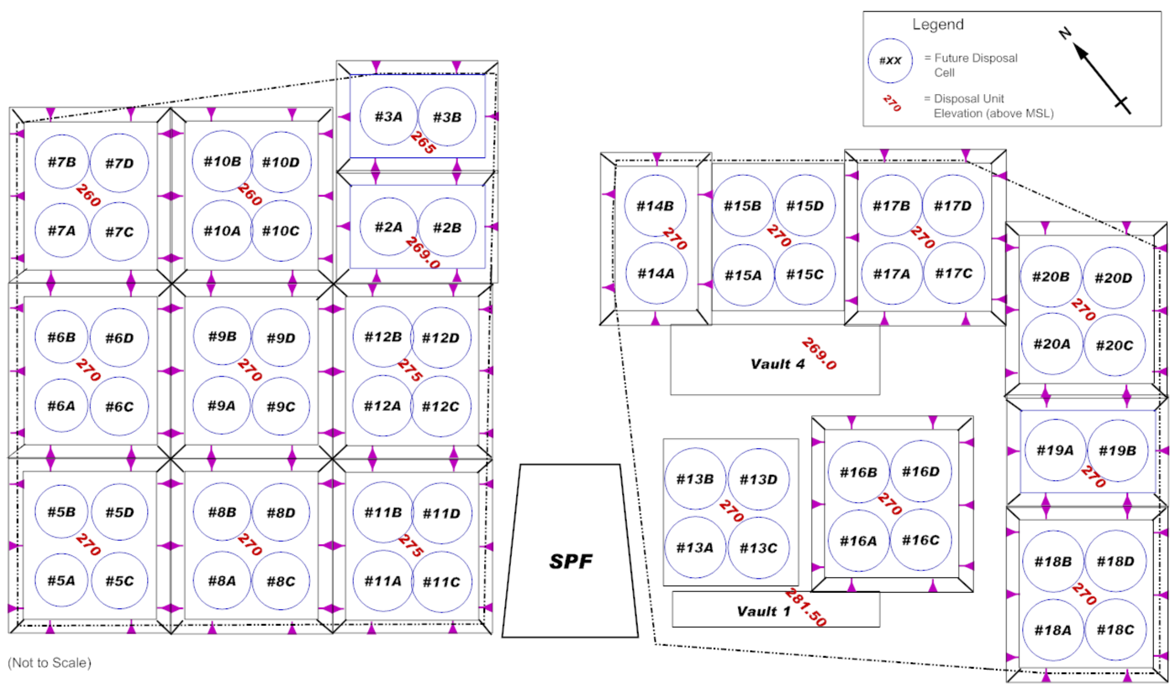


Note: * After 20,000 years, the FY2016 SDF SA only included dose contributions from Tc-99. Contributions from other radionuclides are expected to increase the total peak dose by approximately 40 to 50 mrem/yr. [Source: Figure 1.1-3 from SRR-CWDA-2016-00072]

Aside from variations in the assumed inventories, the primary difference between the SAs are the anticipated layout of the Saltstone Disposal Units (SDUs) at the SDF. The FY2013 SDF SA has the same layout as the PA in which waste is disposed within the two rectangular SDUs (SDU 1 and SDU 4) and 64 150-foot diameter cylindrical SDUs (see Figure 1.2-2); whereas the FY2014 SDF SA is modeled as having the two rectangular SDUs, six 150-foot diameter cylindrical SDUs, and seven 375-foot diameter cylindrical SDUs (see Figure 1.2-3). The FY2016 SDF SA has a very similar layout to the FY2014 SDF SA, except SDUs 6 through 9 are moved slightly and the roofs and floors of select 375-foot diameter SDUs are assumed to have higher initial hydraulic conductivities (6.2E-06 cm/sec versus 9.3E-11 cm/sec used in the FY2014 SDF SA).

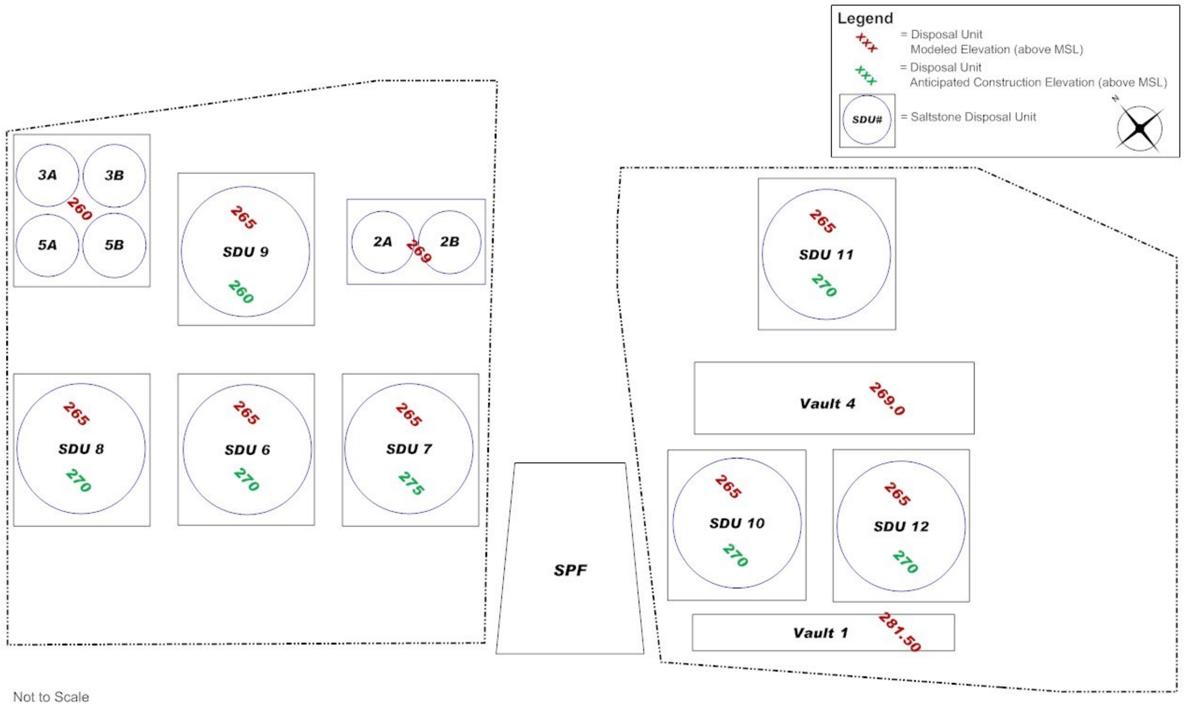
Although the FY2014 and FY2016 SDF SAs model less Tc-99 inventory than the FY2013 SDF SA, the resulting total peak doses to the MOP are similar due to modeling assumptions in the SAs. Specifically, for the facility layouts with the larger SDUs, more Tc-99 inventory is closer to the points of assessment, resulting in higher peak doses from Tc-99. Also, by comparing Figures 1-3 and 1-4 it is apparent that the newer layout (used in the FY2014 SDF SA) occupies less surface area than the previous layout; therefore, the areal distribution of saltstone is more concentrated in the newer layout. As such, despite having different Tc-99 inventories, all of the SAs showed relatively similar peak doses.

Figure 1.2-2: Layout of SDF as Modeled in the 2009 SDF PA and the FY2013 SDF SA



Note: Numbering of the units are placeholders and may not match the final disposal unit numbing.

Figure 1.2-3: Layout of SDUs as Modeled in the FY2014 SDF SA



Because Tc-99 influences the long-term peak doses, and historical projections of Tc-99 have shown significant variability, it is important to develop a more reliable approach for estimating the total Tc-99 inventory that is both reasonable and defensible.

1.3 Assumptions and Intermediate Data Used to Inform Analyses

The analysis presented in this document relies on assumptions and additional, intermediate data. Specifically, Section 1.3.1 provides a list of assumptions, Section 1.3.2 provides the current inventory (Ci) of Tc-99 disposed at SDF, and Section 1.3.3 provides the curies of Tc-99 that are known to be left in place as residual inventory within tanks that are closed (i.e., removed from service).

1.3.1 Key Assumptions

The following provides a list of key assumptions used in the analyses within this report. For reference, these assumptions are numbered as Key Assumptions (KA) 1 through 11.

KA1. It is assumed that all concentrations or inventories must be decayed to the same point in time to properly evaluate any comparisons or relationships. For practical purposes, the expected date of SDF closure (10/1/2032) is assumed.

KA2. It is assumed that the inventories of Cs-137 within the tank farms (as reported by the *Curie and Volume Inventory Reports*) are well characterized and well understood. [SRR-LWP-2017-00033]

KA3. It is assumed that the 2012 report: *Chemical Differences Between Sludge Solids at the F and H Area Tank Farms* shall be the technical basis for evaluating sludge inventories. [SRNL-STI-2012-00479]

KA4. It is assumed that if a relationship can be established between concentrations of Cs-137 and concentrations of Tc-99, then the Cs-137 concentrations can be used as a surrogate for Tc-99.

KA5. Consistent with WCS assumptions (and based on information in DPST-82-502), 70% of sludge volume is assumed to be interstitial liquid.

KA6. Consistent with WCS assumptions, 30% of salt volume is assumed to be interstitial liquid.

KA7. It is assumed that waste concentrations for interstitial liquids are the same as supernate concentrations.

1.3.2 Curies of Tc-99 Disposed at SDF

As of September 2017, the SDF has received 1.24E+03 Ci of Tc-99. (Note that these values are decayed to the expected SDF closure date of October 1, 2032.) These values are based on the SDF-WIDE Model described in the *Saltstone Disposal Facility Waste Inventory Disposed Estimator Model Report*, using more recent input data. [SRR-CWDA-2015-00003, SRR-CWDA-2017-00079]

1.3.3 Curies of Tc-99 Remaining in Waste Tanks that are Removed from Service

As of 2017, eight waste tanks have been emptied and removed from service. The Tc-99 within the residual tank waste of these waste tanks should also be considered for finding the total inventories; although it should be noted that because these values were developed to support performance modeling for the tank farms, these values reflect conservative estimates. Table 1.3-1 provides the residual tank waste inventories for Tc-99 within these waste tanks.

Table 1.3-1: Residual Tank Waste Inventories for Tc-99 and Cs-137

Tank	Year Closed	Tc-99 (Ci)[a]	Reference
Tank 5	2013	0.10	SRR-CWDA-2012-00106
Tank 6	2013	1.70	SRR-CWDA-2012-00106
Tank 12	2016	0.072	SRR-CWDA-2015-00075
Tank 16	2015	4.93	SRR-CWDA-2014-00106
Tank 17	1997	3.90	WSRC-TR-97-0066
Tank 18	2012	0.90	SRR-CWDA-2010-00124
Tank 19	2012	0.38	SRR-CWDA-2010-00124
Tank 20	1997	0.85	WSRC-TR-96-0267
Total		**12.8**	

Note: (a) These values are not decayed from the values presented in the respective references.

Combined with the waste disposed (Section 1.3.2), there are 1.25E+03 Ci of Tc-99 that have been dispositioned.

2.0 NORMALIZATION OF CONCENTRATION DATA

Previous projections of Tc-99 have been based on a fairly limited number of measured samples. By analyzing a larger set of available data, a predictive data model can be developed to improve Tc-99 inventory projections. However, prior to starting the analysis, all of the available data was examined to identify outliers and to correct for duplicate entries.

Section 2.1 presents the initial data, as sampled from the tank farms. Section 2.2 establishes an initial relationship between Cs-137 and Tc-99. In Section 2.3, the Cs-137 concentrations from Tank 50 were removed from the data set as the impacts from cesium decontamination invalidates any potential relationship between Cs-137 and Tc-99. Section 2.3 also identifies additional data points that were removed as outliers (i.e., characteristics of the data made the values suspect). Section 2.4 removed very low concentration data to ensure that the analysis focuses on reflecting bulk waste relationships. Section 2.5 combines duplicate entries, by averaging very similar data points together (i.e., points sampled from the same tank on or near the same date) to reduce the risk of "double-counting". Finally, Section 2.6 provides a high-level summary of the data normalization.

2.1 Initial Analysis of Available Concentration Data

Table 2.1-1 provides a summary of the historical Tc-99 concentrations and sample data (including the associated Cs-137 concentrations) that are considered within this document. To ensure that the decay of Cs-137 will not influence the analysis, all of these values have been decayed from the measured values to October 1, 2032, the assumed date of SDF closure (see Section 1.3.1).

Table 2.1-1: Sampled Concentrations of Tc-99 and Cs-137

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
19	1.58E+04	1.38E+07	DPST-81-00329	5/1/1981	not available	Supernate
19	1.44E+04	9.68E+06	DPST-81-00329	5/1/1981	not available	Supernate
20	3.14E+03	3.22E+06	HLW-HLE-94-0328	11/1/1985	1.170	not specified
20	1.08E+04	2.61E+07	HLW-HLE-94-0328	11/15/1985	1.370	not specified
22	3.80E+03	1.03E+07	CBU-PIT-2005-00127	5/21/1986	not available	Supernate
22	3.78E+03	1.02E+07	HLW-HLE-94-0328	5/21/1986	1.260	not specified
21	2.12E+02	7.30E+05	HLW-HLE-94-0328	6/4/1986	1.040	not specified
20	9.01E+03	2.03E+07	HLW-HLE-94-0328	7/14/1986	1.340	not specified
20	6.31E+03	9.70E+04	HLW-HLE-94-0328	8/2/1986	1.220	not specified
20	8.11E+03	9.35E+06	HLW-HLE-94-0328	9/3/1986	1.210	not specified
21	3.90E+03	8.33E+06	CBU-PIT-2005-00127	9/10/1986	not available	Supernate
21	3.20E+04	6.60E+07	CBU-PIT-2005-00127	9/22/1986	not available	Supernate
21	3.25E+04	6.57E+07	HLW-HLE-94-0328	9/22/1986	1.170	not specified
21	1.60E+04	3.82E+07	CBU-PIT-2005-00127	9/24/1986	not available	Supernate
21	1.62E+04	3.75E+07	HLW-HLE-94-0328	9/24/1986	1.210	not specified
21	3.88E+03	8.46E+06	HLW-HLE-94-0328	10/9/1986	1.060	not specified
20	8.10E+03	9.44E+06	CBU-PIT-2005-00127	1/5/1987	not available	Supernate
50	7.24E+03	5.73E+02	HLW-HLE-94-0328	6/28/1990	not available	not specified
50	7.77E+03	6.05E+02	HLW-HLE-94-0328	6/28/1990	not available	not specified

Table 2.1-1: Sampled Concentrations of Tc-99 and Cs-137 (Continued)

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
50	4.28E+03	6.78E+02	HLW-HLE-94-0328	2/28/1992	not available	not specified
50	4.38E+03	6.49E+02	HLW-HLE-94-0328	2/28/1992	not available	not specified
50	2.32E+03	7.57E+02	HLW-HLE-94-0328	3/30/1992	not available	not specified
50	2.36E+03	6.65E+02	HLW-HLE-94-0328	3/30/1992	not available	not specified
30	3.43E+05	9.95E+08	HLW-HLE-94-0328	4/10/1992	1.336	not specified
33	2.07E+05	1.96E+08	HLW-HLE-94-0328	4/29/1992	1.245	not specified
34	1.40E+05	1.98E+08	CBU-PIT-2005-00127	4/30/1992	not available	Supernate
34	1.40E+05	1.96E+08	HLW-HLE-94-0328	4/30/1992	1.218	not specified
50	5.07E+03	7.89E+02	HLW-HLE-94-0328	5/4/1992	not available	not specified
50	5.07E+03	7.89E+02	HLW-HLE-94-0328	5/4/1992	not available	not specified
50	3.78E+03	1.43E+03	HLW-HLE-94-0328	6/4/1992	not available	not specified
50	4.04E+03	9.28E+02	HLW-HLE-94-0328	6/4/1992	not available	not specified
27	1.40E+05	3.93E+08	CBU-PIT-2005-00127	7/21/1992	not available	Supernate
27	1.40E+05	3.94E+08	WSRC-RP-93-1009	7/21/1992	1.453	Supernate
27	1.40E+05	3.93E+08	HLW-HLE-94-0328	7/21/1992	1.453	not specified
28	1.80E+05	4.77E+08	CBU-PIT-2005-00127	7/21/1992	not available	Supernate
28	1.80E+05	4.65E+08	WSRC-RP-93-1009	7/21/1992	1.474	Supernate
28	1.80E+05	4.65E+08	HLW-HLE-94-0328	7/21/1992	1.474	not specified
25	1.67E+05	4.47E+08	WSRC-RP-93-1009	7/24/1992	1.482	Supernate
50	3.09E+03	9.40E+02	HLW-HLE-94-0328	7/28/1992	not available	not specified
50	3.09E+03	9.95E+02	HLW-HLE-94-0328	7/28/1992	not available	not specified
26	1.80E+05	5.73E+08	WSRC-RP-93-1009	7/29/1992	1.546	Supernate
26	1.80E+05	5.57E+08	CBU-PIT-2005-00127	8/14/1992	not available	Supernate
26	1.80E+05	5.74E+08	HLW-HLE-94-0328	8/14/1992	1.546	not specified
50	4.12E+03	9.77E+02	HLW-HLE-94-0328	8/31/1992	not available	not specified
50	4.31E+03	9.77E+02	HLW-HLE-94-0328	8/31/1992	not available	not specified
30	3.40E+05	9.97E+08	CBU-PIT-2005-00127	10/4/1992	not available	Supernate
50	3.88E+03	9.92E+02	HLW-HLE-94-0328	11/4/1992	not available	not specified
50	3.96E+03	8.92E+02	HLW-HLE-94-0328	11/4/1992	not available	not specified
29	5.18E+05	1.17E+09	WSRC-RP-93-1009	11/23/1992	1.430	Supernate
30	2.61E+05	8.66E+08	WSRC-RP-93-1009	11/23/1992	1.280	Supernate
32	1.94E+05	3.97E+08	WSRC-RP-93-1009	11/23/1992	1.240	Supernate
38	1.98E+05	3.97E+08	WSRC-RP-93-1009	11/23/1992	1.470	Supernate
43	1.44E+05	2.70E+08	WSRC-RP-93-1009	11/23/1992	1.430	Supernate
38	2.00E+05	3.96E+08	CBU-PIT-2005-00127	11/24/1992	not available	Supernate
38	1.98E+05	3.97E+08	HLW-HLE-94-0328	11/24/1992	1.470	not specified
43	1.40E+05	2.72E+08	CBU-PIT-2005-00127	11/24/1992	not available	Supernate
43	1.44E+05	2.71E+08	HLW-HLE-94-0328	11/24/1992	1.430	not specified
29	5.20E+05	1.16E+09	CBU-PIT-2005-00127	11/28/1992	not available	Supernate
29	5.18E+05	1.17E+09	HLW-HLE-94-0328	11/28/1992	1.430	not specified
30	2.60E+05	8.81E+08	CBU-PIT-2005-00127	11/29/1992	not available	Supernate
30	2.61E+05	8.65E+08	HLW-HLE-94-0328	11/29/1992	1.280	not specified
32	1.90E+05	3.96E+08	CBU-PIT-2005-00127	11/29/1992	not available	Supernate
32	1.94E+05	3.97E+08	HLW-HLE-94-0328	11/29/1992	1.240	not specified
50	5.84E+02	5.31E+02	HLW-HLE-94-0328	12/9/1992	not available	not specified
50	5.94E+02	5.66E+02	HLW-HLE-94-0328	12/9/1992	not available	not specified
50	4.97E+02	1.38E+03	HLW-HLE-94-0328	1/31/1993	not available	not specified

Table 2.1-1: Sampled Concentrations of Tc-99 and Cs-137 (Continued)

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
50	5.57E+02	1.37E+03	HLW-HLE-94-0328	1/31/1993	not available	not specified
50	2.48E+02	1.20E+03	HLW-HLE-94-0328	2/20/1993	not available	not specified
50	7.45E+02	1.14E+03	HLW-HLE-94-0328	2/20/1993	not available	not specified
50	3.59E+03	9.50E+02	HLW-HLE-94-0328	3/18/1993	not available	not specified
50	3.72E+03	1.00E+03	HLW-HLE-94-0328	3/18/1993	not available	not specified
50	2.01E+03	1.05E+03	HLW-HLE-94-0328	6/24/1993	not available	not specified
50	2.01E+03	1.11E+03	HLW-HLE-94-0328	6/24/1993	not available	not specified
50	5.57E+02	1.01E+03	HLW-HLE-94-0328	8/2/1993	not available	not specified
50	1.35E+03	1.02E+03	HLW-HLE-94-0328	8/2/1993	not available	not specified
50	1.24E+03	1.01E+03	HLW-HLE-94-0328	8/19/1993	not available	not specified
50	1.24E+03	1.01E+03	HLW-HLE-94-0328	8/19/1993	not available	not specified
50	8.56E+02	9.10E+02	HLW-HLE-94-0328	9/16/1993	not available	not specified
50	8.56E+02	9.10E+02	HLW-HLE-94-0328	9/16/1993	not available	not specified
50	7.18E+02	9.63E+02	HLW-HLE-94-0328	10/12/1993	not available	not specified
50	7.18E+02	9.63E+02	HLW-HLE-94-0328	10/12/1993	not available	not specified
50	8.69E+02	9.65E+02	HLW-HLE-94-0328	11/25/1993	not available	not specified
50	9.06E+02	9.65E+02	HLW-HLE-94-0328	11/25/1993	not available	not specified
44	1.40E+05	5.86E+08	WSRC-TR-2004-00375, Rev. 1	5/12/1999	not available	Supernate
35	1.49E+05	3.50E+08	WSRC-TR-2004-00375, Rev. 1	6/25/2000	not available	Supernate
33	4.23E+03	9.17E+06	WSRC-TR-2004-00375, Rev. 1	6/27/2000	not available	Supernate
23	1.78E+02	2.84E+04	SRT-LWP-2003-00008	11/1/2002	not available	Supernate
23	1.78E+02	2.84E+04	WSRC-TR-2003-00112	11/1/2002	not available	Supernate
23	2.17E+02	4.10E+04	WSRC-TR-2004-00375, Rev. 1	11/1/2002	not available	Supernate
23	1.38E+02	1.58E+04	WSRC-TR-2004-00375, Rev. 1	11/1/2002	not available	Supernate
24	3.29E+02	1.39E+06	SRT-LWP-2003-00008	11/1/2002	not available	Supernate
24	3.29E+02	1.39E+06	WSRC-TR-2003-00112	11/1/2002	not available	Supernate
23	1.72E+02	4.48E+04	WSRC-TR-2003-00162, R0	3/20/2003	not available	Supernate
30	9.83E+05	1.18E+09	X-ESR-G-00004	5/12/2003	not available	Supernate
30	3.51E+05	4.21E+08	WSRC-TR-2004-00386, R1	5/12/2003	1.490	Supernate
45	1.62E+05	5.69E+08	WSRC-TR-2004-00375, Rev. 1	6/9/2003	not available	Supernate
45	1.70E+05	6.37E+08	X-ESR-G-00004	6/9/2003	not available	Supernate
46	9.55E+04	2.59E+08	WSRC-TR-2004-00386, R1	6/23/2003	1.490	Supernate
46	2.77E+05	7.50E+08	X-ESR-G-00004	6/23/2003	not available	Supernate
46	2.77E+05	7.64E+08	WSRC-TR-2004-00375, Rev. 1	6/23/2003	not available	Supernate
39	1.56E+06	3.78E+08	X-ESR-G-00004	7/10/2003	not available	Supernate
41	4.70E+04	5.09E+07	WSRC-TR-2003-00380, R1	7/10/2003	1.401	Supernate
41	4.70E+04	5.09E+07	WSRC-TR-2004-00375, Rev. 1	7/10/2003	not available	Supernate
41	4.70E+04	5.09E+07	SRT-LWP-2003-00061	7/10/2003	1.400	Supernate
39	1.42E+06	3.44E+08	WSRC-TR-2004-00386, R1	7/11/2003	1.290	Supernate
3	1.76E+05	2.00E+08	WSRC-TR-2004-00131	8/5/2003	2.070	Salt
3	2.28E+05	4.74E+08	WSRC-TR-2004-00131	8/5/2003	2.070	Salt
3	3.12E+05	8.28E+08	WSRC-TR-2004-00131	8/5/2003	1.470	Supernate
3	3.10E+05	8.90E+08	WSRC-TR-2004-00131	8/5/2003	1.500	Supernate
3	3.72E+05	9.57E+08	WSRC-TR-2004-00131	8/5/2003	1.520	Supernate
3	3.64E+05	9.61E+08	WSRC-TR-2004-00131	8/5/2003	1.490	Supernate
29	4.28E+05	6.99E+08	WSRC-TR-2004-00130	8/26/2003	2.130	Salt
38	2.91E+04	3.70E+07	WSRC-TR-2004-00129	9/1/2003	1.940	Salt
2	4.06E+05	8.39E+08	WSRC-TR-2004-00131	9/10/2003	1.500	Supernate

Table 2.1-1: Sampled Concentrations of Tc-99 and Cs-137 (Continued)

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
29	1.76E+05	3.55E+08	WSRC-TR-2004-00130	9/11/2003	1.260	Supernate
38	4.99E+04	8.85E+07	WSRC-TR-2004-00129	9/11/2003	1.450	Supernate
38	2.91E+04	3.70E+07	WSRC-TR-2004-00129	9/11/2003	1.940	Salt
2	8.36E+04	1.02E+08	WSRC-TR-2004-00131	9/12/2003	2.040	Salt
41	7.37E+04	7.39E+07	WSRC-TR-2004-00375, Rev. 1	9/12/2003	not available	Supernate
41	7.32E+04	7.90E+07	WSRC-TR-2004-00375, Rev. 1	9/12/2003	not available	Supernate
48	3.83E+04	6.38E+06	WSRC-TR-2003-00720	9/17/2003	1.148	Supernate
41	7.98E+04	8.97E+07	WSRC-TR-2004-00375, Rev. 1	9/18/2003	not available	Supernate
41	8.21E+04	8.77E+07	WSRC-TR-2004-00375, Rev. 1	9/18/2003	not available	Supernate
37	3.59E+05	7.09E+08	WSRC-TR-2004-00386, R1	10/10/2003	1.520	Supernate
37	8.11E+05	2.10E+09	X-ESR-G-00004	10/10/2003	not available	Supernate
13	2.80E+05	8.43E+08	WSRC-TR-2004-00386, R1	10/20/2003	1.460	Supernate
13	6.30E+05	1.82E+09	X-ESR-G-00004	10/20/2003	not available	Supernate
49	1.42E+05	3.00E+08	WSRC-TR-2004-00386, R1	10/20/2003	1.420	Supernate
49	2.18E+05	6.94E+08	X-ESR-G-00004	10/20/2003	not available	Supernate
10	1.07E+05	1.27E+08	WSRC-TR-2004-00164	10/23/2003	2.170	Salt
10	4.24E+04	8.51E+07	WSRC-TR-2004-00164	10/23/2003	1.980	Salt
10	1.49E+05	4.52E+08	WSRC-TR-2004-00164	10/23/2003	1.435	Supernate
10	2.13E+05	5.03E+08	WSRC-TR-2004-00164	10/23/2003	1.438	Supernate
23	6.80E+01	2.72E+04	WSRC-TR-2005-00192, Rev. 1	2/15/2005	1.030	Supernate
23	6.62E+01	2.94E+04	WSRC-TR-2005-00192, Rev. 1	2/15/2005	1.050	Supernate
49	6.28E+04	6.83E+07	WSRC-TR-2005-00336	6/1/2005	1.370	Supernate
28	1.51E+05	1.47E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	1.05E+05	1.45E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	2.58E+05	5.89E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	8.55E+04	1.53E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	1.31E+05	3.01E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	3.23E+05	6.43E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	2.60E+05	4.49E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	2.96E+05	6.47E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	1.92E+05	3.00E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	1.99E+05	5.64E+08	WSRC-STI-2006-00151	2/15/2006	1.458	Supernate
28	2.38E+04	5.39E+07	WSRC-STI-2006-00151	2/15/2006	not available	Salt
25	4.38E+04	7.44E+07	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	2.88E+04	5.03E+07	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	3.23E+04	6.26E+07	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	1.17E+05	1.29E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	7.64E+04	1.92E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	1.02E+05	2.15E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	9.25E+04	2.13E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	1.66E+05	3.24E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	8.54E+04	2.14E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	1.42E+05	2.83E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	1.36E+05	3.88E+08	WSRC-STI-2007-00123	6/7/2006	1.440	Supernate
39	4.64E+04	9.55E+07	WSRC-TR-2007-00199, Rev. 1	4/2/2007	1.230	Supernate
51	9.06E+03	1.23E+07	WSRC-STI-2007-00697	5/31/2007	1.060	Supernate
49	7.16E+04	3.91E+07	WSRC-STI-2008-00117	12/7/2007	1.251	Supernate
49	7.44E+04	4.06E+07	X-ESR-H-00120	12/7/2007	1.020	Supernate

Table 2.1-1: Sampled Concentrations of Tc-99 and Cs-137 (Continued)

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
49	7.93E+04	1.50E+08	WSRC-STI-2008-00117	1/18/2008	1.258	Supernate
11	6.45E+03	8.46E+06	WSRC-STI-2008-00227	2/15/2008	1.170	Supernate
51	7.32E+03	8.52E+06	WSRC-STI-2008-00227	2/15/2008	1.200	Supernate
5	1.71E+03	4.39E+06	SRNL-L3100-2008-00020	6/24/2008	1.022	Residual
23	1.10E+04	1.31E+07	SRNS-TR-2008-00103	7/2/2008	1.178	Supernate
6	1.13E+03	1.42E+07	SRNL-L3100-2008-00021	7/15/2008	1.100	Residual
22	6.93E+02	1.32E+05	SRNL-STI-2008-00446, Rev 1	7/22/2008	1.024	Supernate
5	1.31E+02	1.63E+08	SRNL-L3100-2008-00020	9/24/2008	1.040	Residual
6	9.01E+01	4.15E+06	SRNL-L3100-2008-00021	9/25/2008	1.035	Residual
49	6.89E+04	3.08E+07	SRNL-STI-2008-00446, Rev 1	11/5/2008	1.273	Supernate
49	6.89E+04	3.16E+07	X-ESR-H-00209, Rev. 0	1/5/2009	not available	Supernate
24	4.75E+04	5.87E+07	SRNL-STI-2009-00805	7/28/2009	not available	Supernate
24	4.78E+04	6.11E+07	X-ESR-H-00209, Rev. 0	7/28/2009	not available	Supernate
21	3.69E+02	1.65E+05	X-ESR-H-00209, Rev. 0	8/17/2009	not available	Supernate
21	3.54E+02	1.61E+05	SRNL-STI-2009-00805	8/17/2009	not available	Supernate
23	2.41E+04	4.85E+07	SRNL-STI-2010-00017	11/16/2009	not available	Supernate
23	2.47E+04	4.95E+07	X-ESR-H-00209, Rev. 0	11/16/2009	not available	Supernate
18	3.40E+04	1.24E+08	SRNL-STI-2010-00386	2/1/2010	not available	Residual
18	3.67E+04	2.10E+08	SRNL-STI-2010-00386	2/1/2010	not available	Residual
18	2.90E+04	1.49E+08	SRNL-STI-2010-00386	2/1/2010	not available	Residual
18	4.13E+04	2.17E+08	SRNL-STI-2010-00386	2/1/2010	not available	Residual
18	5.02E+04	2.16E+08	SRNL-STI-2010-00386	2/1/2010	not available	Residual
18	4.79E+04	2.58E+08	SRNL-STI-2010-00386	2/1/2010	not available	Residual
19	4.34E+04	4.24E+08	SRNL-STI-2010-00439	2/1/2010	not available	Residual
19	5.54E+04	3.07E+08	SRNL-STI-2010-00439	2/1/2010	not available	Residual
19	3.55E+04	3.86E+08	SRNL-STI-2010-00439	2/1/2010	not available	Residual
19	3.55E+04	3.69E+08	SRNL-STI-2010-00439	2/1/2010	not available	Residual
19	3.61E+04	3.34E+08	SRNL-STI-2010-00439	2/1/2010	not available	Residual
19	3.16E+04	3.97E+08	SRNL-STI-2010-00439	2/1/2010	not available	Residual
21	2.06E+04	3.18E+07	SRNL-STI-2011-00061	9/23/2010	1.284	Supernate
21	2.28E+04	3.64E+07	SRNL-STI-2012-00076	10/13/2011	1.301	Supernate
48	2.26E+04	7.21E+06	SRNL-STI-2012-00420	2/28/2012	1.198	Supernate
22	8.60E+02	1.63E+06	SRR-LWE-2012-00198, Rev. 1	8/23/2012	not available	Supernate
7	2.20E+04	4.16E+07	SRR-LWE-2012-00198, Rev. 1	8/29/2012	not available	Supernate
8	2.30E+04	4.35E+07	SRR-LWE-2012-00198, Rev. 1	8/29/2012	not available	Supernate
4	1.90E+04	3.60E+07	SRR-LWE-2012-00198, Rev. 1	9/6/2012	not available	Supernate
21	2.17E+04	3.64E+07	SRNL-STI-2012-00707, Rev. 1	10/3/2012	1.304	Supernate
21	1.30E+04	2.46E+07	SRR-LWE-2012-00198, Rev. 1	10/3/2012	not available	Supernate
11	1.75E+04	3.31E+07	SRNL-L3100-2013-00094	5/10/2013	1.217	Supernate
21	1.67E+04	2.95E+07	SRNL-STI-2013-00437	5/16/2013	1.272	Supernate
35	1.14E+05	3.19E+08	SRNL-STI-2013-00730	9/25/2013	1.267	Supernate
35	1.06E+05	2.90E+08	SRNL-STI-2013-00730	9/25/2013	1.262	Supernate
35	2.04E+05	4.71E+08	SRNL-STI-2013-00730	9/25/2013	not available	Supernate
35	1.14E+05	3.20E+08	SRNL-L3100-2013-00212	11/14/2013	not available	Supernate
35	1.06E+05	2.91E+08	SRNL-L3100-2013-00212	11/14/2013	not available	Supernate
35	2.04E+05	4.72E+08	SRNL-L3100-2013-00212	11/14/2013	not available	Supernate
16	1.37E+05	1.18E+06	SRR-CWDA-2014-00071	1/1/2014	1.660	Residual
38	1.63E+04	2.31E+07	SRNL-STI-2014-00081	1/15/2014	1.215	Supernate

Table 2.1-1: Sampled Concentrations of Tc-99 and Cs-137 (Continued)

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
38	1.51E+04	2.39E+07	SRNL-STI-2014-00081	1/15/2014	1.240	Supernate
43	1.05E+04	1.52E+07	SRNL-STI-2014-00081	1/15/2014	1.150	Supernate
43	1.07E+04	1.60E+07	SRNL-STI-2014-00081	1/15/2014	1.160	Supernate
38	1.68E+04	3.16E+07	SRNL-TR-2014-00141	6/2/2014	1.287	Supernate
38	1.50E+04	2.84E+07	SRNL-TR-2014-00141	6/2/2014	1.288	Supernate
43	1.00E+04	2.02E+07	SRNL-TR-2014-00141	6/2/2014	1.197	Supernate
43	1.02E+04	1.90E+07	SRNL-TR-2014-00141	6/2/2014	1.188	Supernate
8	4.80E+04	6.70E+07	SRNL-L3100-2014-00124	6/12/2014	not available	Supernate
22	2.87E+03	2.92E+06	SRNL-L3100-2014-00124	6/12/2014	not available	Supernate
38	1.48E+04	2.43E+07	SRNL-L3100-2014-00124	6/12/2014	not available	Supernate
38	1.40E+04	2.44E+07	SRNL-L3100-2014-00124	6/12/2014	not available	Supernate
21	5.76E+04	1.41E+08	SRNL-STI-2014-00561	9/18/2014	1.257	Supernate
50	1.71E+04	1.71E+06	SRNL-L3100-2014-00221	9/30/2014	1.24	Supernate
41	1.07E+04	1.01E+07	SRNL-L3100-2014-00193	10/1/2014	1.170	Supernate
38	1.96E+04	3.41E+07	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00008	12/2/2014	1.300	Supernate
38	1.41E+04	3.50E+07	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00008	12/2/2014	1.330	Supernate
43	9.74E+03	2.31E+07	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00008	12/2/2014	1.170	Supernate
43	1.33E+04	2.25E+07	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00008	12/2/2014	1.180	Supernate
13	4.92E+04	1.71E+08	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00064	12/16/2014	1.080	Supernate
13	5.72E+04	1.78E+08	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00064	12/16/2014	1.070	Supernate
50	1.89E+04	8.65E+05	SRNL-L3100-2014-00279	1/7/2015	1.241	Supernate
35	1.47E+05	4.53E+08	SRNL-STI-2015-00224	3/9/2015	1.370	Supernate
35	4.03E+04	1.36E+08	SRNL-STI-2015-00224	3/9/2015	1.22	Supernate
35	1.26E+05	4.44E+08	SRNL-STI-2015-00224	3/9/2015	1.34	Supernate
50	1.71E+04	5.66E+05	SRNL-L3100-2015-00065	4/16/2015	1.24	Supernate
12	5.27E+03	7.49E+06	SRR-CWDA-2015-00075, Rev.1	6/1/2015	1.280	Residual
30	2.48E+05	6.59E+08	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.371	Supernate
30	3.68E+05	1.04E+09	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.477	Supernate
32	4.26E+05	9.59E+08	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.495	Supernate
32	2.97E+05	8.80E+08	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.439	Supernate
37	1.01E+05	3.18E+08	SRNL-L3100-2016-00221	6/1/2015	not available	Supernate
37	1.09E+05	3.09E+08	SRNL-L3100-2016-00221	6/1/2015	not available	Supernate
39	2.18E+04	5.60E+07	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.204	Supernate
39	2.46E+04	5.66E+07	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.209	Supernate
23	2.66E+04	4.94E+07	SRNL-STI-2015-00369	6/8/2015	1.270	Supernate
23	4.16E+04	1.00E+08	SRNL-STI-2015-00369	6/8/2015	1.160	Supernate
23	4.19E+04	1.07E+08	SRNL-STI-2015-00369	6/8/2015	1.170	Supernate
50	1.58E+04	4.39E+05	SRNL-L3100-2015-00107	7/6/2015	1.24	Supernate

Table 2.1-1: Sampled Concentrations of Tc-99 and Cs-137 (Continued)

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
50	1.56E+04	3.69E+05	SRNL-L3100-2015-00178	7/9/2015	1.24	Supernate
4	3.74E+04	9.81E+07	SRNL-STI-2015-00456	8/19/2015	1.110	Supernate
4	3.56E+04	1.01E+08	SRNL-STI-2015-00456	8/19/2015	1.100	Supernate
21	6.28E+04	1.65E+08	SRNL-STI-2015-00622	9/1/2015	1.250	Supernate
38	1.80E+04	3.78E+07	SRNL-STI-2015-00662	10/12/2015	1.050	Supernate
43	2.25E+04	3.38E+07	SRNL-STI-2015-00662	10/12/2015	1.220	Supernate
43	2.02E+04	3.44E+07	SRNL-STI-2015-00662	10/12/2015	1.220	Supernate
51	7.19E+04	1.73E+08	SRNL-STI-2016-00026, Rev. 1	10/20/2015	1.150	Sludge
50	1.54E+04	3.48E+05	SRNL-L3100-2015-00227	10/30/2015	1.24	Supernate
50	1.96E+04	8.58E+05	SRNL-L3100-2016-00069	1/14/2016	1.23	Supernate
50	3.24E+04	4.44E+05	SRNL-L3100-2016-00124	4/6/2016	1.24	Supernate
22	1.13E+04	3.00E+07	SRNL-L3100-2016-00221	6/1/2016	not available	Supernate
38	2.40E+04	4.52E+07	SRNL-L3100-2016-00221	6/1/2016	not available	Supernate
41	2.22E+04	2.51E+07	SRNL-L3100-2016-00221	6/1/2016	not available	Supernate
50	4.04E+04	1.87E+05	SRNL-L3100-2016-00173	7/14/2016	1.242	Supernate
50	4.35E+04	3.67E+05	SRNL-L3100-2016-00229	10/4/2016	1.235	Supernate
21	3.87E+04	8.61E+07	SRNL-STI-2017-00055	11/21/2016	1.254	Supernate
50	4.70E+04	1.85E+05	SRNL-L3100-2017-00033	1/16/2017	1.238	Supernate
40	2.10E+04	3.29E+07	SRNL-L3100-2017-00029	4/12/2017	not available	Supernate
50	4.80E+04	6.64E+05	SRNL-L3100-2017-00076	4/19/2017	1.236	Supernate
51	7.95E+04	1.66E+08	SRNL-STI-2017-00486	5/1/2017	1.100	Supernate
24	3.95E+05	1.43E+09	SRNL-L3100-2017-00108	7/1/2017	1.488	Supernate
50	4.39E+04	6.28E+05	SRNL-L3100-2017-00116	7/17/2017	1.240	Supernate
25	1.57E+05	4.10E+08	SRNL-L3100-2017-00141	7/21/2017	1.380	Supernate
34	2.11E+05	7.53E+08	SRNL-L3100-2017-00141	7/21/2017	1.430	Supernate
21	4.17E+04	1.09E+08	SRNL-STI-2017-00698	7/31/2017	1.269	Supernate
42	3.26E+05	1.16E+09	SRNL-L3100-2017-00141	8/14/2017	1.460	Supernate
36	4.28E+05	2.53E+09	SRNL-L3100-2017-00141	8/21/2017	1.480	Supernate

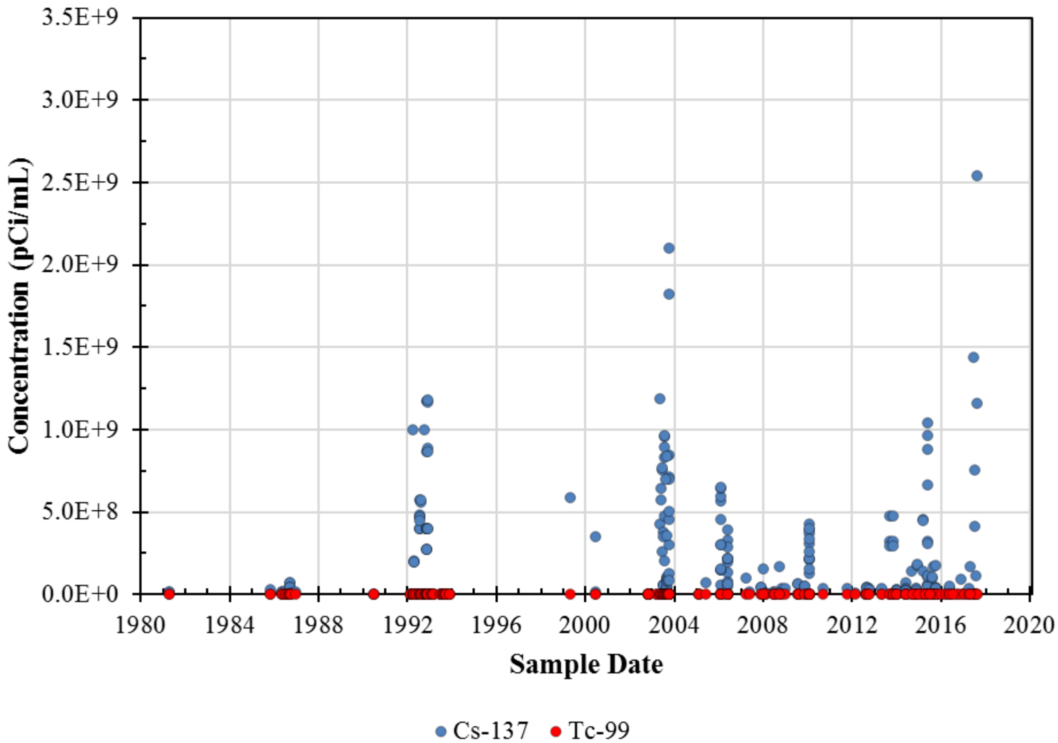
Note: All concentrations have been decayed to the assumed date of SDF closure (October 1, 2032).

Figure 2.1-1 provides a graphical depiction of the data from Table 2.1-1. As can be seen, a relatively small number of data points are significantly higher than the others. These higher data points skew the average values (1.06E+05 pCi/mL for Tc-99 and 2.34E+08 pCi/mL for Cs-137).

Further analysis reveals that the behavior of the data more typically varies on a logarithmic scale. As such, it is more appropriate to present the concentrations on a logarithmic scale (Figure 2.1-2) and to determine the average values based on the logarithmic means. The logarithmic means of the sampled values are 2.72E+04 pCi/mL for Tc-99 and 1.41E+07 pCi/mL for Cs-137, which are both much closer to the respective median values of 3.95E+04 pCi/mL and 5.99E+07 pCi/mL, indicating that logarithmic means are more representative values than the linear means.

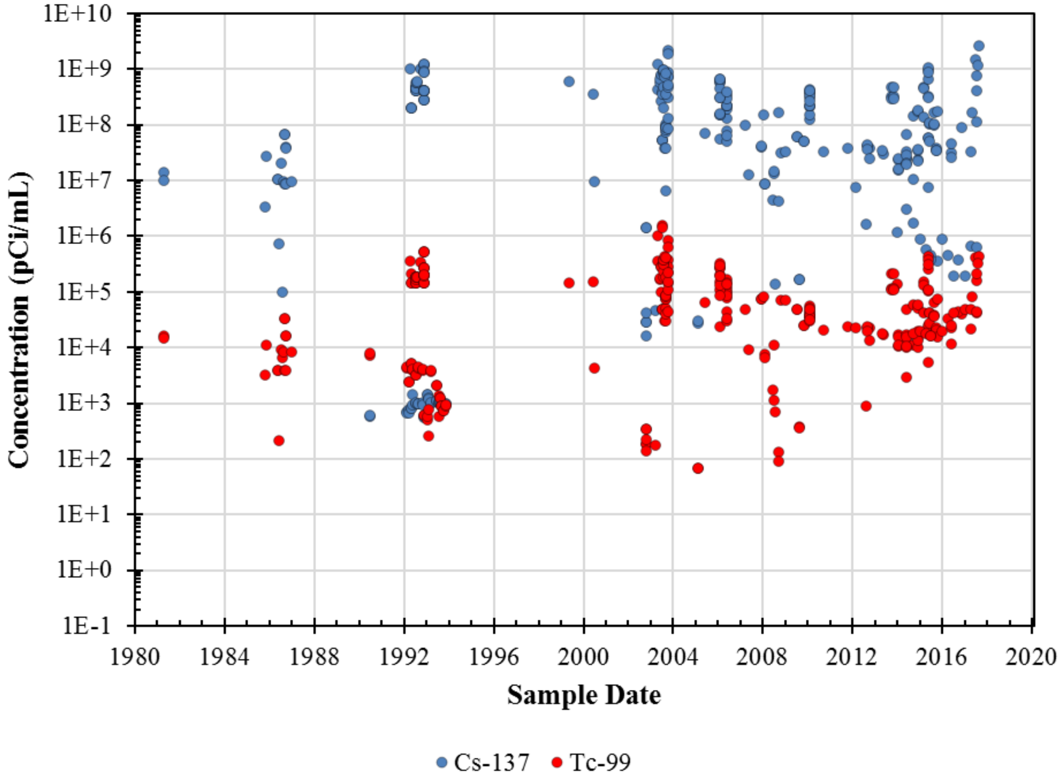
Figure 2.1-3 provides an alternative illustration of this distinctive behavior by presenting the number of sampled data points falling within increments of 0.5 standard deviations (σ) from the mean (μ) along both normal and log-normal distributions. The log-normal distribution provides a more "bell-shaped" representation of the data, indicating a better fit of the distributions.

Figure 2.1-1: Sampled Concentrations of Tc-99 and Cs-137 (Linear Scale)



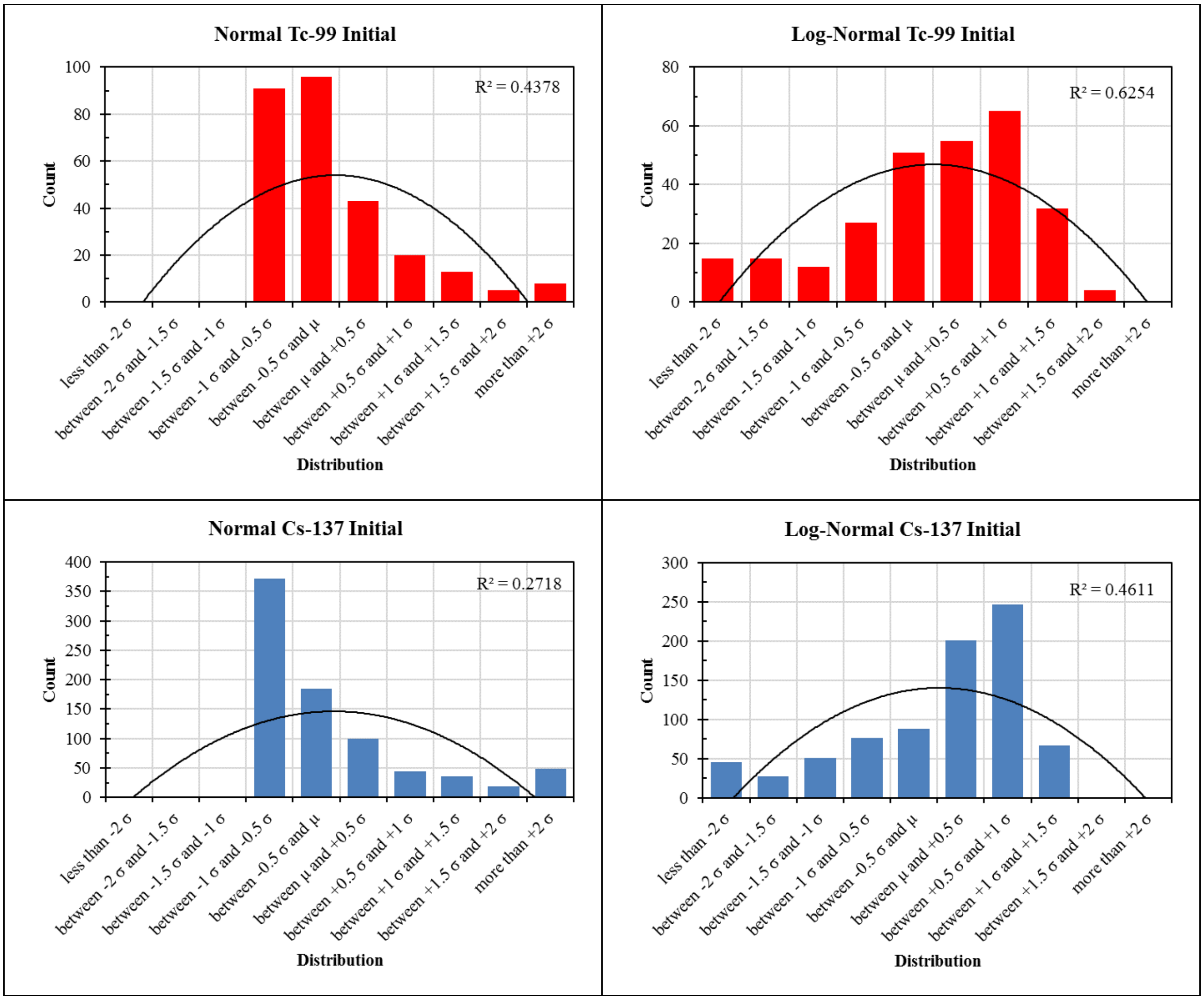
Note: All concentrations have been decayed to the assumed date of SDF closure (October 1, 2032).

Figure 2.1-2: Sampled Concentrations of Tc-99 and Cs-137 (Logarithmic Scale)



Note: All concentrations have been decayed to the assumed date of SDF closure (October 1, 2032).

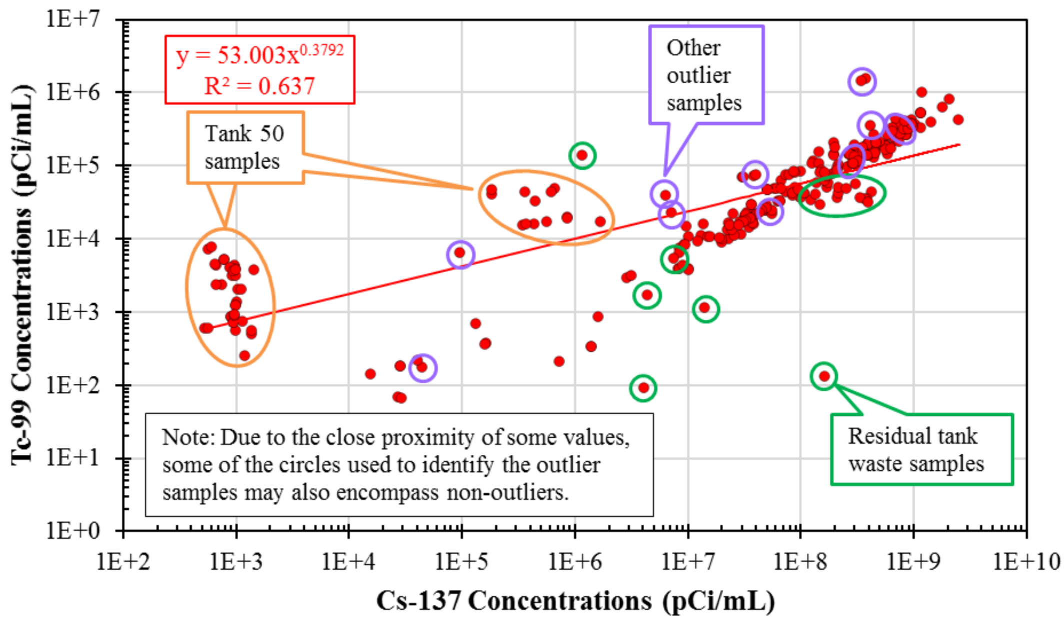
Figure 2.1-3: Distribution Behavior of Sampled Concentrations of Tc-99 and Cs-137



2.2 Initial Relationship Between Tc-99 Concentrations and Cs-137 Concentrations

Observation of Figure 2.1-2 and Figure 2.1-3 shows that the data points for the Tc-99 concentrations appear to have a very similar distribution to the respective Cs-137 concentrations. This relationship between Tc-99 and Cs-137 is expected based on theoretical fission yield relationships determined within the predicted canyon waste stream compositions. [WSRC-TR-94-0562; CBU-PIT-2005-00127] Both radionuclides are fission products from a number of nuclear fission reactions. [WSRC-TR-94-0562] Figure 2.2-1 provides a more direct comparison, plotting the Tc-99 concentrations as a function of the Cs-137 concentrations.

Figure 2.2-1: Relationship Between Concentrations of Tc-99 and Cs-137 from the Initial Data Set



This figure shows the relationship between Tc-99 and Cs-137 along a power curve:

$$y = 53.00x^{0.3792} \quad \text{(Eq. 2-1)}$$

where y is the Tc-99 concentration (pCi/mL) and x is the Cs-137 concentration (pCi/mL), both decayed to October 1, 2032 (i.e., the assumed data of SDF closure).

The distribution has an R-squared of 0.637. This R-squared value is relatively low. However, as identified in Figure 2.2-1, a number of the samples are identified as outliers (see orange, green, and purple callouts). These are discussed further in the following section.

2.3 Remove Outliers

Three types of outliers were identified in the initial data set. The first is the Tank 50 samples, the second is the tank closure residual waste samples, and the third are those samples which were considered outliers due to the inconsistent handling of the sample (e.g., dissolution, filtration, etc.) such that comparing the relationship between the Tc-99 concentrations and the Cs-137 may not be reliable.

For the Tank 50 samples, the decontamination of the salt solution (i.e., the removal of Cs-137) significantly alters the waste characteristics such that there is no discernible relationship between the Cs-137 and the Tc-99 concentrations. Accordingly, all Tank 50 samples were removed from the initial data set. This one change significantly improved the R-squared (from 0.637 to 0.8187) of the relationship between the Tc-99 concentrations and the Cs-137 concentrations (see Figure 2.3-1).

Next, because the residual tank waste samples are not expected to be indicative of the bulk waste in the tank farms or the waste destined for SDF disposal, all the residual waste samples were selected for removal as well. Figure 2.3-1 identifies these samples with green callouts. Figure 2.3-2 shows the resulting data set after removing the residual tank waste samples. By removing residual tank waste samples, the R-squared value improved from 0.8187 to 0.9194 (Figure 2.3-2).

Figure 2.3-1: Relationship Between Concentrations of Tc-99 and Cs-137 After Removing Tank 50 Sample Data

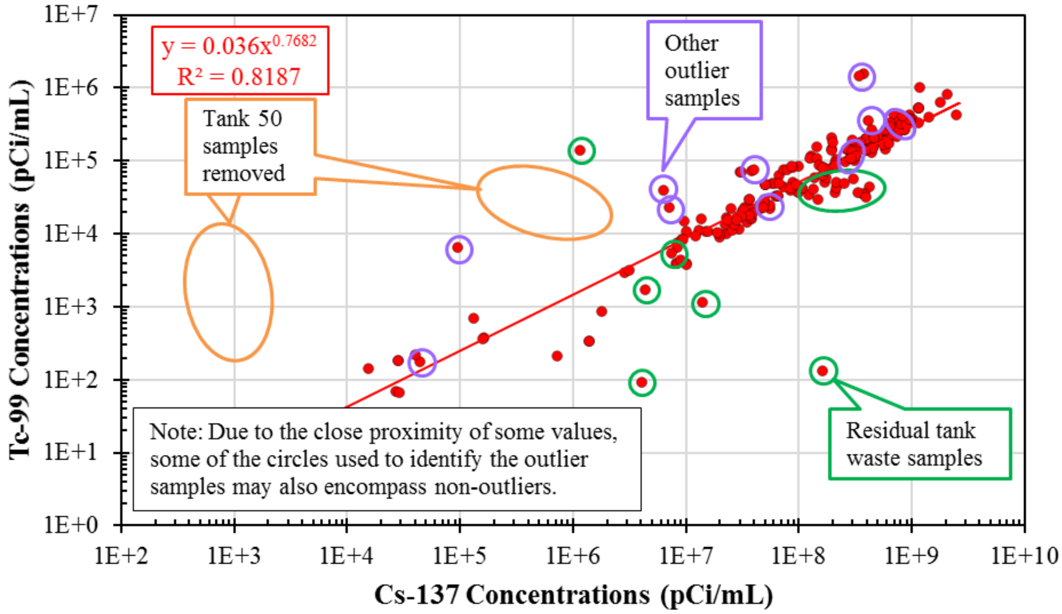
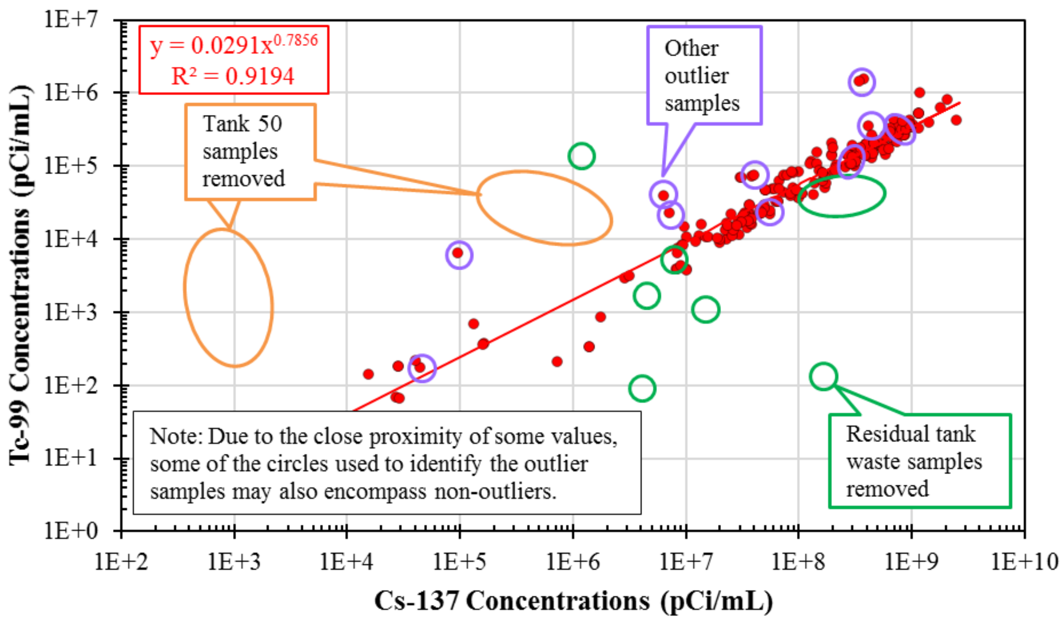
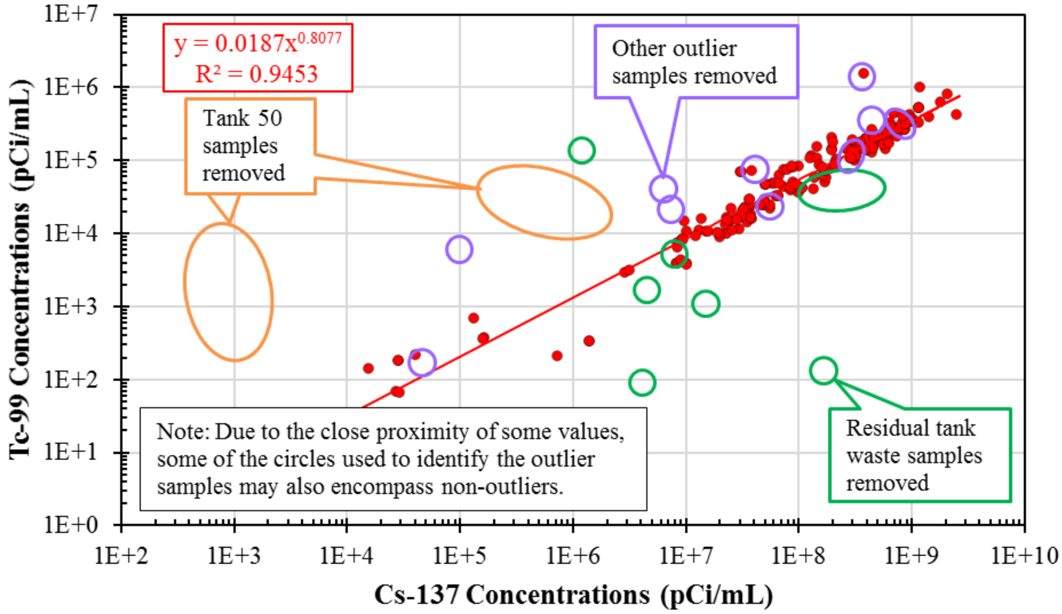


Figure 2.3-2: Relationship Between Concentrations of Tc-99 and Cs-137 After Removing Tank 50 Samples and Residual Tank Waste Samples



Finally, samples which had undergone processes which might alter the relationship between Cs-137 and Tc-99 concentrations (i.e., dilution or filtration), or which were associated with other identified issues, were assumed to be non-representative of the bulk waste within the tank farms (i.e., waste destined for SDF disposal). These samples were each identified (purple callouts) and selected for removal as well. Figure 2.3-3 shows the resulting data set after removing these remaining outliers.

Figure 2.3-3: Relationship Between Concentrations of Tc-99 and Cs-137 (Less All Outliers)



By removing the remaining outlier samples, the R-squared value improved from 0.9194 to 0.9453 (Figure 2.3-3), and the range of the data set became slightly more constrained. The revised relationship is defined by Equation 2-2:

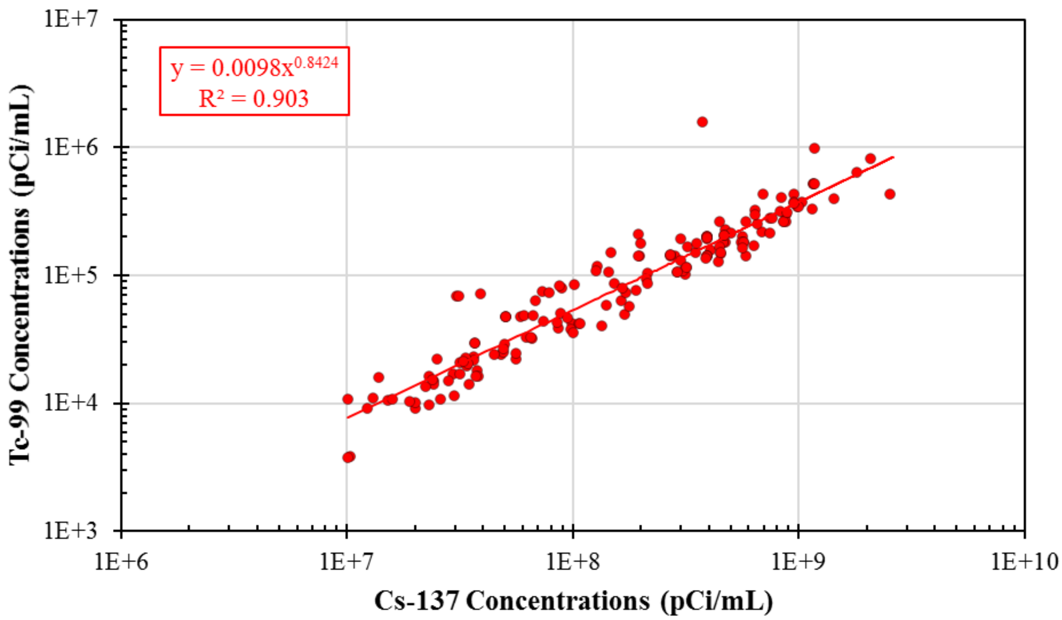
$$y = 0.0187x^{0.8077} \quad \text{(Eq. 2-2)}$$

where y is the Tc-99 concentration (pCi/mL) and x is the Cs-137 concentration (pCi/mL), both decayed to October 1, 2032.

2.4 Remove Very Low Concentration Samples

Upon removing the outliers, it was clear that a small number of samples had concentrations which were significantly lower in magnitude than the majority of the samples (see Figure 2.3-3). Because the intent of this study is to improve predictions of the total number of curies in the tank farms, the very low concentration samples are not significant. Therefore, to better represent the higher concentration samples, the lower-concentration values were removed. Specifically, all samples with Cs-137 concentrations less than 1.0E+07 pCi/mL were ignored (deleted) as shown in Figure 2.4-1.

Figure 2.4-1: Relationship Between Concentrations of Tc-99 and Cs-137 (Less Outliers and Low-Concentration Samples)



The resulting R-squared value for the relationship between Tc-99 concentrations and Cs-137 concentrations decreased from 0.9453 to 0.9030 (Figure 2.3-3 and Figure 2.4-1, respectively), however the trendline is positioned such that the higher concentration samples are better represented. The revised relationship is defined by Equation 2-3:

$$y = 9.78E\text{-}03x^{0.8424} \qquad \text{(Eq. 2-3)}$$

where y is the Tc-99 concentration (pCi/mL) and x is the Cs-137 concentration (pCi/mL) decayed to October 1, 2032. This relationship can be used to assume Tc-99 concentrations for samples that only include Cs-137 data.

2.5 Consolidate Like Values

The next step in data normalization is to prevent the possibility of double-counting "like values". In this case, "like values" are data points that represent the same waste phase from the same waste tank and were sampled on the same date or near the same date. To prevent double-counting, all like values were averaged together, using the linear mean. For example, a number of samples from Tank 28 were collected in February of 2006. [WSRC-STI-2006-00151] Rather than using each of these values for further analysis, all of these values were averaged together to provide a single data point for use (see the last row in Table 2.5-1).

Table 2.5-1: Example of Data for Consolidation

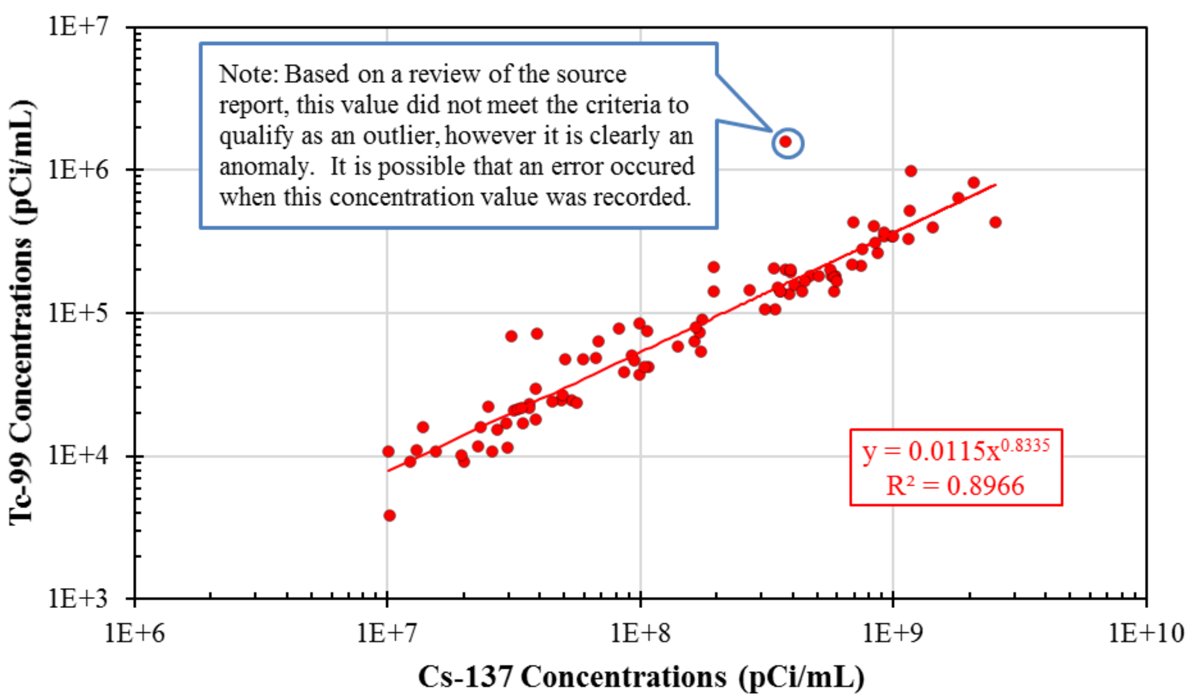
Tank	Tc-99 Concentration (pCi/mL)	Cs-137 Concentration (pCi/mL)	Sample Description
28	1.51E+05	1.47E+08	Sample: FTF-456 and Depth: 298 to 279 in
28	1.05E+05	1.45E+08	Sample: FTF-457 and Depth: 279 to 260 in
28	2.58E+05	5.89E+08	Sample: FTF-459 and Depth: 241to 222 in
28	8.55E+04	1.53E+08	Sample: FTF-460 and Depth: 222 to 203 in
28	1.31E+05	3.01E+08	Sample: FTF-461 and Depth: 203 to 184 in
28	3.23E+05	6.43E+08	Sample: FTF-462 and Depth: 184 to 165 in
28	2.60E+05	4.49E+08	Sample: FTF-463 and Depth: 165 to 146 in
28	2.96E+05	6.47E+08	Sample: FTF-464 and Depth: 146 to 127 in
28	1.92E+05	3.00E+08	Sample: FTF-465 and Depth: 127 to 108 in
28	**2.00E+05**	**3.75E+08**	**Consolidated Average**

By consolidating these "like" values, R-squared value decreased (very slightly) from 0.9030 to 0.8966 (Figure 2.5-1). The revised relationship is defined by Equation 2-4:

$$y = 0.0115x^{0.8335} \quad \text{(Eq. 2-4)}$$

where y is the Tc-99 concentration (pCi/mL) and x is the Cs-137 concentration (pCi/mL), both decayed to October 1, 2032.

Figure 2.5-1: Relationship Between Concentrations of Tc-99 and Cs-137 (Less Outliers, with Additional Cs-137 Values, and Consolidating Like Values)



Note that one value (Tank 39 data sampled on 7/10/2003) is identified as an anomaly. It clearly seems to be an outlier; however, after careful review of the reference report (X-ESR-G-00004), there was no clear justification for treating this unusual value as an outlier. As such, it shall be retained for analytical purposes. Note that if this one data point were ignored, the R-squared value would improve from 0.8966 to 0.9263. However, because the anomalous sample shows a significantly higher Tc-99 concentration, relative to the Cs-137 concentration, retaining this value is considered a conservative approach.

Based on this analysis, Equation 2-4 will be used to estimate the associated Tc-99 concentrations.

2.6 Normalization Summary

Table 2.6-1 and Figure 2.6-1 provide the results from the data normalizing activities described in Section 2.1 through 2.5.

Table 2.6-1: Sampled Concentrations of Tc-99 and Cs-137 After Data Normalization

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
19	1.58E+04	1.38E+07	5/1/1981	not available	Supernate
20	1.08E+04	2.61E+07	11/15/1985	1.370	not specified
22	3.79E+03	1.03E+07	5/21/1986	1.260	Supernate
20	9.01E+03	2.03E+07	7/14/1986	1.340	not specified
21	2.42E+04	5.40E+07	9/18/1986	1.183	not specified
30	3.43E+05	9.95E+08	4/10/1992	1.336	not specified
33	2.07E+05	1.96E+08	4/29/1992	1.245	not specified
34	1.40E+05	1.97E+08	4/30/1992	1.218	Supernate
27	1.40E+05	4.36E+08	7/21/1992	1.471	Supernate
28	1.80E+05	5.11E+08	7/21/1992	1.470	Supernate
25	1.67E+05	4.47E+08	7/27/1992	1.466	Supernate
26	1.80E+05	5.73E+08	7/29/1992	1.546	Supernate
26	1.80E+05	5.90E+08	8/14/1992	1.532	Supernate
30	3.40E+05	9.97E+08	10/4/1992	not available	Supernate
38	1.99E+05	3.97E+08	11/23/1992	1.470	Supernate
43	1.43E+05	2.71E+08	11/23/1992	1.430	Supernate
29	5.19E+05	1.17E+09	11/26/1992	1.430	Supernate
30	2.61E+05	8.71E+08	11/27/1992	1.280	Supernate
32	1.92E+05	3.97E+08	11/27/1992	1.240	Supernate
44	1.40E+05	5.86E+08	5/12/1999	not available	Supernate
35	1.49E+05	3.50E+08	6/25/2000	not available	Supernate
30	9.83E+05	1.18E+09	5/12/2003	not available	Supernate
45	1.66E+05	6.03E+08	6/9/2003	not available	Supernate
46	2.77E+05	7.57E+08	6/23/2003	not available	Supernate
39	1.56E+06	3.78E+08	7/10/2003	not available	Supernate
41	4.70E+04	5.09E+07	7/10/2003	1.401	Supernate
3	2.02E+05	3.37E+08	8/4/2003	2.070	Salt
3	3.39E+05	9.19E+08	8/4/2003	1.494	Supernate
29	4.28E+05	7.00E+08	8/26/2003	2.130	Salt
29	1.76E+05	5.86E+08	9/2/2003	1.260	Supernate

Table 2.6-1: Sampled Concentrations of Tc-99 and Cs-137 After Data Normalization (Continued)

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
2	4.06E+05	8.39E+08	9/7/2003	1.500	Supernate
2	8.36E+04	1.00E+08	9/8/2003	2.040	Salt
38	2.91E+04	3.88E+07	9/8/2003	1.955	Salt
38	4.99E+04	9.25E+07	9/8/2003	1.442	Supernate
41	7.72E+04	8.24E+07	9/15/2003	1.404	Supernate
37	8.11E+05	2.10E+09	10/10/2003	not available	Supernate
10	7.47E+04	1.06E+08	10/12/2003	2.068	Salt
10	1.81E+05	4.68E+08	10/15/2003	1.434	Supernate
13	6.30E+05	1.82E+09	10/20/2003	not available	Supernate
49	2.18E+05	6.94E+08	10/20/2003	not available	Supernate
49	6.28E+04	6.83E+07	6/1/2005	1.370	Supernate
28	2.00E+05	3.75E+08	2/14/2006	1.900	Salt
28	1.99E+05	5.64E+08	2/15/2006	1.458	Supernate
25	8.85E+04	1.76E+08	6/7/2006	1.920	Salt
25	1.36E+05	3.88E+08	6/7/2006	1.440	Supernate
39	4.64E+04	9.55E+07	4/2/2007	1.230	Supernate
51	9.06E+03	1.23E+07	5/31/2007	1.060	Supernate
49	7.16E+04	3.91E+07	12/7/2007	1.251	Supernate
23	1.10E+04	1.31E+07	7/2/2008	1.178	Supernate
49	6.89E+04	3.12E+07	12/5/2008	1.273	Supernate
24	4.76E+04	5.99E+07	7/28/2009	not available	Supernate
23	2.44E+04	4.90E+07	11/16/2009	not available	Supernate
21	2.06E+04	3.18E+07	9/23/2010	1.284	Supernate
21	2.28E+04	3.64E+07	10/13/2011	1.301	Supernate
21	2.17E+04	3.64E+07	10/3/2012	1.304	Supernate
21	1.67E+04	2.95E+07	5/16/2013	1.272	Supernate
35	1.41E+05	3.60E+08	9/25/2013	1.265	Supernate
35	1.41E+05	3.61E+08	11/14/2013	not available	Supernate
38	1.57E+04	2.35E+07	1/15/2014	1.228	Supernate
43	1.06E+04	1.56E+07	1/15/2014	1.155	Supernate
43	1.01E+04	1.96E+07	6/2/2014	1.193	Supernate
38	1.51E+04	2.72E+07	6/7/2014	1.288	Supernate
8	4.80E+04	6.70E+07	6/12/2014	not available	Supernate
21	5.76E+04	1.41E+08	9/18/2014	1.257	Supernate
41	1.07E+04	1.01E+07	10/1/2014	1.170	Supernate
38	1.68E+04	3.45E+07	11/28/2014	1.315	Supernate
43	1.15E+04	2.28E+07	11/28/2014	1.175	Supernate
13	5.32E+04	1.74E+08	12/8/2014	1.075	Supernate
35	1.04E+05	3.44E+08	3/9/2015	1.310	Supernate
30	3.08E+05	8.49E+08	6/1/2015	1.424	Supernate
32	3.62E+05	9.20E+08	6/1/2015	1.467	Supernate
37	1.05E+05	3.13E+08	6/1/2015	not available	Supernate
39	2.32E+04	5.63E+07	6/1/2015	1.207	Supernate
23	2.66E+04	4.94E+07	6/8/2015	1.270	Supernate

Table 2.6-1: Sampled Concentrations of Tc-99 and Cs-137 After Data Normalization (Continued)

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
23	4.18E+04	1.04E+08	6/8/2015	1.165	Supernate
4	3.65E+04	9.93E+07	8/19/2015	1.105	Supernate
21	6.28E+04	1.65E+08	9/1/2015	1.250	Supernate
43	2.14E+04	3.41E+07	10/12/2015	1.220	Supernate
38	1.80E+04	3.87E+07	10/17/2015	1.145	Supernate
51	7.24E+04	1.73E+08	10/20/2015	1.150	Sludge
22	1.13E+04	3.00E+07	6/1/2016	not available	Supernate
38	2.40E+04	4.52E+07	6/1/2016	not available	Supernate
41	2.22E+04	2.51E+07	6/1/2016	not available	Supernate
21	3.87E+04	8.61E+07	11/21/2016	1.254	Supernate
40	2.10E+04	3.29E+07	4/12/2017	not available	Supernate
51	7.95E+04	1.66E+08	5/1/2017	1.100	Supernate
24	3.95E+05	1.43E+09	7/1/2017	1.488	Supernate
25	1.57E+05	4.10E+08	7/21/2017	1.380	Supernate
34	2.11E+05	7.53E+08	7/21/2017	1.430	Supernate
21	4.17E+04	1.09E+08	7/31/2017	1.269	Supernate
42	3.26E+05	1.16E+09	8/14/2017	1.460	Supernate
36	4.28E+05	2.53E+09	8/21/2017	1.480	Supernate

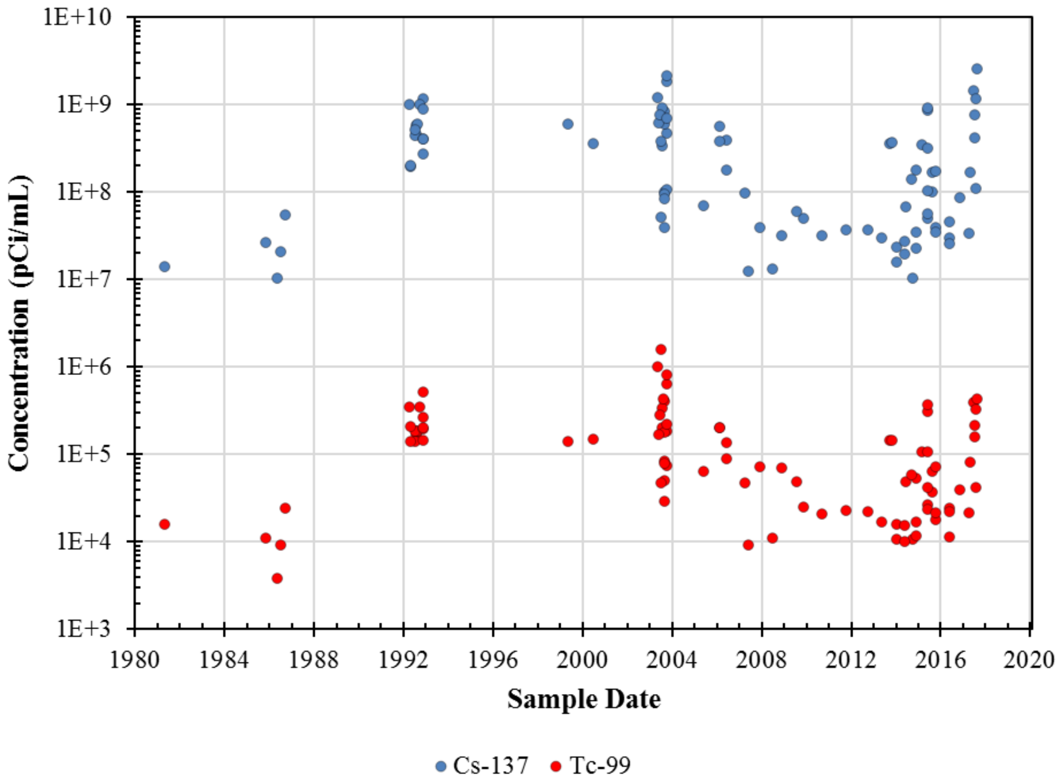
Note: All concentrations have been decayed to the assumed date of SDF closure (October 1, 2032).

The logarithmic means for Tc-99 and Cs-137 were 7.61E+04 pCi/mL and 1.53E+08 pCi/mL, respectively. Similarly, the median concentrations for Tc-99 and Cs-137 were 7.84E+04 pCi/mL and 1.69E+08 pCi/mL, respectively.

As stated in Section 2.1, the behavior of the data more typically varies on a logarithmic scale so it is appropriate to present the normalized concentrations from Table 2.6-1 on a logarithmic scale (Figure 2.6-1). Figure 2.6-2 provides an alternative illustration of this distinctive behavior by presenting the number of sampled data points falling within increments of 0.5 standard deviations (σ) from the mean (μ) along both normal and log-normal distributions. The log-normal distribution provides a more "bell-shaped" representation of the data points, indicating a better fit of the distributions. This figure is comparable to Figure 2.1-3.

Finally, Figure 2.6-3 provides a 1-to-1 comparison of the actual Tc-99 concentrations versus the estimated concentrations based on the measured Cs-137 concentrations (using Equation 2-4). This comparison provides confidence that the use of Equation 2-4 provides an excellent estimate of Tc-99 concentrations.

Figure 2.6-1: Concentrations of Tc-99 and Cs-137 After Data Normalization



Note: All concentrations have been decayed to the assumed date of SDF closure (October 1, 2032).

Figure 2.6-2: Distribution Behavior of Sampled Concentrations of Tc-99 and Cs-137

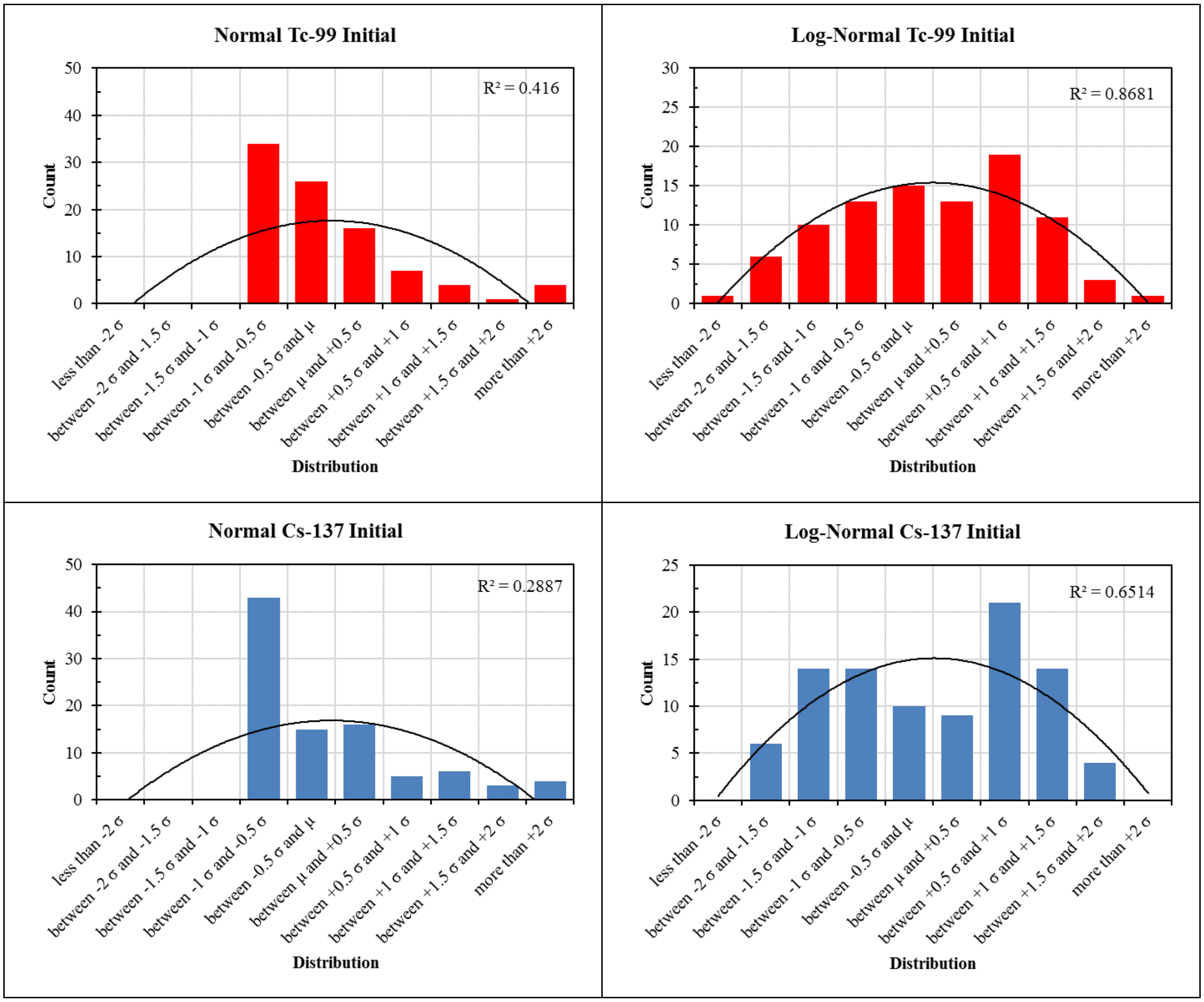
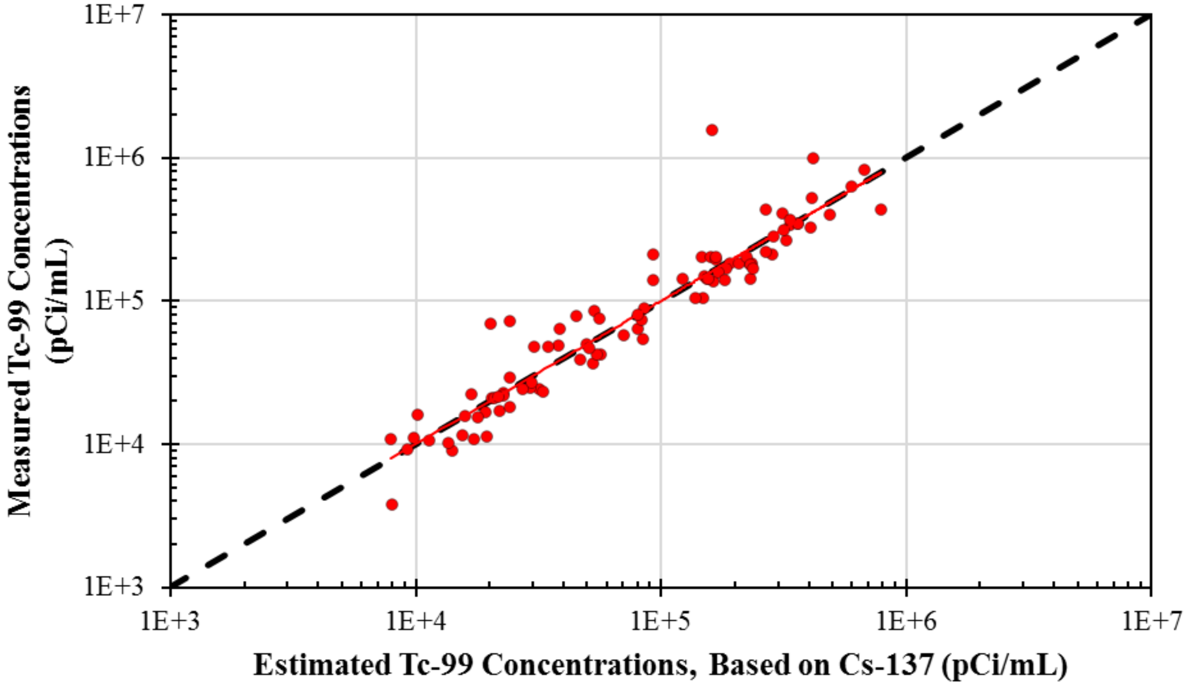


Figure 2.6-3: Direct Comparison of Measured Tc-99 Concentrations Versus Estimated Tc-99 Concentrations Based on Measured Cs-137 Concentrations



3.0 Tc-99 INVENTORY ESTIMATE

Section 3.1 provides a description of the approach used to estimate the Tc-99 concentrations for aqueous waste (supernate and sludge interstitial liquid). Section 3.2 describes how the concentrations for Tc-99 in sludge solids were estimated. Section 3.3 describes the salt concentration estimate. Section 3.4 multiplies these concentrations by the recent tank farm volumes (see Table A-2 in Appendix A) to provide an estimated inventory of Tc-99 based on Cs-137 data. Finally, Section 3.5 examines the set of available Tc-99 samples and replaces the estimated concentration values with recent sample concentrations, where applicable. Finally, Section 3.6 provides a brief summary of the recommended inventory.

3.1 Estimate of Tc-99 Concentrations of Aqueous Waste

Data from a recent *Curie and Volume Inventory Report* (SRR-LWP-2017-00033) was used to estimate current Cs-137 concentrations (see Table A-6 in Appendix A) within supernate. Using these Cs-137 supernate concentrations with Equation 2-4 (Section 2.5), the data was converted into estimated aqueous concentrations for Tc-99.

3.2 Estimate of Tc-99 Concentrations of Insoluble Sludge

For estimating the insoluble sludge concentrations of Tc-99, the approach was more complex and based on information found in the 2012 technical report: *Chemical Differences Between Sludge Solids at the F and H Area Tank Farms*. [SRNL-STI-2012-00479] This report provided an estimate of the sludge inventories for a number of radionuclides (including Cs-137 and Tc-99) based upon waste receipts and an evaluation of chemical properties. Table 3.2-1 provides these inventory estimates, decayed to October 1, 2032.

According to *Chemical Differences Between Sludge Solids at the F and H Area Tank Farms*, the total sludge inventory of Cs-137, based on receipts from the Canyons, is 3.2E+06 Ci (Table 3.2-1). [SRNL-STI-2012-00479] The Tc-99 sludge inventory (3.1E+04 Ci) was estimated to be two orders of magnitude lower than the Cs-137 inventory.

For context, the WCS-based estimates in a recent *Curie and Volume Inventory Report* (SRR-LWP-2017-00033) estimated the decayed sludge inventories for Cs-137 and Tc-99 to be 2.9E+06 Ci and 1.85E+04 Ci (see Appendix A).

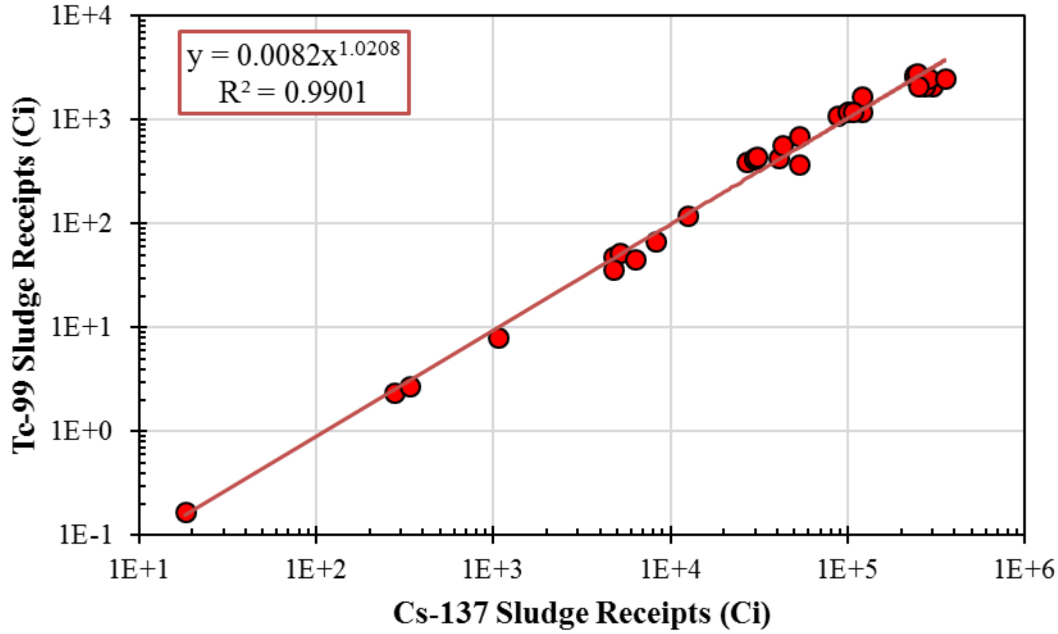
Table 3.2-1: Estimated Curies in Sludge Based on Tank Farm Receipts and Evaluation of Chemical Properties

Tank #	Cs-137 Sludge Inventory (Ci)	Tc-99 Sludge Inventory (Ci)	SS Received from Canyons (kg)	Cs-137 Sludge Concentration (Ci/kg SS)	Tc-99 Sludge Concentration (Ci/kg SS)
1F	8.81E+04	1.10E+03	4.90E+04	1.80E+00	2.24E-02
2F	2.71E+04	4.00E+02	1.60E+04	1.69E+00	2.50E-02
3F	2.96E+04	4.20E+02	3.80E+04	7.78E-01	1.10E-02
4F	1.20E+05	1.20E+03	6.50E+04	1.84E+00	1.85E-02
5F	1.01E+05	1.20E+03	5.80E+04	1.74E+00	2.07E-02
6F	1.01E+05	1.20E+03	3.90E+04	2.58E+00	3.08E-02
7F	1.20E+05	1.70E+03	4.10E+05	2.92E-01	4.15E-03
8F	1.07E+05	1.20E+03	1.80E+05	5.94E-01	6.66E-03
9H	2.96E+04	4.30E+02	1.50E+04	1.97E+00	2.87E-02
10H	3.08E+04	4.40E+02	3.10E+04	9.95E-01	1.42E-02
11H	2.39E+05	2.60E+03	2.10E+05	1.14E+00	1.24E-02
12H	2.39E+05	2.70E+03	1.90E+05	1.26E+00	1.42E-02
13H	4.09E+04	4.30E+02	2.60E+05	1.57E-01	1.65E-03
14H	4.28E+04	5.80E+02	2.70E+04	1.58E+00	2.15E-02
15H	2.45E+05	2.80E+03	1.70E+05	1.44E+00	1.65E-02
16H	5.29E+04	7.00E+02	7.10E+04	7.44E-01	9.86E-03
17F	4.72E+03	4.80E+01	4.40E+05	1.07E-02	1.09E-04
18F	5.16E+03	5.30E+01	4.90E+05	1.05E-02	1.08E-04
19F	1.82E+01	1.70E-01	2.80E+03	6.52E-03	6.07E-05
21H	8.18E+03	6.80E+01	3.60E+04	2.27E-01	1.89E-03
22H	1.26E+04	1.20E+02	5.50E+04	2.29E-01	2.18E-03
26F	6.29E+03	4.60E+01	1.60E+05	3.93E-02	2.87E-04
30H	1.07E+03	8.00E+00	5.40E+02	1.98E+00	1.48E-02
32H	2.83E+05	2.50E+03	2.00E+05	1.42E+00	1.25E-02
33F	3.02E+05	2.10E+03	2.50E+05	1.21E+00	8.40E-03
34F	2.71E+05	2.10E+03	7.70E+04	3.51E+00	2.73E-02
35H	2.52E+05	2.10E+03	1.40E+05	1.80E+00	1.50E-02
36H	2.77E+02	2.40E+00	1.60E+02	1.73E+00	1.50E-02
39H	3.52E+05	2.50E+03	1.80E+05	1.96E+00	1.39E-02
41H	3.40E+02	2.70E+00	2.40E+03	1.42E-01	1.12E-03
43H	5.29E+04	3.70E+02	9.20E+04	5.74E-01	4.02E-03
47F	4.78E+03	3.60E+01	1.40E+05	3.42E-02	2.57E-04
Total	**3.2E+06**	**3.1E+04**	**4.1E+06**	Not Applicable	Not Applicable

SS = Sludge Solids (waste received from Canyons).
All concentrations have been decayed to the assumed date of SDF closure (October 1, 2032).

Next, given that the sludge inventories in *Chemical Differences Between Sludge Solids at the F and H Area Tank Farms* (SRNL-STI-2012-00479) are based on process knowledge and on the chemical properties of the waste, it is assumed that the relationship between Cs-137 and Tc-99 concentrations within that report provides an adequate basis for estimating current Tc-99 concentrations in the tank farm sludge solids. Figure 3.2-1 illustrates the relationship between the sludge receipts based on the 2012 technical report (SRNL-STI-2012-00479). As seen, the relationship is very well correlated.

Figure 3.2-1: Relationship Between Cs-137 Sludge Receipts and Tc-99 Sludge Receipts



Based on this information, the sludge inventory (in Ci) for Tc-99 in the tank farms shall be based on the sludge inventories (in Ci) for Cs-137 in the tank farms, according to the power law relationship defined in Equation 3-1:

$$y = 8.17E\text{-}03x^{1.0208} \quad \text{(Eq. 3-1)}$$

where y is the Tc-99 sludge inventory and x is the Cs-137 sludge inventory, both decayed to October 1, 2032. Note that this equation uses inventory values as opposed to concentrations.

3.3 Estimate of Tc-99 Concentrations of Salt

The values provided in Table 3.3-1 show all the salt samples from the normalized data set (i.e., from Table 2.6-1). This shows that there were only seven entries for salt waste samples within the normalized data set (from Tanks 2, 3, 10, 25, 28, 29, and 38). To improve the estimates for Tc-99 inventories in salt waste, a follow-up analysis was performed using the data in Table 3.3-1.

The Cs-137 concentrations have a median value of 1.76E+08 pCi/mL, an arithmetic average of 2.62E+08 pCi/mL, and a logarithmic average of 1.81E+08 pCi/mL. Based on these values, any tanks which do not have recent measured data for salt waste shall be assumed to have a Cs-137 salt waste concentration of 2.0E+08 pCi/mL. Note that this value is considerably higher than the 4.20E+06 pCi/mL that was estimated using data from the recent *Curie and Volume Inventory Report* (SRR-LWP-2017-00033) (see Appendix A, Table A-6).

Using Equation 2-4 with the measured Cs-137 salt concentrations in Table 3.3-1 results in the Tc-99 inventory being slightly under-estimated (i.e., the estimated values are lower than the measured values). This is attributed to the fact that Cs-137 is more soluble than Tc-99, thus, Tc-99 is more likely to precipitate into salt. To account for this, the estimated concentrations of

Tc-99 from Equation 2-4 shall be increased by 50% for salt waste concentrations. For example, if the Cs-137 concentration is 2.0E+08 pCi/mL, then Equation 2-4 would estimate a Tc-99 concentration of 9.52E+04 pCi/mL (which would be applicable to supernate waste). Then, to make the value applicable to salt waste, the estimate should be increased by 50%: 9.52E+04 pCi/mL × 1.5 = 1.43E+05 pCi/mL. Note that the data presented in Table 3.3-1 is for "undrained bulk salt cake" samples (i.e., samples containing both salt solids and interstitial liquid). Therefore, the Tc-99 concentrations calculated for salt waste in a given tank will be applied to the entire salt volume (i.e., salt solids and interstitial liquid) of that tank.

Table 3.3-1: Concentrations of Tc-99 and Cs-137 for Salt Waste Samples

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference	Tc-99 Estimate Based on Equation 2-4	Tc-99 Ratio of Measured Concentration/Estimated Concentration
2	8.36E+04	1.00E+08	9/8/2003	5.35E+04	1.56
3	2.02E+05	3.37E+08	8/4/2003	1.47E+05	1.37
10	7.47E+04	1.06E+08	10/12/2003	5.62E+04	1.33
25	8.85E+04	1.76E+08	6/7/2006	8.54E+04	1.04
28	2.00E+05	3.75E+08	2/14/2006	1.61E+05	1.25
29	4.28E+05	7.00E+08	8/26/2003	2.71E+05	1.58
38	2.91E+04	3.88E+07	9/8/2003	2.43E+04	1.20

Note: All concentrations have been decayed to the assumed date of SDF closure (October 1, 2032).

3.4 Estimated Tc-99 Inventories Based on Cs-137

The aqueous concentrations (Section 3.1) were multiplied by the sum of the supernate volume and the sludge interstitial liquid volume (Table A-2) to provide an estimated Tc-99 aqueous inventory. The Tc-99 sludge solids inventories (Section 3.2) were estimated based on the Cs-137 sludge inventories (Table A-4). The salt concentrations (Section 3.3) were multiplied by the salt volumes (i.e., the sum of the salt solids volume and salt interstitial liquid volume; see Table A-2) to provide an estimated Tc-99 salt inventory. These values are all provided in Table 3.4-1.

Table 3.4-1: Preliminary Estimates of Concentrations and Inventories for Tc-99

Tank	Aqueous Waste Conc. (pCi/mL) [a]	Sludge Conc. (pCi/mL)	Salt Waste Conc. (pCi/mL) [b]	Aqueous Waste Inventory (Ci) [a]	Insol. Sludge Waste Inventory (Ci)	Salt Waste Inventory (Ci) [b]
1	7.07E+05	2.46E+07	1.43E+05	1.32E+01	1.97E+02	2.59E+02
2	3.05E+05	5.63E+06	1.43E+05	3.29E+00	2.60E+01	2.90E+02
3	3.07E+05	4.91E+06	1.43E+05	3.32E+00	2.27E+01	2.90E+02
4	5.21E+04	1.02E+07	1.43E+05	2.34E+01	9.24E+01	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.					
7	6.15E+04	8.01E+06	1.43E+05	6.63E+01	1.24E+02	0.00E+00
8	3.99E+04	1.07E+08	1.43E+05	5.35E+01	4.91E+02	0.00E+00
9	1.89E+05	9.13E+06	1.43E+05	1.36E+00	2.81E+01	2.97E+02
10	5.39E+04	9.06E+05	1.43E+05	8.08E+00	2.79E+00	1.03E+02
11	1.40E+04	9.56E+06	1.43E+05	6.01E+00	2.10E+02	0.00E+00
12	Not Applicable. Tank(s) closed.					
13	9.76E+04	3.46E+07	1.43E+05	1.54E+02	1.51E+03	0.00E+00
14	9.30E+05	1.96E+06	1.43E+05	6.90E+01	6.23E+01	7.03E+01
15	8.79E+04	4.21E+06	1.43E+05	1.43E+02	8.93E+02	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.					
21	4.73E+04	6.05E+06	1.43E+05	1.36E+02	4.04E+02	0.00E+00
22	6.56E+03	1.33E+06	1.43E+05	1.85E+01	1.09E+02	0.00E+00
23	4.93E+04	2.80E+05	1.43E+05	8.83E+01	2.45E+01	0.00E+00
24	3.81E+05	0.00E+00	1.43E+05	1.71E+03	0.00E+00	0.00E+00
25	1.71E+05	0.00E+00	1.43E+05	3.99E+02	0.00E+00	2.71E+02
26	1.21E+05	2.12E+05	1.43E+05	4.31E+02	6.14E+01	1.52E+01
27	2.57E+05	0.00E+00	1.43E+05	7.43E+01	0.00E+00	6.27E+02
28	2.65E+05	0.00E+00	1.43E+05	1.89E+02	0.00E+00	5.57E+02
29	7.69E+04	0.00E+00	1.43E+05	2.06E+01	0.00E+00	5.51E+02
30	4.90E+05	1.30E+07	1.43E+05	1.54E+03	1.04E+01	1.72E+02
31	5.08E+05	0.00E+00	1.43E+05	1.28E+01	0.00E+00	6.70E+02
32	2.95E+05	2.50E+07	1.43E+05	6.78E+02	2.95E+03	1.42E+02
33	1.79E+05	3.66E+07	1.43E+05	6.22E+02	3.33E+03	1.59E+02
34	2.76E+05	2.00E+08	1.43E+05	9.99E+02	2.85E+03	1.03E+02
35	1.77E+05	3.22E+07	1.43E+05	6.36E+02	2.62E+03	0.00E+00
36	7.64E+05	6.33E+06	1.43E+05	3.39E+02	2.52E+00	6.21E+02
37	1.82E+05	0.00E+00	1.43E+05	2.64E+02	0.00E+00	4.69E+02
38	3.12E+04	2.78E+07	1.43E+05	3.86E+01	1.30E+03	4.14E+02
39	3.35E+04	1.80E+07	1.43E+05	1.06E+02	4.20E+03	0.00E+00
40	2.39E+04	8.98E+06	1.43E+05	3.38E+01	5.43E+03	0.00E+00
41	1.32E+04	1.38E+06	1.43E+05	2.78E+01	1.03E+01	1.86E+02
42	4.04E+05	7.58E+06	1.43E+05	1.88E+03	1.51E+02	0.00E+00
43	4.57E+04	2.05E+06	1.43E+05	1.21E+02	5.54E+02	0.00E+00
44	1.76E+05	0.00E+00	1.43E+05	1.47E+02	0.00E+00	5.46E+02
45	2.46E+05	0.00E+00	1.43E+05	6.54E-01	0.00E+00	6.70E+02
46	3.15E+05	0.00E+00	1.43E+05	4.18E+00	0.00E+00	6.75E+02
47	2.88E+05	1.64E+05	1.43E+05	4.48E+02	4.62E+01	4.18E+02
48	7.39E+03	0.00E+00	1.43E+05	6.77E+00	2.24E+03	0.00E+00
49	6.63E+04	0.00E+00	1.43E+05	2.68E+02	0.00E+00	3.79E+00
50[c]	4.39E+04	0.00E+00	1.43E+05	1.13E+02	0.00E+00	0.00E+00
51	2.92E+04	1.48E+07	1.43E+05	3.27E+00	2.47E+02	0.00E+00
TOTAL	not applicable	not applicable	not applicable	**1.19E+04**	**3.02E+04**	**8.58E+03**

Note: (a) Aqueous waste is comprised of supernate and sludge interstitial liquid.
(b) Salt waste is comprised of both salt solids and salt interstitial liquid.
(c) Due to the variable decontamination factor (DF) applied to Cs-137, the Tank 50 concentration of Tc-99 is not based on Cs-137 data. Instead, the measured value from SRNL-L3100-2017-00116 is applied.

3.5 Replacement of Recent Concentrations of Tc-99

Table 3.4-1 provided a summary of the Tc-99 waste concentrations for each tank based on the Cs-137 data from the recent *Curie and Volume Inventory Report* (SRR-LWP-2017-00033) and on the analysis of available sample data in Section 2. The intent of these values was to provide an informed estimate of Tc-99 concentrations and inventories when tank-specific sample data is not available. However, for tanks with recent sample data, the best value to use is usually the recently measured sample value. Also, for tanks that have been "operationally idle" (i.e., no transfer activity) for an extended period of time, older sample data may also still be applicable and appropriate to use. Table 3.5-1 identifies recent Cs-137 and Tc-99 supernate sampling data for each tank.

Next, an evaluation of tank volume histories (from the historical *Curie and Volume Inventory Reports*) was performed (see Appendix B). Based on this evaluation, it was determined how long ago each waste tank has undergone substantial transfer activity. Based on the history of this transfer activity, "applicability dates" were selected (Table B-2 in Appendix B). These applicability dates indicate how recent the measured sample data must be in order to qualify as still being applicable to the waste tank:

- Any concentration from 6/1/2015 or newer was assumed to still be valid, regardless of any transfer activity during the past couple of years.
- Because the volume analysis in Appendix B was limited to evaluating transfers starting in December 2004, it is assumed that substantial volume transfers occurred in every waste tank just before December 1, 2004 (i.e., only sample data more recent than December 1, 2004 will be considered for applicability).
- Finally, any sample data that is more recent than the most recent substantial waste transfer is assumed to be applicable.

The applicable supernate sample data was then selected by cross-referencing the applicability dates from Table B-2 against the sample dates in Table 3.5-1. The analysis-estimated concentrations in Table 3.4-1 were then replaced with the applicable concentrations from Table 3.5-1 to provide final supernate concentration recommendations (Table 3.5-4).

While not as expansive as the supernate data set, salt and sludge-specific sampling data is available for select tanks (Table 2.1-1). Where appropriate, this data was used to estimate the salt and sludge inventories presented in Table 3.5-4. For salt waste, the applicable salt sample data is presented in Table 3.5-2. Due to the dearth of available salt sampling data, samples taken prior to December 1, 2004 for Tanks 2, 3, and 29 were considered applicable based on their specific tank volume history (Figures B-2, B-3, and B-29, respectively).

Sludge sampling data used to estimate sludge inventories is presented in Table 3.5-3. In Tanks 13 and 15, measured Cs-137 concentrations (from SRNL-L3100-2012-00088 and SRNL-L3100-2017-00070, respectively) were used to estimate the Tc-99 sludge inventories based on Equation 3-1 and the sludge volume data (Table A-2). In Tank 40, X-ESR-H-00858 provided an estimated sludge slurry concentration for Tc-99; however, the value was inconsistent with other data. Therefore, to determine the Tc-99 sludge inventory for Tank 40, the Cs-137 concentration from X-ESR-H-00858 was applied to Equation 3-1. (Note that this estimate is still likely to be conservative as it is nearly double the inventory value reported in SRR-LWP-2017-00033). Finally, Tank 51 uses the Tc-99 concentration from SRNL-STI-2016-00026 (7.19E+04 pCi/mL) to estimate the Tank 51 sludge solid inventory. For all other tanks, the sludge inventory is based on the Cs-137 inventory from a recent *Curie and Volume Inventory Report* (SRR-LWP-2017-00033) and Equation 3-1.

Table 3.5-1: Most Recent Supernate Sample Concentrations for Each Waste Tank

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference
1[a]	6.42E+05	1.98E+09	HLW-HLE-94-0328	7/22/1993
2	4.06E+05	8.39E+08	WSRC-TR-2004-00131	9/10/2003
3	3.72E+05	9.57E+08	WSRC-TR-2004-00131	8/5/2003
4	3.74E+04	9.81E+07	SRNL-STI-2015-00456	8/19/2015
5 & 6	Not Applicable. Tank(s) closed.			
7[a]	6.27E+04	1.21E+08	SRNL-STI-2015-00486	8/24/2015
8	4.80E+04	6.70E+07	SRNL-L3100-2014-00124	6/12/2014
9[a]	1.89E+05	4.57E+08	HLW-HLE-94-0328	1/11/1973
10	2.13E+05	5.03E+08	WSRC-TR-2004-00164	10/23/2003
11[b]	1.75E+04	3.31E+07	SRNL-L3100-2013-00094	5/10/2013
12	Not Applicable. Tank(s) closed.			
13	5.72E+04	1.78E+08	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00064	12/16/2014
14[a]	1.06E+05	2.28E+08	HLW-HLE-94-0328	1/3/1973
15[a]	2.67E+03	2.75E+06	HLW-HLE-94-0328	3/7/1988
16 to 20	Not Applicable. Tank(s) closed.			
21	4.17E+04	1.09E+08	SRNL-STI-2017-00698	7/31/2017
22	1.13E+04	3.00E+07	SRNL-L3100-2016-00221	6/1/2016
23	4.19E+04	1.07E+08	SRNL-STI-2015-00369	6/8/2015
24	3.95E+05	1.43E+09	SRNL-L3100-2017-00108	7/1/2017
25	1.57E+05	4.10E+08	SRNL-L3100-2017-00141	7/21/2017
26[a]	2.85E+05	7.47E+08	SRT-LWP-2002-00033	3/25/2002
27	1.40E+05	3.94E+08	WSRC-RP-93-1009	7/21/1992
28	1.99E+05	5.64E+08	WSRC-STI-2006-00151	2/15/2006
29	1.76E+05	3.55E+08	WSRC-TR-2004-00130	9/11/2003
30	3.68E+05	1.04E+09	SRNL-L3100-2016-00221	6/1/2015
31[a]	1.57E+05	3.63E+08	WSRC-TR-2002-00388	8/6/2002
32	4.26E+05	9.59E+08	SRNL-L3100-2016-00221	6/1/2015
33	4.23E+03	9.17E+06	WSRC-TR-2004-00375, Rev. 1	6/27/2000
34	2.11E+05	7.53E+08	SRNL-L3100-2017-00141	7/21/2017
35[b]	1.47E+05	4.53E+08	SRNL-STI-2015-00224	3/9/2015
36	4.28E+05	2.53E+09	SRNL-L3100-2017-00141	8/21/2017
37	1.09E+05	3.09E+08	SRNL-L3100-2016-00221	6/1/2015
38	2.40E+04	4.52E+07	SRNL-L3100-2016-00221	6/1/2016
39	2.46E+04	5.66E+07	SRNL-L3100-2016-00221	6/1/2015
40	2.10E+04	3.29E+07	SRNL-L3100-2017-00029	4/12/2017
41	2.22E+04	2.51E+07	SRNL-L3100-2016-00221	6/1/2016
42	3.26E+05	1.16E+09	SRNL-L3100-2017-00141	8/14/2017
43	2.25E+04	3.38E+07	SRNL-STI-2015-00662	10/12/2015
44	1.40E+05	5.86E+08	WSRC-TR-2004-00375, Rev. 1	5/12/1999
45	1.70E+05	6.37E+08	X-ESR-G-00004	6/9/2003
46	2.77E+05	7.50E+08	X-ESR-G-00004	6/23/2003
47[a]	1.72E+05	4.07E+08	HLW-HLE-94-0328	11/13/1991
48	2.26E+04	7.21E+06	SRNL-STI-2012-00420	2/28/2012
49	6.10E+04	1.62E+08	X-ESR-H-00844	8/11/2016
50	4.39E+04	6.28E+05	SRNL-L3100-2017-00116	7/17/2017
51	7.95E+04	1.66E+08	SRNL-STI-2017-00486	5/1/2017

Notes: (a) Reference did not include a Tc-99 concentration, so the value provided is based on Eq. 2-4.
(b) Although the dates of the most recent samples for Tanks 11 and 35 are before the respective cutoff dates (as identified in Table B-2), these measured values will be assumed.

Table 3.5-2: Applicable Salt[a] Sample Concentrations for Specific Waste Tanks

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference
2	8.36E+04	1.02E+08	WSRC-TR-2004-00131	9/12/2003
3	2.28E+05	4.74E+08	WSRC-TR-2004-00131	8/5/2003
28	3.23E+05	6.43E+08	WSRC-STI-2006-00151	2/14/2006
29	4.28E+05	6.99E+08	WSRC-TR-2004-00130	8/26/2003

Notes: (a) Salt waste is comprised of both salt solids and salt interstitial liquid.

Table 3.5-3: Applicable Sludge[a] Sample Concentrations for Specific Waste Tanks

Tank	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference
13	not available	3.15E+08	SRNL-L3100-2012-00088	6/18/2012
15	not available	8.22E+07	SRNL-L3100-2017-00070	5/30/2017
40	6.97E+04 [b]	1.43E+08	X-ESR-H-00858	11/5/2016
51	7.19E+04	1.73E+08	SRNL-STI-2016-00026, Rev. 1	10/20/2015

Notes: (a) For this table, sludge waste is comprised of sludge solids and sludge interstitial liquid.
(b) The Tc-99 sludge concentration value for Tank 40 is inconsistent with other data considered in this analysis.

Table 3.5-4: Final Tank-Specific Tc-99 Concentrations and Inventory Estimate

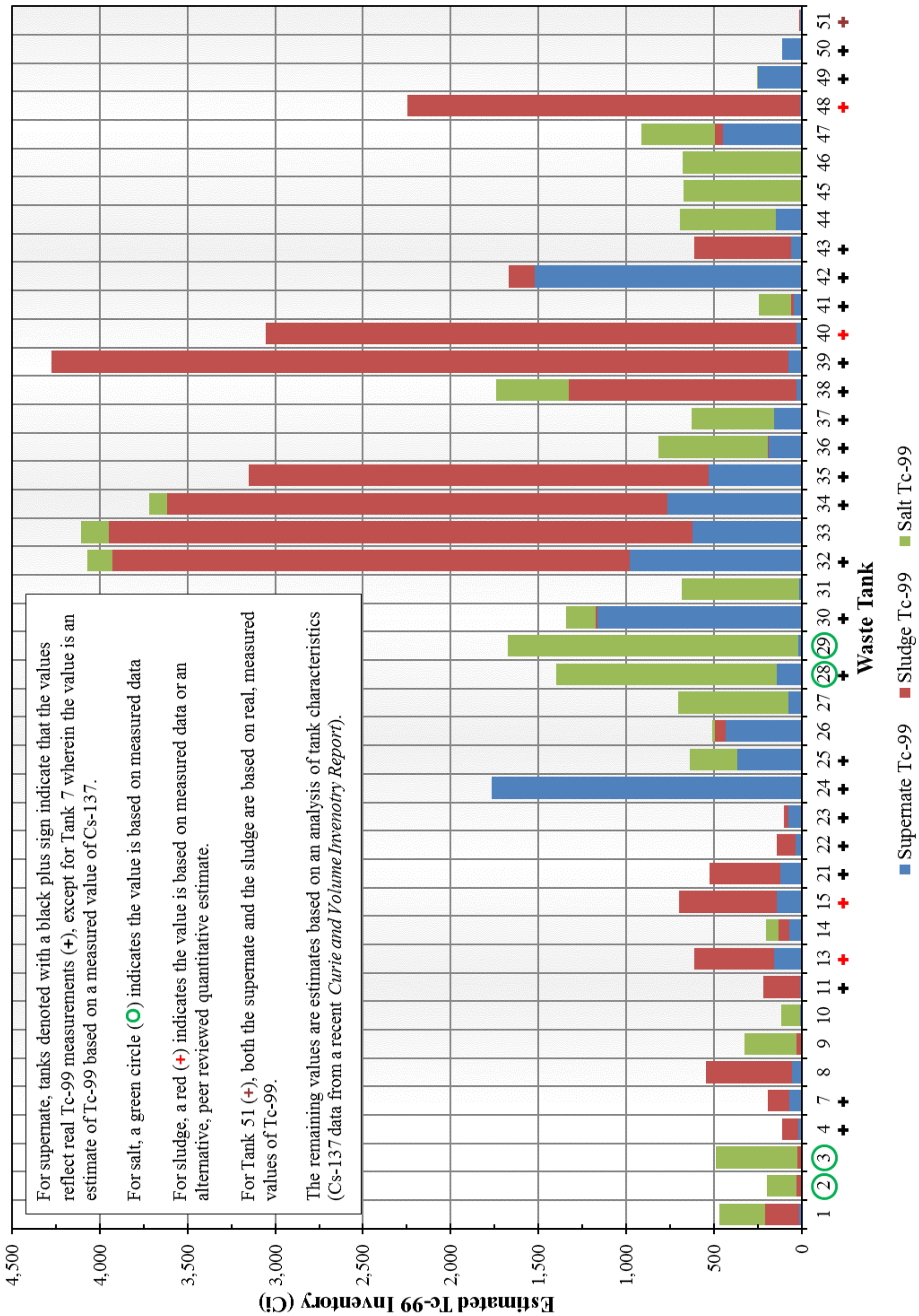
	Concentration (pCi/mL)			Inventory (Ci)		
Tank	**Aqueous Waste [a]**	**Insol. Sludge**	**Salt [b]**	**Aqueous Waste [a]**	**Insol. Sludge**	**Salt [b]**
1	7.07E+05	2.46E+07	1.43E+05	1.32E+01	1.97E+02	2.59E+02
2 [c]	3.05E+05	5.63E+06	8.36E+04	3.29E+00	2.60E+01	1.70E+02
3 [c]	3.07E+05	4.91E+06	2.28E+05	3.32E+00	2.27E+01	4.62E+02
4	3.74E+04	1.02E+07	1.43E+05	1.68E+01	9.24E+01	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.					
7	6.27E+04	8.01E+06	1.43E+05	6.76E+01	1.24E+02	0.00E+00
8	3.99E+04	1.07E+08	1.43E+05	5.35E+01	4.91E+02	0.00E+00
9	1.89E+05	9.13E+06	1.43E+05	1.36E+00	2.81E+01	2.97E+02
10	5.39E+04	9.06E+05	1.43E+05	8.08E+00	2.79E+00	1.03E+02
11	1.75E+04	9.56E+06	1.43E+05	7.52E+00	2.10E+02	0.00E+00
12	Not Applicable. Tank(s) closed.					
13 [d]	9.76E+04	1.05E+07	1.43E+05	1.54E+02	4.59E+02	0.00E+00
14	9.30E+05	1.96E+06	1.43E+05	6.90E+01	6.23E+01	7.03E+01
15 [d]	8.79E+04	2.61E+06	1.43E+05	1.43E+02	5.54E+02	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.					
21	4.17E+04	6.05E+06	1.43E+05	1.20E+02	4.04E+02	0.00E+00
22	1.13E+04	1.33E+06	1.43E+05	3.18E+01	1.09E+02	0.00E+00
23	4.19E+04	2.80E+05	1.43E+05	7.50E+01	2.45E+01	0.00E+00
24	3.95E+05	0.00E+00	1.43E+05	1.77E+03	0.00E+00	0.00E+00
25	1.57E+05	0.00E+00	1.43E+05	3.66E+02	0.00E+00	2.71E+02
26	1.21E+05	2.12E+05	1.43E+05	4.31E+02	6.14E+01	1.52E+01
27	2.57E+05	0.00E+00	1.43E+05	7.43E+01	0.00E+00	6.27E+02
28 [c]	1.99E+05	0.00E+00	3.23E+05	1.42E+02	0.00E+00	1.26E+03
29 [c]	7.69E+04	0.00E+00	4.28E+05	2.06E+01	0.00E+00	1.65E+03
30	3.68E+05	1.30E+07	1.43E+05	1.16E+03	1.04E+01	1.72E+02
31	5.08E+05	0.00E+00	1.43E+05	1.28E+01	0.00E+00	6.70E+02
32	4.26E+05	2.50E+07	1.43E+05	9.79E+02	2.95E+03	1.42E+02
33	1.79E+05	3.66E+07	1.43E+05	6.22E+02	3.33E+03	1.59E+02
34	2.11E+05	2.00E+08	1.43E+05	7.63E+02	2.85E+03	1.03E+02
35	1.47E+05	3.22E+07	1.43E+05	5.28E+02	2.62E+03	0.00E+00
36	4.28E+05	6.33E+06	1.43E+05	1.90E+02	2.52E+00	6.21E+02
37	1.09E+05	0.00E+00	1.43E+05	1.57E+02	0.00E+00	4.69E+02
38	2.40E+04	2.78E+07	1.43E+05	2.97E+01	1.30E+03	4.14E+02
39	2.46E+04	1.80E+07	1.43E+05	7.74E+01	4.20E+03	0.00E+00
40 [d]	2.10E+04	5.00E+06	1.43E+05	2.97E+01	3.02E+03	0.00E+00
41	2.22E+04	1.38E+06	1.43E+05	4.67E+01	1.03E+01	1.86E+02
42	3.26E+05	7.58E+06	1.43E+05	1.52E+03	1.51E+02	0.00E+00
43	2.25E+04	2.05E+06	1.43E+05	5.96E+01	5.54E+02	0.00E+00
44	1.76E+05	0.00E+00	1.43E+05	1.47E+02	0.00E+00	5.46E+02
45	2.46E+05	0.00E+00	1.43E+05	6.54E-01	0.00E+00	6.70E+02
46	3.15E+05	0.00E+00	1.43E+05	4.18E+00	0.00E+00	6.75E+02
47	2.88E+05	1.64E+05	1.43E+05	4.48E+02	4.62E+01	4.18E+02
48 [e]	7.39E+03	2.44E+06	1.43E+05	6.77E+00	2.24E+03	0.00E+00
49	6.10E+04	0.00E+00	1.43E+05	2.47E+02	0.00E+00	3.79E+00
50	4.39E+04	0.00E+00	1.43E+05	1.13E+02	0.00E+00	0.00E+00
51 [d]	7.95E+04	5.40E+04	1.43E+05	8.91E+00	9.01E-01	0.00E+00
TOTAL	not applicable	not applicable	not applicable	**1.07E+04**	**2.62E+04**	**1.04E+04**

Notes: (a) Aqueous waste is comprised of supernate and sludge interstitial liquid.
(b) Salt waste is comprised of both salt solids and salt interstitial liquid.
(c) Salt inventories for select tanks were based on various tank-specific data, as discussed above.
(d) Sludge inventories for select tanks were based on various tank-specific data, as discussed above.
(e) Sludge concentration for Tank 48 was determined by assuming that the sludge volume for Tank 48 was equal to the supernate volume reported in SRR-LWP-2017-00033.

3.6 Tc-99 Inventory Estimate Summary

Table 3.5-4 and Figure 3.6-1 provide a best estimate for current Tc-99 inventories in the SRS waste tanks based upon an analysis of the available sample data. The sum of these values is 4.73E+04 Ci of Tc-99. The recent *Curie and Volume Inventory Report* (SRR-LWP-2017-00033) estimates a similar value (4.40E+04 Ci). However, it should also be noted that only the soluble waste inventory (i.e., supernate, interstitial liquid from both salt and sludge, and salt solids) is destined for disposal at SDF (i.e., insoluble sludge is expected to be sent to DWPF for vitrification). The total soluble inventory (supernate, interstitial liquids, plus salt) from Table 3.5-4 is 2.12E+04 Ci compared to 2.55E+04 Ci of supernate estimated in the *Curie and Volume Inventory Report.* [SRR-LWP-2017-00033] As indicated at the end of Section 2.6 (Figure 2.6-3), the comparison of analysis-based concentrations versus recently measured sample values were similar, providing evidence that the analysis-based estimates for Tc-99 in aqueous waste were reasonably accurate. As such, the higher inventory values in the aqueous waste estimates based on WCS is likely due to conservatisms.

Figure 3.6-1: Best Estimate of Current Tc-99 Inventory in SRS Tank Farms



4.0 CONCLUSIONS

Based upon the analysis of the data provided herein, it is recommended to update the approach for projecting Tc-99 inventories. Specifically, wherever appropriate sampled data is not available, the Tc-99 inventory (in Ci) should be determined based on the available Cs-137 data and the applicable approaches (i.e., Equation 2-4 for supernate and interstitial liquids, Equation 2-4 increased by 50% for salt waste (salt waste is comprised of both salt solids and salt interstitial liquid), and Equation 3-1 for insoluble sludge waste).

Based upon this approach, as of late 2017 there is a total of 4.73E+04 Ci of Tc-99 projected in the tank farms (1.07E+04 Ci of supernate and sludge interstitial liquids, 2.62E+04 Ci in sludge solids, and 1.04E+04 Ci in salt waste (salt solids and salt interstitial liquid)). Given that this total Tc-99 inventory is based on analytical approaches using real measured data, these final values are considered appropriate and defensible.

4.1 Recommendations for Future Performance Modeling

Based on the results of this analysis, three Tc-99 inventory values are suggested for future SDF modeling purposes:

- For **realistic** models, the Tc-99 inventory for supernate, sludge interstitial liquid, and salt (2.12E+04 Ci) plus the 1.24E+03 Ci already disposed in the SDF should be used: **2.24E+04 Ci**.
- For **nominal** models (i.e., reasonable and defensible), the Tc-99 inventory for supernate, sludge interstitial liquid, and salt (2.12E+04 Ci) increased by 50% (3.17E+04 Ci) plus the 1.24E+03 Ci already disposed in the SDF should be used: **3.30E+04 Ci**. Note that this value is slightly lower than the value assumed in the 2009 SDF PA and FY2013 SDF SA (i.e., 3.5E+04 Ci).
- For **defense-in-depth** models, the Tc-99 inventory for supernate, sludge interstitial liquid, and salt (2.12E+04 Ci), plus half of the total sludge inventory (1.31E+04 Ci) tank farm Tc-99 inventory, plus the 1.24E+03 Ci already disposed in the SDF should be used: **3.55E+04 Ci**. Note that this value is very close to the value assumed in the 2009 SDF PA and FY2013 SDF SA (i.e., 3.5E+04 Ci).

Finally, for probabilistic simulations, the realistic value should be used, along with the sampling distribution described in Appendix C.

4.2 Recommendations to Reduce Uncertainty in Concentration Projections

Of the estimated 1.07E+04 Ci of aqueous (i.e., supernate and sludge interstitial liquid) Tc-99 in the tank farms, 8.50E+03 Ci (79% of the aqueous total) either reflect measured Tc-99 concentrations or were based on measured Cs-137 concentrations. Note that while salt solids and salt interstitial liquids are estimated separately, because salt concentrations are limited by solubility the variability in the concentration is expected to be somewhat limited relative to supernate variability (see footnote “c” in Table 3.5-4). The remaining 2.22E+03 Ci (21% of the aqueous total) are based on Cs-137 values from SRR-LWP-2017-00033, rather than from measured sample data from the specific waste tanks. The values in these tanks represent greater uncertainty than the tanks based on measured data. Of these, Tanks 33 and 47 are estimated to have the most Tc-99 supernate (wherein these two tanks represent approximately half of the estimated aqueous inventories of Tc-99). Therefore, to reduce future uncertainty it is recommended that if future sampling is performed that samples be collected and analyzed from Tanks 33 and 47.

5.0 REFERENCES

10 CFR 61, *Licensing Requirements for Land Disposal of Radioactive Waste*, U.S. Nuclear Regulatory Commission, Washington DC, December 2011.

CBU-PIT-2004-00024, Ledbetter, L.S., *12/01/04 – December Monthly WCS Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, December 2004.

CBU-PIT-2005-00003, Ledbetter, L.S., *1/03/05 – January Monthly WCS Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, January 2005.

CBU-PIT-2005-00025, Tran, H.Q., *2/01/05 - February Monthly WCS Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, February 2005.

CBU-PIT-2005-00085, Tran, H.Q., *4/01/05 - April Monthly WCS Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, April 2005.

CBU-PIT-2005-00108, Tran, H.Q., *5/01/05 - May Monthly WCS Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, May 2005.

CBU-PIT-2005-00127, Hill, P.J., *Soluble Phase Selenium-79, Technetium-99, and Tin-126 Inventories*, Savannah River Site, Aiken, SC, Rev. 0, May 2005.

CBU-PIT-2005-00132, Tran, H.Q., *6/1/05 – June Monthly WCS Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, June 2005.

CBU-PIT-2005-00162, Tran, H.Q., *7/01/05 – July Monthly WCS Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 1, July 2005.

CBU-PIT-2005-00185, Tran, H.Q., *8/01/05 – August Monthly WCS Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, August 2005.

CBU-PIT-2005-00214, Dean, W.B., *9/01/05 – September Monthly WCS Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, September 2005.

CBU-PIT-2005-00246, Dean, W.B., *10/01/05 – October Monthly WCS Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, October 2005.

CBU-PIT-2005-00266, Dean, W.B., *11/01/05 – November Monthly WCS Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, November 2005.

CBU-PIT-2005-00285, Dean, W.B., *12/01/05 – December Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, December 2005.

CBU-PIT-2006-00002, Dean, W.B., *1/1/06 – January Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, January 2006.

CBU-PIT-2006-00023, Dean, W.B., *2/1/06 – February Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, February 2006.

CBU-PIT-2006-00037, Dean, W.B., *3/1/06 – March Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, March 2006.

CBU-PIT-2006-00061, Dean, W.B., *4/1/06 – April Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, April 2006.

CBU-PIT-2006-00079, Dean, W.B., *5/1/06 – May Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, May 2006.

CBU-PIT-2006-00104, Dean, W.B., *6/1/06 – June Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, June 2006.

DOE M 435.1-1, Change 1, *Radioactive Waste Management Manual,* U.S. Department of Energy, Washington DC, June 19, 2001.

DPST-81-329, Lee, L.M., *Decontamination of Dissolved Salt Solution from Tank 19F Using Duolite CS-100 and Amberlite IRC-718 Resins*, Savannah River Laboratory, SC, May 1981.

DPST-82-502, Fowler, J.R., *Composition of H-Area & SRP Soluble High Level Waste*, Savannah River Laboratory, Aiken, SC, Rev. 0, April 1982.

HLW-HLE-94-0328, Pike, J.A., *Radio Nuclide Sample Analysis of Waste Tanks 1-51*, Savannah River Site, Aiken, SC, Rev. 0, January 1994.

LWO-CES-2008-00034, Le, T.A., *07/01/2008 – July, 2008 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, July 2008.

LWO-LWP-2008-00002, Le, T.A., *10/01/2008 – October, 2008 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, October 2008.

LWO-LWP-2009-00002, Le, T.A., *1/05/2009 – January, 2009 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, January 2009.

LWO-LWP-2009-00012, Le, T.A., *3/31/2009 – March, 2009 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, April 2009.

LWO-PIT-2006-00003, Dean, W.B., *7/1/06 – July Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, July 2006.

LWO-PIT-2006-00013, Dean, W.B., *8/1/06 – August Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, August 2006.

LWO-PIT-2006-00027, Dean, W.B., *9/1/06 – September Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, September 2006.

LWO-PIT-2006-00040, Dean, W.B., *10/1/06 – October Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 1, October 2006.

LWO-PIT-2006-00076, Le, T.A., *12/7/06 – December Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, December 2006.

LWO-PIT-2007-00002, Le, T.A., *1/1/07 – January 2007 Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 1, January 2007.

LWO-PIT-2007-00028, Le, T.A., *3/1/07 – March 2007 Monthly Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, March 2007.

LWO-PIT-2007-00072, Le, T.A., *8/14/07 – August 2007 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 1, August 2007.

LWO-PIT-2007-00088, Le, T.A., *12/31/2007 – December, 2007 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, February 2008.

LWO-PIT-2008-00019, *04/01/2008 – April, 2008 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, May 2008.

SRNL-L3100-2008-00020, Poirier, M.R., *Analysis of Samples from Chemical Cleaning in Tank 5F*, Savannah River National Laboratory, Aiken, SC, Rev. 3, May 2009.

SRNL-L3100-2008-00021, Poirier, M.R., *Analysis of Samples from Chemical Cleaning in Tank 6F*, Savannah River National Laboratory, Aiken, SC, Rev. 1, March 2009.

SRNL-L3100-2012-00088, Pereizs, J.M., *June 2012 Tank 13 Characterization*, Savannah River National Laboratory, Aiken, SC, Rev. 0, June 2012.

SRNL-L3100-2013-00094, Martion, C.J., *Analysis of Tank 11H (HTF-11-13-76) for Technetium-99*, Savannah River National Laboratory, Aiken, SC, Rev. 0, June 2013.

SRNL-L3100-2013-00212, Hay, M.S., *Early Results of the Analysis of Tank 35H Samples HTF-35-13-146 HTF-35-13-147, HTF-35-13-148 for Salt Batch Planning*, Savannah River National Laboratory, Aiken, SC, Rev. 0, November 2013.

SRNL-L3100-2014-00124, Pareizs, J.M., *Analytical Results of Pre-Salt Batch 8 Samples HTF-38-14-6; HTF-38-14-7; HTF-22-14-51, -52, and -53; and FTF-08-14-11*, Savannah River National Laboratory, Aiken, SC, Rev. 0, June 2014.

SRNL-L3100-2014-00193, Pareizs, J.M., *Analytical Results of Pre-Salt Batch 8 Samples HTF-41-14-100 and -101*, Savannah River National Laboratory, Aiken, SC, Rev. 1, October 2014.

SRNL-L3100-2014-00221, Crawford, C.L., *Tables Containing Results for the Third Quarter 2014 Tank 50 WAC Slurry Sample: Chemical and Radionuclide Contaminant Results*, Savannah River National Laboratory, Aiken, SC, Rev. 0, September 2014.

SRNL-L3100-2014-00279, Crawford, C.L., *Tables Containing Results for the Fourth Quarter 2014 Tank 50 WAC Slurry Sample: Chemical and Radionuclide Contaminant Results*, Savannah River National Laboratory, Aiken, SC, Rev. 0, January 2015.

SRNL-L3100-2015-00032, Oji, L.N., *Tanks 35H and 43H Characterizations for Iodine-129 and Technetium-99*, Savannah River National Laboratory, Aiken, SC, Rev. 1, March 2015.

SRNL-L3100-2015-00065, Crawford, C.L., *Tables Containing Results for the First Quarter Calendar Year 2015 Tank 50 WAC Slurry Sample: Chemical and Radionuclide Contaminant Results*, Savannah River National Laboratory, Aiken, SC, Rev. 1, May 2015.

SRNL-L3100-2015-00107, Crawford, C.L., *Tables Containing Results for the Second Quarter Calendar Year 2015 Tank 50 WAC Slurry Sample: Chemical and Radionuclide Contaminant Results*, Savannah River National Laboratory, Aiken, SC, Rev. 0, July 2015.

SRNL-L3100-2015-00178, Crawford, C.L., *Tables Containing Results for the Third Quarter Calendar Year 2015 Tank 50 WAC Slurry Sample: Chemical and Radionuclide Contaminant Results*, Savannah River National Laboratory, Aiken, SC, Rev. 0, October 2015.

SRNL-L3100-2015-00227, Crawford, C.L., *Results for the Fourth Quarter Calendar Year 2015 Tank 50H Salt Solution Sample*, Savannah River National Laboratory, Aiken, SC, Rev. 0, January 2016.

SRNL-L3100-2016-00069, Crawford, C.L., *Results for the First Quarter Calendar Year 2016 Tank 50H Salt Solution Sample*, Savannah River National Laboratory, Aiken, SC, Rev. 0, April 2016.

SRNL-L3100-2016-00124, Crawford, C.L., *Results for the Second Quarter Calendar Year 2016 Tank 50H Salt Solution Sample*, Savannah River National Laboratory, Aiken, SC, Rev. 0, July 2016.

SRNL-L3100-2016-00173, Crawford, C.L., *Results for the Third Quarter Calendar Year 2016 Tank 50H Salt Solution Sample*, Savannah River National Laboratory, Aiken, SC, Rev. 0, October 2016.

SRNL-L3100-2016-00221, Fowley, M.D., Bannochie, C.J., and King, W.D., *Summary of Unreported SRNL Iodine Data*, Savannah River National Laboratory, Aiken, SC, Rev. 0, December 2016.

SRNL-L3100-2016-00229, Crawford, C.L., *Results for the Fourth Quarter Calendar Year 2016 Tank 50H Salt Solution Sample*, Savannah River National Laboratory, Aiken, SC, Rev. 1, February 2017.

SRNL-L3100-2017-00007, King, W.D., *Analysis Results for Sub-Samples of SRS Tanks 30, 32, and 39 to Support Evaluations of the I-129 Inventory*, Savannah River National Laboratory, Aiken, SC, Rev. 0, December 2016.

SRNL-L3100-2017-00029, King, W.D. and Bannochie, C.J., *Tank 40 Sludge Batch 8 Iodine, Cesium, and Technetium Data from Recent SRNL Mercury Speciation Studies,* Savannah River National Laboratory, Aiken, SC, Rev. 0, April 2017.

SRNL-L3100-2017-00033, Crawford, C.L., *Results for the First Quarter Calendar Year 2017 Tank 50H Salt Solution Sample*, Savannah River National Laboratory, Aiken, SC, Rev. 0, April 2017.

SRNL-L3100-2017-00070, Reboul, S.H., Coleman, C.J., and DiPrete, D.P., *Characterization of the May 2017 Tank 15 Waste Removal Slurry Sample (HTF-15-17-49)*, Savannah River National Laboratory, Aiken, SC, Rev. 0, June 2017.

SRNL-L3100-2017-00076, Crawford, C.L., *Results for the Second Quarter Calendar Year 2017 Tank 50 Salt Solution Sample*, Savannah River National Laboratory, Aiken, SC, Rev. 0, July 2017.

SRNL-L3100-2017-00108, King, W.D., *Characterization of Tank 24H Waste Supernate Samples to Support SRS Iodine Inventory Evaluations*, Savannah River National Laboratory, Aiken, SC, Rev. 0, September 2017.

SRNL-L3100-2017-00116, Crawford, C.L., *Results for the Third Quarter Calendar Year 2017 Tank 50 Salt Solution Sample*, Savannah River National Laboratory, Aiken, SC, Rev. 0, October 2017.

SRNL-L3100-2017-00141, Hay, M.S. and King, W.D., *Results of the Analysis of Iodine Inventory Evaluation Samples from Tanks 25F, 34F, 36H, and 42H*, Savannah River National Laboratory, Aiken, SC, Rev. 0, December 2017.

SRNL-STI-2008-00446, Peters, T.B., Nash, C.A., and Fink, S.D., *ISDP Salt Batch #2 Supernate Qualification*, Savannah River National Laboratory, Aiken, SC, Rev. 1, January 2009.

SRNL-STI-2009-00805, Peters, T.B. and Fink, S.D., *Initial Radiochemical Results From ISDP Macrobatch 3 Tank 21H and Tank 24H Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 0, January 2010.

SRNL-STI-2010-00017, Peters, T.B. and Fink, S.D., *Complete Results From ISDP Macrobatch 3 Tank 23H Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 0, January 2010.

SRNL-STI-2010-00386, Oji, L.N, Diprete, D.P., and Coleman, C.J., *Characterization of Additional Tank 18F Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 0, September 2010.

SRNL-STI-2010-00439, Oji, L.N, Diprete, D.P., and Coleman, C.J., *Characterization of Additional Tank 19F Floor Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 0, August 2010.

SRNL-STI-2011-00061, Peters, T.B. and Fink, S.D., *Sample Results from the Integrated Salt Disposition Program Macrobatch 4 Tank 21H Qualification Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 1, June 2011.

SRNL-STI-2012-00076, Peters, T.B. and Fink, S.D., *Sample Results from the Integrated Salt Disposition Program Macrobatch 5 Tank 2H Qualification Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 0, March 2012.

SRNL-STI-2012-00420, Nash, C.A. and Peters, T.B., *Analyses of HTF-48-12-20/24 (February, 2012) and Archived HTF-E-05-021 Tank 48H Slurry Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 0, August 2012.

SRNL-STI-2012-00479, Reboul, S.H., *Chemical Differences Between Sludge Solids at the F and H Area Tank Farms*, Savannah River National Laboratory, Aiken, SC, Rev. 0, August 2012.

SRNL-STI-2012-00707, Peters, T.B. and Fink, S.D., *Sample Results from the Interim Salt Disposition Program Macrobatch 6 Tank 21H Qualification Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 1, December 2012.

SRNL-STI-2013-00437, Peters, T.B. and Washington, A.L., *Sample Results from the Interim Salt Disposition Program Macrobatch 7 Tank 21H Qualification Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 0, August 2013.

SRNL-STI-2013-00730, Hay, M.S., *Characterization of Tank 35H Samples in Support of Salt Batch Planning*, Savannah River National Laboratory, Aiken, SC, Rev. 0, March 2014.

SRNL-STI-2014-00081, Martino, C.J., *Analysis of Tank 38H (HTF-38-14-6, 7) and Tank 43H (HTF-43-14-8, 9) Samples for Support of the Enrichment Control and Corrosion Control Programs*, Savannah River National Laboratory, Aiken, SC, Rev. 1, November 2014.

SRNL-STI-2014-00561, Peters, T.B. and Washington, A.L., *Disposition Program Macrobatch 8 Tank 21H Qualification Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 1, January 2015.

SRNL-STI-2015-00008, Oji, L.N., *Analysis of Tank 38H (HTF-38-14-150, 151) and Tank 43H (HTF-43-14-152, 53) Surface and Subsurface Supernatant Samples in Support of Enrichment Control, Corrosion Control and Sodium Aluminosilicate Formation Potential Programs*, Savannah River National Laboratory, Aiken, SC, Rev. 0, January 2015.

SRNL-STI-2015-00064, Oji, L.N., *Analysis of Tank 13H (HTF-13-14-156, 157) Surface and Subsurface Supernatant Samples in Support of Enrichment Control, Corrosion Control and Sodium Aluminosilicate Formation Potential Programs*, Savannah River National Laboratory, Aiken, SC, Rev. 0, February 2015.

SRNL-STI-2015-00224, Hay, M.S., Coleman, C.J., and Diprete, D.P., *Analysis of Tank 35H Samples in Support of Salt Batch Planning*, Savannah River National Laboratory, Aiken, SC, Rev. 0, April 2015.

SRNL-STI-2015-00369, Hay, M.S., Coleman, C.J., and Diprete, D.P., *Analysis of Tank 23H Samples in Support of Salt Batch Planning*, Savannah River National Laboratory, Aiken, SC, Rev. 0, August 2015.

SRNL-STI-2015-00456, Oji, L.N., *Analysis of Tank 4 (FTF-4-15-22, 23) Surface and Subsurface Supernatant Samples in Support of Enrichment Control, Corrosion Control and Evaporator Feed Qualification Programs*, Savannah River National Laboratory, Aiken, SC, Rev. 0, September 2015.

SRNL-STI-2015-00486, Oji, L.N., *Analysis of Tank 7 Surface Supernant Sample (FTF-7-15-26) in Support of Corrosion Control Program*, Savannah River National Laboratory, Aiken, SC, Rev. 0, October 2015.

SRNL-STI-2015-00622, Peters, T.B., *Sample Results from the Interim Salt Disposition Program Macrobatch 9 Tank 21H Qualification Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 0, November 2015.

SRNL-STI-2015-00662, Oji, L.N., *Analysis of Tank 38H (HTF-38-15-119, 127) Surface, Subsurface and Tank 43H (HTF-43-15-116, 117 and 118) Surface, Feed Pump Suction and Jet Suction Subsurface Supernatant Samples in Support of Enrichment, Corrosion Control and Salt Batch Planning Programs*, Savannah River National Laboratory, Aiken, SC, Rev. 0, November 2015.

SRNL-STI-2016-00026, Bannochie, C.J., DiPrete, D.P., and Pareizs, J.M., *Sludge Batch 9 (SB9) Acceptance Evaluation: Radionuclide Concentrations in Tank 51 SB9 Qualification Sample Prepared at SRNL*, Savannah River National Laboratory, Aiken, SC, Rev. 1, March 2016.

SRNL-STI-2017-00055, Peters, T.B. and Bannochie, C.J., *Results from the Interim Salt Disposition Program Macrobatch 10 Tank 21H Qualification Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 0, February 2017.

SRNL-STI-2017-00486, Oji, L.N., *Characterization of Tank 51 Sludge Slurry Samples (HTF-51-17-44/ HTF-51-17-48) in Support of Sludge Batch 10 Processing*, Savannah River National Laboratory, Aiken, SC, Rev. 1, February 2018.

SRNL-STI-2017-00698, Peters, T.B. and Bannochie, C.J., *Results from the Interim Salt Disposition Program Macrobatch 11 Tank 21H Acceptance Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 0, November 2017.

SRNL-TR-2014-00141, Martino, C.J., *Analysis of Tank 38H (HTF-38-14-67, 68) and Tank 43H (HTF-43-14-69, 70) Samples for Support of the Enrichment Control and Corrosion Control Programs*, Savannah River National Laboratory, Aiken, SC, Rev. 0, July 2014.

SRNS-TR-2008-00103, Martino, C.J., *Analysis of Tank 23H Samples HTF-23-08-101 and 103 for Saltstone Waste Acceptance Criteria Limits*, Savannah River National Laboratory, Aiken, SC, Rev. 0, October 2008.

SRR-CWDA-2009-00017, *Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site,* Savannah River Site, Aiken, SC, Rev. 0, October 2009.

SRR-CWDA-2010-00124, *Tank 18/Tank 19 Special Analysis for the Performance Assessment for the F-Area Tank Farm at the Savannah River Site*, Savannah River Site, Savannah River Site, Rev. 0, February 2012.

SRR-CWDA-2012-00106, *Tanks 5 and 6 Special Analysis for the Performance Assessment for the F-Area Tank Farm at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 1, January 2013.

SRR-CWDA-2013-00062, *FY2013 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 2, October 2013.

SRR-CWDA-2014-00006, *FY2014 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 2, September 2014.

SRR-CWDA-2014-00071, Dixon, D., *Tank 16 Inventory Determination*, Savannah River Site, Aiken, SC, Rev. 0, October 2014.

SRR-CWDA-2014-00106, *Tanks 16 Special Analysis for the Performance Assessment for the H-Area Tank Farm at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 1, February 2015.

SRR-CWDA-2015-00003, Hommel, S.P., *Saltstone Disposal Facility Waste Inventory Disposed Estimator Model Report*, Savannah River Site, Aiken, SC, Rev. 0, January 2015.

SRR-CWDA-2015-00075, Dixon, D., *Tank 12 Inventory Determination*, Savannah River Site, Aiken, SC, Rev.1, August 2015.

SRR-CWDA-2015-00123, Hommel, S.P., *Evaluation of Tc-99 Concentration Data to Improve Liquid Waste Inventory Projections*, Savannah River Site, Aiken, SC, Rev.1, January 2017.

SRR-CWDA-2016-00072, *FY2016 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site*, Savannah River Site, Aiken, SC, Rev. 0, October 2016.

SRR-CWDA-2017-00079, Wooten, L.A., *Determination of the SDF Inventory through 9/30/2017*, Savannah River Site, Aiken, SC, Rev. 0, November 2017.

SRR-LWE-2012-00198, Duffey, C.E., *Technetium-99 (Tc-99) Results for Samples from Proposed Salt Batch Source, Blend, and/or Feed Tanks*, Savannah River Site, Aiken, SC, Rev. 1, November 2012.

SRR-LWP-2009-00003, Le, T.A., *6/30/2009 – June, 2009 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, July 2009.

SRR-LWP-2009-00013, Le, T.A., *9/30/2009 – September 2009 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, October 2009.

SRR-LWP-2010-00003, Le, T.A., *1/05/2010 – January 2010 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 1, February 2010.

SRR-LWP-2010-00040, Le, T.A., *3/31/2010 – March 2010 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, April 2010.

SRR-LWP-2010-00054, Le, T.A., *7/7/2010 – July 2010 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, July 2010.

SRR-LWP-2010-00071, Le, T.A., *9/30/2010 – September 2010 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, October 2010.

SRR-LWP-2011-00002, Le, T.A., *1/3/2011 – January 2011 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, January 2011.

SRR-LWP-2011-00014, Le, T.A., *3/31/2011 – March 2011 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, April 2011.

SRR-LWP-2011-00027, Le, T.A., *7/5/2011 – July 2011 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, July 2011.

SRR-LWP-2011-00043, Le, T.A., *9/30/2011 – September 2011 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, October 2011.

SRR-LWP-2012-00005, Le, T.A., *1/03/2012 – January 2012 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, January 2012.

SRR-LWP-2012-00029, Le, T.A., *4/02/2012 – April 2012 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, April 2012.

SRR-LWP-2012-00047, Le, T.A., *7/02/2012 – July 2012 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 1, July 2013.

SRR-LWP-2012-00064, Le, T.A., *10/01/2012 – October 2012 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 2, July 2013.

SRR-LWP-2013-00006, Le, T.A., *1/02/2013 – January 2013 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 1, July 2013.

SRR-LWP-2013-00024, Le, T.A., *4/01/2013 – April 2013 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 1, June 2013.

SRR-LWP-2013-00051, Le, T.A., *7/01/2013 – July2013 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, July 2013.

SRR-LWP-2013-00066, Le, T.A., *9/30/2013 – September 2013 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, October 2013.

SRR-LWP-2014-00001, Le, T.A., *1/2/2014 – January 2014 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 1, February 2014.

SRR-LWP-2014-00014, Le, T.A., *3/31/2014 – March 2014 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev.0, April 2014.

SRR-LWP-2014-00030, Le, T.A., *7/01/2014 – July 2014 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev.0, July 2014.

SRR-LWP-2014-00047, Lynn, J., *9/30/2014 – September 2014 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, November 2014.

SRR-LWP-2015-00001, Lynn, J., *12/31/2014 – December 2014 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, January 2015.

SRR-LWP-2015-00013, Lynn, J., *3/31/2015 - March 2015 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, April 2015.

SRR-LWP-2015-00022, Lynn, J., *6/30/2015 - June 2015 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 1, October 2015.

SRR-LWP-2015-00042, Lynn, J., *9/30/2015 – September 2015 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, October 2015.

SRR-LWP-2016-00004, Lynn, J., *12/31/2015 - December 2015 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 1, February 2016.

SRR-LWP-2016-00016, Gilbreath, K.D., *3/31/2016 - March 2016 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, May 2016.

SRR-LWP-2016-00031, Gilbreath, K.D., *6/30/2016 - June 2016 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, August 2016.

SRR-LWP-2016-00045, Gilbreath, K.D., *9/30/2016 – September 2016 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, November 2016.

SRR-LWP-2017-00005, Gilbreath, K.D., *12/29/2016 – December 2016 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, January 2017.

SRR-LWP-2017-00033, Gilbreath, K.D., *3/30/2017 – March 2017 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, May 2017.

SRR-LWP-2017-00057, Chew, D.P., *9/30/2017 – September 2017 Curie and Volume Inventory Report*, Savannah River Site, Aiken, SC, Rev. 0, November 2017.

SRT-LWP-2002-00033, Wilmarth, W.R., *Tank 26F Sample Analysis*, Savannah River Site, Aiken, SC, Rev. 0, March 2002.

SRT-LWP-2003-00008, Swingle, R.F., *Results of Analyses of Tank 23H and 24H Saltstone WAC Samples HTK-521 - HTK-528*, Savannah River Site, Aiken, SC, Rev. 0, January 2003.

SRT-LWP-2003-00061, Martino, C.J. and Wilmarth, W.R., *Initial Results of Tank 41H Saltstone WAC Analyses*, Savannah River Site, Aiken, SC, Rev. 1, August 2003.

WSRC-RP-93-1009, Walker, D.D., Coleman, C.J., and Dewberry, R.A., *Composition of Tank Farm Supernate Samples*, Savannah River Site, Aiken, SC, Rev. 0, July 1993.

WSRC-STI-2006-00151, Martino, C.J., et al, *Analysis of Tank 28F Saltcake Core Samples FTF-456 – 467*, Savannah River National Laboratory, Aiken, SC, Rev. 0, February 2007.

WSRC-STI-2007-00123, Martino, C.J., et al, *Analysis and Dissolution Testing of Tank 25F Saltcake Core Samples (FTF-504 – 513)*, Savannah River National Laboratory, Aiken, SC, Rev. 0, August 2007.

WSRC-STI-2007-00697, Hay, M.S, et al, *Characterization and Aluminum Dissolution Demonstration With a 3 Liter Tank 51H Sample*, Savannah River National Laboratory, Aiken, SC, Rev. 0, February 2008.

WSRC-STI-2008-00117, Nash, C.A., Peters, T.B., and Fink, S.D., *Tank 49H Salt Batch Supernate Qualification for ARP/MCU*, Savannah River National Laboratory, Aiken, SC, Rev. 0, August 2008.

WSRC-STI-2008-00227, Hay, M.S. and McCabe, D.J., *Characterization of Tank 11H and Tank 51H Post Aluminum Dissolution Process Samples*, Savannah River National Laboratory, Aiken, SC, Rev. 0, May 2008.

WSRC-TR-2002-00388, Martino, C.J. and Poirier, M.R., *Tank 31H Saltcake Dissolution Tests*, Savannah River Site, Aiken, SC, Rev. 0, February 2003.

WSRC-TR-2003-00162, Swingle, R.F., *Results of Analyses of Tank 23H Saltstone WAC Samples HTK-542–HTK-545*, Savannah River Site, Aiken, SC, Rev. 0, June 2005.

WSRC-TR-2003-00380, Martino, C.J., et al, *Tank 41H Dissolved Saltcake Sample (HTF-E-03-91–92) Saltstone Waste Acceptance Criteria Analysis*, Savannah River Site, Aiken, SC, Rev. 1, September 2003.

WSRC-TR-2003-00112, Swingle, R.F., *Results of Analyses of Tank 23H and 24H Saltstone WAC Samples HTK-521 and HTK-528*, Savannah River Site, Aiken, SC, Rev. 0, March 2003.

WSRC-TR-2003-00720, Lambert, D.P., et al, *Analysis of Tank 48H Samples, HTF-E-03-73 (June 3, 2003) and HTF-E-03-127 (September 17, 2003)*, Savannah River Site, Aiken, SC, Rev. 0, January 2004.

WSRC-TR-2004-00129, Martino, C.J., et al, *Tank 38H Saltcake Core and Supernate Sample Analysis*, Savannah River Site, Aiken, SC, Rev. 0, April 2004.

WSRC-TR-2004-00130, Martino, C.J., McCabe, D.J., and Nichols, R.L., *Tank 29H Saltcake Core and Supernate Sample Analysis*, Savannah River Site, Aiken, SC, Rev. 0, April 2004.

WSRC-TR-2004-00131, Martino, C.J., et al, *Tanks 3F and 2F Saltcake Core and Supernate Sample Analysis*, Savannah River Site, Aiken, SC, Rev. 0, April 2004.

WSRC-TR-2004-00164, Martino, C.J., et al, *Tank 10H Saltcake Core Sample Analysis*, Savannah River Site, Aiken, SC, Rev. 0, April 2004.

WSRC-TR-2004-00375, Rios-Armstrong, M.A., *Waste Characterization System (WCS) Supernate Baseline Composition Development in Support of Integrated Flowsheet Modeling Efforts*, Savannah River Site, Aiken, SC, Rev. 1, September 2004.

WSRC-TR-2004-00386, Stallings, M.E., et al, *Characterization of Supernate Samples from High Level Waste Tanks 13H, 30H, 37H, 39H, 45F, 46F, and 49H*, Savannah River Site, Aiken, SC, Rev. 2, June 2005.

WSRC-TR-2005-00192, Oji, L.N. and Blume, M.S., *Characterization of Tank 23H Supernate per Saltstone Waste Acceptance Criteria Analysis Requirements - 2005*, Savannah River National Laboratory, Aiken, SC, Rev. 1, May 2005.

WSRC-TR-2005-00336, Martino, C.J., *Analysis of Tank 49H Samples (HTF-064 - 066) for Saltstone Waste Acceptance Criteria Constituents*, Savannah River National Laboratory, Aiken, SC, Rev. 0, August 2005.

WSRC-TR-2007-00199, Martino, C.J. and Coleman, C.J., *Analysis of Tank 39H Sample HTF-39-07-32*, Savannah River National Laboratory, Aiken, SC, Rev. 1, June 2007.

WSRC-TR-94-0562, Georgeton, G.K. and Hester, J.R., *Characterization of Radionuclides in HLW Sludge Based on Isotopic Distribution in Irradiated Assemblies*, Savannah River Site, Aiken, SC, Rev. 1, January 1995.

WSRC-TR-96-0264, Hester, J.R., *High Level Waste Characterization System (WCS)*, Savannah River Site, Aiken, SC, Rev. 0, December 1996.

WSRC-TR-96-0267, d'Entremont, P.D., and Hester, J.R., *Characterization of Tank 20 Residual Waste*, Savannah River National Laboratory, Aiken, SC, Rev. 0, March 1997.

WSRC-TR-97-0066, d'Entremont, P.D., Hester, J.R., and Caldwell, T.B., *Characterization of Tank 17 Residual Waste*, Savannah River National Laboratory, Aiken, SC, Rev. 1, September 1997.

X-ESR-G-00004, Hester, J.R., *WCS Supernate Radionuclide Concentration Algorithms*, Savannah River Site, Aiken, SC, Rev. 0, September 2004.

X-ESR-H-00120, Shafer, A.R., *Evaluation of ISDP Batch 1 Qualification Compliance to 512-S, DWPF, Tank Farm, and Saltstone Waste Acceptance Criteria*, Savannah River Site, Aiken, SC, Rev. 0, March 2008.

X-ESR-H-00209, Campbell, S.E., *Blend Evaluation for Tank 49 Feed for ISDP Salt Batch 3*, Savannah River Site, Aiken, SC, Rev. 0, March 2010.

X-ESR-H-00844, Aponte, C.I., *Blend Evaluation for Tank 49 Feed for ISDP Salt Batch 9*, Savannah River Site, Aiken, SC, Rev. 0, August 2016.

X-ESR-H-00858, Shafer, A.R. and Gillam, J.M., *Projected Blend Compositions and Summary of Sludge Batch 9, After Tank 51 to 40 Transfer*, Savannah River Site, Aiken, SC, Rev. 1, December 2016.

APPENDIX A

WCS-BASED TANK VOLUMES AND INVENTORIES

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APPENDIX A. WCS-BASED TANK VOLUMES AND INVENTORIES

This appendix provides the waste phase volumes within each tank (Table A-1) from a recent *Curie and Volume Inventory Report*. [SRR-LWP-2017-00033] The estimated inventories of Cs-137 are then divided by these volumes to estimate the Cs-137 concentrations within each tank.

For use in estimating the inventories, these volumes are converted from gallons to milliliters. Also, the sludge waste is separated into volumes of *interstitial liquid from sludge* (70% of the volume) and *sludge volumes excluding the interstitial liquid* (30% of the volume). Similarly, the salt waste is separated into volumes of *interstitial liquid from salt* (30% of the volume) and *salt volumes excluding the interstitial liquid* (70% of the volume). Table A-2 provides the volume data used in the inventory estimates.

Tank-specific curie estimates taken from SRR-LWP-2017-00033 were used. The tank-specific inventories for Cs-137 is provided in Table A-3. Table A-4 decays these inventories to the assumed date of SDF closure (i.e., October 1, 2032).

Table A-5 provides the tank-specific inventories for Tc-99 from the March 2017 *Curie and Volume Inventory Report*. [SRR-LWP-2017-00033] The decayed inventories for Tc-99 are not included because the long half-life of Tc-99 negates the impact of decay between September 2016 and October 2032.

Finally, Tables A-6 and A-7 provide the equivalent waste concentrations based on the given inventories and volumes.

Table A-1: Tank Farm Volumes by Tank Based on the March 2017 Curie and Volume Inventory Report

Tank	Supernate (gal)	Sludge (gal)	Salt (gal)
1	0.00E+00	7.05E+03	4.80E+05
2	0.00E+00	4.07E+03	5.36E+05
3	0.00E+00	4.07E+03	5.36E+05
4	1.13E+05	8.00E+03	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.		
7	2.75E+05	1.36E+04	0.00E+00
8	3.51E+05	4.03E+03	0.00E+00
9	0.00E+00	2.71E+03	5.49E+05
10	3.77E+04	2.71E+03	1.91E+05
11	1.00E+05	1.93E+04	0.00E+00
12	Not Applicable. Tank(s) closed.		
13	3.91E+05	3.85E+04	0.00E+00
14	0.00E+00	2.80E+04	1.30E+05
15	2.98E+05	1.87E+05	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.		
21	7.17E+05	5.88E+04	0.00E+00
22	6.92E+05	7.27E+04	0.00E+00
23	4.19E+05	7.71E+04	0.00E+00
24	1.18E+06	5.31E+03	0.00E+00
25	6.16E+05	1.05E+03	5.02E+05
26	7.60E+05	2.55E+05	2.81E+04
27	7.30E+04	4.91E+03	1.16E+06
28	1.88E+05	0.00E+00	1.03E+06
29	7.06E+04	0.00E+00	1.02E+06
30	8.32E+05	7.02E+02	3.18E+05
31	6.67E+03	0.00E+00	1.24E+06
32	5.34E+05	1.04E+05	2.63E+05
33	8.60E+05	8.00E+04	2.94E+05
34	9.47E+05	1.26E+04	1.91E+05
35	9.00E+05	7.16E+04	0.00E+00
36	1.17E+05	3.51E+02	1.15E+06
37	3.83E+05	0.00E+00	8.68E+05
38	2.98E+05	4.11E+04	7.66E+05
39	6.89E+05	2.05E+05	0.00E+00
40	0.00E+00	5.33E+05	0.00E+00
41	5.52E+05	6.53E+03	3.44E+05
42	1.22E+06	1.76E+04	0.00E+00
43	5.32E+05	2.38E+05	0.00E+00
44	2.21E+05	0.00E+00	1.01E+06
45	7.02E+02	0.00E+00	1.24E+06
46	3.51E+03	0.00E+00	1.25E+06
47	2.37E+05	2.48E+05	7.74E+05
48	2.42E+05	0.00E+00	0.00E+00
49	1.07E+06	0.00E+00	7.02E+03
50	6.78E+05	0.00E+00	0.00E+00
51	1.93E+04	1.47E+04	0.00E+00

Table A-2: Tank Farm Volumes by Tank – For Use in Inventory Estimates

Tank	Free Supernate Volume (mL)	Sludge Volume (Interstitial Liquid ONLY) (mL)	Salt Volume (Interstitial Liquid ONLY) (mL)	Sludge Volume (excl. Interstitial Liquid) (mL)	Salt Volume (excl. Interstitial Liquid) (mL)
1	0.00E+00	1.87E+07	5.45E+08	8.01E+06	1.27E+09
2	0.00E+00	1.08E+07	6.09E+08	4.62E+06	1.42E+09
3	0.00E+00	1.08E+07	6.09E+08	4.62E+06	1.42E+09
4	4.28E+08	2.12E+07	0.00E+00	9.08E+06	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.				
7	1.04E+09	3.60E+07	0.00E+00	1.54E+07	0.00E+00
8	1.33E+09	1.07E+07	0.00E+00	4.58E+06	0.00E+00
9	0.00E+00	7.18E+06	6.23E+08	3.08E+06	1.45E+09
10	1.43E+08	7.18E+06	2.17E+08	3.08E+06	5.06E+08
11	3.79E+08	5.11E+07	0.00E+00	2.19E+07	0.00E+00
12	Not Applicable. Tank(s) closed.				
13	1.48E+09	1.02E+08	0.00E+00	4.37E+07	0.00E+00
14	0.00E+00	7.42E+07	1.48E+08	3.18E+07	3.44E+08
15	1.13E+09	4.96E+08	0.00E+00	2.12E+08	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.				
21	2.71E+09	1.56E+08	0.00E+00	6.68E+07	0.00E+00
22	2.62E+09	1.93E+08	0.00E+00	8.26E+07	0.00E+00
23	1.59E+09	2.04E+08	0.00E+00	8.76E+07	0.00E+00
24	4.47E+09	1.41E+07	0.00E+00	6.03E+06	0.00E+00
25	2.33E+09	2.78E+06	5.70E+08	1.19E+06	1.33E+09
26	2.88E+09	6.76E+08	3.19E+07	2.90E+08	7.45E+07
27	2.76E+08	1.30E+07	1.32E+09	5.58E+06	3.07E+09
28	7.12E+08	0.00E+00	1.17E+09	0.00E+00	2.73E+09
29	2.67E+08	0.00E+00	1.16E+09	0.00E+00	2.70E+09
30	3.15E+09	1.86E+06	3.61E+08	7.97E+05	8.43E+08
31	2.52E+07	0.00E+00	1.41E+09	0.00E+00	3.29E+09
32	2.02E+09	2.76E+08	2.99E+08	1.18E+08	6.97E+08
33	3.26E+09	2.12E+08	3.34E+08	9.08E+07	7.79E+08
34	3.58E+09	3.34E+07	2.17E+08	1.43E+07	5.06E+08
35	3.41E+09	1.90E+08	0.00E+00	8.13E+07	0.00E+00
36	4.43E+08	9.30E+05	1.31E+09	3.99E+05	3.05E+09
37	1.45E+09	0.00E+00	9.86E+08	0.00E+00	2.30E+09
38	1.13E+09	1.09E+08	8.70E+08	4.67E+07	2.03E+09
39	2.61E+09	5.43E+08	0.00E+00	2.33E+08	0.00E+00
40	0.00E+00	1.41E+09	0.00E+00	6.05E+08	0.00E+00
41	2.09E+09	1.73E+07	3.91E+08	7.42E+06	9.12E+08
42	4.62E+09	4.66E+07	0.00E+00	2.00E+07	0.00E+00
43	2.01E+09	6.31E+08	0.00E+00	2.70E+08	0.00E+00
44	8.37E+08	0.00E+00	1.15E+09	0.00E+00	2.68E+09
45	2.66E+06	0.00E+00	1.41E+09	0.00E+00	3.29E+09
46	1.33E+07	0.00E+00	1.42E+09	0.00E+00	3.31E+09
47	8.97E+08	6.57E+08	8.79E+08	2.82E+08	2.05E+09
48	9.16E+08	0.00E+00	0.00E+00	0.00E+00	0.00E+00
49	4.05E+09	0.00E+00	7.97E+06	0.00E+00	1.86E+07
50	2.57E+09	0.00E+00	0.00E+00	0.00E+00	0.00E+00
51	7.31E+07	3.90E+07	0.00E+00	1.67E+07	0.00E+00

Table A-3: Tank-Specific Inventory of Cs-137, 3/31/2017, Based on the March 2017 Curie and Volume Inventory Report

Tank	Supernate (Ci)	Sludge (Ci)	Salt (Ci)
1	1.79E+06	2.80E+04	7.63E+03
2	7.14E+05	3.86E+03	8.52E+03
3	7.22E+05	3.37E+03	8.52E+03
4	6.23E+04	1.33E+04	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.		
7	1.82E+05	1.78E+04	0.00E+00
8	1.35E+05	6.85E+04	0.00E+00
9	4.11E+05	4.16E+03	8.72E+03
10	5.29E+04	4.33E+02	3.04E+03
11	1.23E+04	2.98E+04	0.00E+00
12	Not Applicable. Tank(s) closed.		
13	4.66E+05	2.06E+05	0.00E+00
14	9.77E+05	9.07E+03	2.06E+03
15	4.21E+05	1.23E+05	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.		
21	3.54E+05	5.66E+04	0.00E+00
22	3.25E+04	1.58E+04	0.00E+00
23	2.32E+05	3.64E+03	0.00E+00
24	6.77E+06	0.00E+00	0.00E+00
25	1.67E+06	0.00E+00	7.98E+03
26	1.37E+06	8.94E+03	4.46E+02
27	1.51E+06	0.00E+00	1.84E+04
28	1.84E+06	0.00E+00	1.64E+04
29	3.15E+05	0.00E+00	1.63E+04
30	7.16E+06	1.57E+03	5.06E+03
31	3.05E+06	0.00E+00	1.97E+04
32	2.88E+06	3.97E+05	4.19E+03
33	2.32E+06	4.47E+05	4.67E+03
34	3.93E+06	3.85E+05	3.04E+03
35	2.16E+06	3.54E+05	0.00E+00
36	6.08E+06	3.92E+02	1.82E+04
37	1.52E+06	0.00E+00	1.38E+04
38	1.58E+05	1.78E+05	1.22E+04
39	2.58E+05	5.61E+05	0.00E+00
40	7.69E+04	7.23E+05	0.00E+00
41	6.67E+04	1.55E+03	5.47E+03
42	7.54E+06	2.17E+04	0.00E+00
43	3.13E+05	7.72E+04	0.00E+00
44	1.19E+06	0.00E+00	1.60E+04
45	1.26E+06	0.00E+00	1.97E+04
46	1.72E+06	0.00E+00	1.99E+04
47	2.62E+06	6.78E+03	1.23E+04
48	1.22E+04	3.03E+05	0.00E+00
49	7.50E+05	0.00E+00	1.12E+02
50	6.81E+02	0.00E+00	0.00E+00
51	7.76E+03	3.50E+04	0.00E+00
TOTAL	**6.51E+07**	**4.08E+06**	**2.52E+05**

Table A-4: Tank-Specific Inventory of Cs-137, Decayed to 10/1/2032, Based on the March 2017 Curie and Volume Inventory Report

Tank	Supernate (Ci)	Sludge (Ci)	Salt (Ci)
1	1.25E+06	1.96E+04	5.34E+03
2	5.00E+05	2.70E+03	5.97E+03
3	5.06E+05	2.36E+03	5.97E+03
4	4.36E+04	9.35E+03	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.		
7	1.28E+05	1.24E+04	0.00E+00
8	9.45E+04	4.80E+04	0.00E+00
9	2.88E+05	2.91E+03	6.11E+03
10	3.71E+04	3.03E+02	2.13E+03
11	8.61E+03	2.09E+04	0.00E+00
12	Not Applicable. Tank(s) closed.		
13	3.26E+05	1.44E+05	0.00E+00
14	6.84E+05	6.35E+03	1.44E+03
15	2.95E+05	8.63E+04	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.		
21	2.48E+05	3.97E+04	0.00E+00
22	2.27E+04	1.10E+04	0.00E+00
23	1.63E+05	2.55E+03	0.00E+00
24	4.74E+06	0.00E+00	0.00E+00
25	1.17E+06	0.00E+00	5.59E+03
26	9.59E+05	6.26E+03	3.13E+02
27	1.06E+06	0.00E+00	1.29E+04
28	1.29E+06	0.00E+00	1.15E+04
29	2.21E+05	0.00E+00	1.14E+04
30	5.02E+06	1.10E+03	3.54E+03
31	2.14E+06	0.00E+00	1.38E+04
32	2.02E+06	2.78E+05	2.93E+03
33	1.63E+06	3.13E+05	3.27E+03
34	2.75E+06	2.69E+05	2.13E+03
35	1.51E+06	2.48E+05	0.00E+00
36	4.26E+06	2.75E+02	1.28E+04
37	1.06E+06	0.00E+00	9.67E+03
38	1.11E+05	1.24E+05	8.53E+03
39	1.80E+05	3.93E+05	0.00E+00
40	5.38E+04	5.06E+05	0.00E+00
41	4.67E+04	1.09E+03	3.83E+03
42	5.28E+06	1.52E+04	0.00E+00
43	2.19E+05	5.41E+04	0.00E+00
44	8.31E+05	0.00E+00	1.12E+04
45	8.82E+05	0.00E+00	1.38E+04
46	1.20E+06	0.00E+00	1.39E+04
47	1.84E+06	4.74E+03	8.61E+03
48	8.54E+03	2.12E+05	0.00E+00
49	5.26E+05	0.00E+00	7.82E+01
50	4.77E+02	0.00E+00	0.00E+00
51	5.43E+03	2.45E+04	0.00E+00
TOTAL	**4.56E+07**	**2.86E+06**	**1.77E+05**

Table A-5: Tank-Specific Inventory of Tc-99, 3/31/2017, Based on the March 2017 Curie and Volume Inventory Report

Tank	Supernate (Ci)	Sludge (Ci)	Salt (Ci)
1	6.97E+02	2.60E+02	0.00E+00
2	2.79E+02	3.99E+01	0.00E+00
3	2.82E+02	3.34E+01	0.00E+00
4	2.43E+01	9.85E+01	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.		
7	7.11E+01	1.41E+02	0.00E+00
8	5.26E+01	5.37E+02	0.00E+00
9	1.60E+02	4.31E+01	0.00E+00
10	2.06E+01	4.41E+00	0.00E+00
11	4.79E+00	2.16E+02	0.00E+00
12	Not Applicable. Tank(s) closed.		
13	1.82E+02	1.71E+03	0.00E+00
14	3.81E+02	8.71E+01	0.00E+00
15	1.64E+02	1.01E+03	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.		
21	1.38E+02	2.36E+02	0.00E+00
22	1.27E+01	4.34E+01	0.00E+00
23	9.07E+01	3.04E+00	0.00E+00
24	2.64E+03	0.00E+00	0.00E+00
25	6.52E+02	0.00E+00	0.00E+00
26	5.34E+02	4.61E+01	0.00E+00
27	5.88E+02	0.00E+00	0.00E+00
28	7.17E+02	0.00E+00	0.00E+00
29	1.23E+02	0.00E+00	0.00E+00
30	2.79E+03	7.98E+00	0.00E+00
31	1.19E+03	0.00E+00	0.00E+00
32	1.12E+03	2.53E+03	0.00E+00
33	9.05E+02	2.22E+03	0.00E+00
34	1.53E+03	2.06E+03	0.00E+00
35	8.42E+02	2.08E+03	0.00E+00
36	2.37E+03	2.39E+00	0.00E+00
37	5.92E+02	0.00E+00	0.00E+00
38	6.16E+01	0.00E+00	0.00E+00
39	1.00E+02	2.71E+03	0.00E+00
40	3.00E+01	1.73E+03	0.00E+00
41	2.60E+01	3.04E+00	0.00E+00
42	2.94E+03	1.00E+02	0.00E+00
43	1.22E+02	3.69E+02	0.00E+00
44	4.63E+02	0.00E+00	0.00E+00
45	4.91E+02	0.00E+00	0.00E+00
46	6.70E+02	0.00E+00	0.00E+00
47	1.02E+03	3.65E+01	0.00E+00
48	4.76E+00	2.16E+01	0.00E+00
49	2.93E+02	0.00E+00	0.00E+00
50	1.57E+02	0.00E+00	0.00E+00
51	3.03E+00	1.11E+02	0.00E+00
TOTAL	**2.55E+04**	**1.85E+04**	**0.00E+00**

Table A-6: Tank-Specific Concentrations of Cs-137, Decayed to 10/1/2032, Based on the March 2017 Curie and Volume Inventory Report

Tank	Supernate (pCi/mL)	Sludge (pCi/mL)	Salt (pCi/mL)
1	2.22E+09	2.45E+09	4.20E+06
2	8.08E+08	5.84E+08	4.20E+06
3	8.17E+08	5.11E+08	4.20E+06
4	9.72E+07	1.03E+09	4.20E+06
5 & 6	Not Applicable. Tank(s) closed.		
7	1.19E+08	8.06E+08	0.00E+00
8	7.05E+07	1.05E+10	0.00E+00
9	4.57E+08	9.46E+08	4.20E+06
10	1.01E+08	9.85E+07	4.21E+06
11	2.00E+07	9.51E+08	0.00E+00
12	Not Applicable. Tank(s) closed.		
13	2.06E+08	3.30E+09	0.00E+00
14	3.08E+09	2.00E+08	4.19E+06
15	1.82E+08	4.07E+08	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.		
21	8.65E+07	5.94E+08	0.00E+00
22	8.09E+06	1.34E+08	0.00E+00
23	9.09E+07	2.91E+07	0.00E+00
24	1.06E+09	0.00E+00	0.00E+00
25	4.03E+08	0.00E+00	4.20E+06
26	2.68E+08	2.16E+07	4.20E+06
27	6.58E+08	0.00E+00	4.19E+06
28	6.84E+08	0.00E+00	4.20E+06
29	1.55E+08	0.00E+00	4.21E+06
30	1.43E+09	1.38E+09	4.20E+06
31	1.49E+09	0.00E+00	4.20E+06
32	7.78E+08	2.36E+09	4.21E+06
33	4.28E+08	3.44E+09	4.20E+06
34	7.17E+08	1.88E+10	4.21E+06
35	4.20E+08	3.05E+09	0.00E+00
36	2.43E+09	6.89E+08	4.19E+06
37	4.36E+08	0.00E+00	4.20E+06
38	5.25E+07	2.66E+09	4.20E+06
39	5.72E+07	1.69E+09	0.00E+00
40	3.81E+07	8.36E+08	0.00E+00
41	1.87E+07	1.47E+08	4.20E+06
42	1.13E+09	7.59E+08	0.00E+00
43	8.30E+07	2.00E+08	0.00E+00
44	4.19E+08	0.00E+00	4.20E+06
45	6.25E+08	0.00E+00	4.19E+06
46	8.40E+08	0.00E+00	4.21E+06
47	7.55E+08	1.68E+07	4.20E+06
48	9.33E+06	0.00E+00	0.00E+00
49	1.30E+08	0.00E+00	4.20E+06
50	1.86E+05	0.00E+00	0.00E+00
51	4.85E+07	1.47E+09	0.00E+00

Table A-7: Tank-Specific Concentrations of Tc-99, Decayed to 10/1/2032, Based on the March 2017 Curie and Volume Inventory Report

Tank	Supernate (pCi/mL)	Sludge (pCi/mL)	Salt (pCi/mL)
1	1.24E+06	3.25E+07	0.00E+00
2	4.50E+05	8.63E+06	0.00E+00
3	4.55E+05	7.23E+06	0.00E+00
4	5.41E+04	1.08E+07	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.		
7	6.60E+04	9.13E+06	0.00E+00
8	3.93E+04	1.17E+08	0.00E+00
9	2.54E+05	1.40E+07	0.00E+00
10	5.63E+04	1.43E+06	0.00E+00
11	1.12E+04	9.85E+06	0.00E+00
12	Not Applicable. Tank(s) closed.		
13	1.15E+05	3.92E+07	0.00E+00
14	1.72E+06	2.74E+06	0.00E+00
15	1.01E+05	4.75E+06	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.		
21	4.82E+04	3.54E+06	0.00E+00
22	4.50E+03	5.25E+05	0.00E+00
23	5.06E+04	3.47E+04	0.00E+00
24	5.89E+05	0.00E+00	0.00E+00
25	2.25E+05	0.00E+00	0.00E+00
26	1.49E+05	1.59E+05	0.00E+00
27	3.66E+05	0.00E+00	0.00E+00
28	3.81E+05	0.00E+00	0.00E+00
29	8.62E+04	0.00E+00	0.00E+00
30	7.96E+05	1.00E+07	0.00E+00
31	8.30E+05	0.00E+00	0.00E+00
32	4.33E+05	2.14E+07	0.00E+00
33	2.38E+05	2.45E+07	0.00E+00
34	4.00E+05	1.44E+08	0.00E+00
35	2.34E+05	2.55E+07	0.00E+00
36	1.35E+06	6.00E+06	0.00E+00
37	2.43E+05	0.00E+00	0.00E+00
38	2.92E+04	0.00E+00	0.00E+00
39	3.19E+04	1.16E+07	0.00E+00
40	2.12E+04	2.87E+06	0.00E+00
41	1.04E+04	4.10E+05	0.00E+00
42	6.30E+05	5.01E+06	0.00E+00
43	4.62E+04	1.37E+06	0.00E+00
44	2.33E+05	0.00E+00	0.00E+00
45	3.48E+05	0.00E+00	0.00E+00
46	4.68E+05	0.00E+00	0.00E+00
47	4.20E+05	1.29E+05	0.00E+00
48	5.19E+03	0.00E+00	0.00E+00
49	7.21E+04	0.00E+00	0.00E+00
50	6.13E+04	0.00E+00	0.00E+00
51	2.70E+04	6.65E+06	0.00E+00

APPENDIX B

TANK VOLUME HISTORY

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APPENDIX B. TANK VOLUME HISTORY

This appendix provides a summary of the tank volume histories based on the periodic Curie and Volume Inventory Reports produced by the Liquid Waste Planning (LWP) group. The purpose of examining this data is to determine appropriate dates for which concentration values may still be applicable. Knowing whether or not tanks have not undergone substantial transfers for a long period of time, provides the basis for this decision-making. Table B-1 provides a summary of total tank farm volumes over time and the references from which this data was gathered. Within each of these references, tank-specific data was also collected. This tank-specific data is provided graphically in Figures B-1 through B-51.

Table B-1: History of Waste Tank Phase Volume Inventories

Reference	Date	Supernate Total (gal)	Sludge Total (gal)	Salt Total (gal)	Total (gal)
CBU-PIT-2004-00024	12/1/2004	17,417,099	2,625,682	16,421,916	36,464,697
CBU-PIT-2005-00003	1/3/2005	17,243,217	2,538,592	16,511,298	36,293,107
CBU-PIT-2005-00025	2/1/2005	17,126,945	2,538,592	16,511,298	36,176,835
CBU-PIT-2005-00085	3/31/2005	17,100,000	2,770,000	16,200,000	36,070,000
CBU-PIT-2005-00108	4/30/2005	17,300,000	2,800,000	16,200,000	36,300,000
CBU-PIT-2005-00132	5/31/2005	17,700,000	2,800,000	16,200,000	36,700,000
CBU-PIT-2005-00162	6/30/2005	18,200,000	2,760,000	16,200,000	37,160,000
CBU-PIT-2005-00185	7/31/2005	18,200,000	2,760,000	16,400,000	37,360,000
CBU-PIT-2005-00214	8/31/2005	18,300,000	2,740,000	16,000,000	37,040,000
CBU-PIT-2005-00246	9/30/2005	18,100,000	2,740,000	16,100,000	36,940,000
CBU-PIT-2005-00266	10/31/2005	17,900,000	2,740,000	16,000,000	36,640,000
CBU-PIT-2005-00285	11/30/2005	17,300,000	2,760,000	16,300,000	36,360,000
CBU-PIT-2006-00002	12/31/2005	17,400,000	2,750,000	16,300,000	36,450,000
CBU-PIT-2006-00023	1/31/2006	17,600,000	2,770,000	16,100,000	36,470,000
CBU-PIT-2006-00037	2/28/2006	17,700,000	2,740,000	16,000,000	36,440,000
CBU-PIT-2006-00061	3/31/2006	17,800,000	2,740,000	16,000,000	36,540,000
CBU-PIT-2006-00079	4/30/2006	17,800,000	2,720,000	16,200,000	36,720,000
CBU-PIT-2006-00104	5/31/2006	18,100,000	2,760,000	16,200,000	37,060,000
LWO-PIT-2006-00003	6/30/2006	18,100,000	2,730,000	16,200,000	37,030,000
LWO-PIT-2006-00013	7/31/2006	18,100,000	2,800,000	16,200,000	37,100,000
LWO-PIT-2006-00027	8/31/2006	17,900,000	2,800,000	16,200,000	36,900,000
LWO-PIT-2006-00040	9/30/2006	17,600,000	2,910,000	16,200,000	36,710,000
LWO-PIT-2006-00076	12/7/2006	17,700,000	2,990,000	16,200,000	36,890,000
LWO-PIT-2007-00002	12/31/2006	17,700,000	2,970,000	16,200,000	36,870,000
LWO-PIT-2007-00028	2/28/2007	17,500,000	2,730,000	16,400,000	36,630,000
LWO-PIT-2007-00072	8/14/2007	17,300,000	2,760,000	16,600,000	36,660,000
LWO-PIT-2007-00088	12/31/2007	16,900,000	2,660,000	16,600,000	36,160,000
LWO-PIT-2008-00019	4/1/2008	16,600,000	2,820,000	16,700,000	36,120,000

Table B-1: History of Waste Tank Phase Volume Inventories (Continued)

Reference	Date	Supernate Total (gal)	Sludge Total (gal)	Salt Total (gal)	Total (gal)
LWO-CES-2008-00034	6/30/2008	17,100,000	2,690,000	16,500,000	36,290,000
LWO-LWP-2008-00002	9/30/2008	18,200,000	2,670,000	16,400,000	37,270,000
LWO-LWP-2009-00002	1/5/2009	18,600,000	2,760,000	16,400,000	37,760,000
LWO-LWP-2009-00012	3/31/2009	18,300,000	2,640,000	16,400,000	37,340,000
SRR-LWP-2009-00003	6/30/2009	17,400,000	2,810,000	16,300,000	36,510,000
SRR-LWP-2009-00013	9/30/2009	17,700,000	2,850,000	16,100,000	36,650,000
SRR-LWP-2010-00003	1/5/2010	17,900,000	2,900,000	15,900,000	36,700,000
SRR-LWP-2010-00040	3/31/2010	18,400,000	3,010,000	15,900,000	37,310,000
SRR-LWP-2010-00054	7/7/2010	18,500,000	2,730,000	15,900,000	37,130,000
SRR-LWP-2010-00071	9/30/2010	18,100,000	3,150,000	15,800,000	37,050,000
SRR-LWP-2011-00002	1/3/2011	19,200,000	3,180,000	15,700,000	38,080,000
SRR-LWP-2011-00014	3/31/2011	19,700,000	2,940,000	15,800,000	38,440,000
SRR-LWP-2011-00027	7/5/2011	19,400,000	2,950,000	15,800,000	38,150,000
SRR-LWP-2011-00043	9/30/2011	19,400,000	2,810,000	15,800,000	38,010,000
SRR-LWP-2012-00005	1/3/2012	18,300,000	2,810,000	15,800,000	36,910,000
SRR-LWP-2012-00029	4/2/2012	18,800,000	2,700,000	15,700,000	37,200,000
SRR-LWP-2012-00047	7/2/2012	18,900,000	2,700,000	15,900,000	37,500,000
SRR-LWP-2012-00064	10/1/2012	18,800,000	2,740,000	15,800,000	37,340,000
SRR-LWP-2013-00006	1/2/2013	18,300,000	2,640,000	15,800,000	36,740,000
SRR-LWP-2013-00024	4/1/2013	18,200,000	2,610,000	15,900,000	36,710,000
SRR-LWP-2013-00051	7/1/2013	18,700,000	2,550,000	15,800,000	37,050,000
SRR-LWP-2013-00066	9/30/2013	19,000,000	2,640,000	15,900,000	37,540,000
SRR-LWP-2014-00001	1/2/2014	18,800,000	2,670,000	16,000,000	37,470,000
SRR-LWP-2014-00014	3/31/2014	18,500,000	2,660,000	16,200,000	37,360,000
SRR-LWP-2014-00030	7/1/2014	18,000,000	2,720,000	16,200,000	36,920,000
SRR-LWP-2014-00047	9/30/2014	17,800,000	2,630,000	16,100,000	36,530,000
SRR-LWP-2015-00001	12/31/2014	17,600,000	2,600,000	16,100,000	36,300,000
SRR-LWP-2015-00013	3/31/2015	18,300,000	2,560,000	16,000,000	36,860,000
SRR-LWP-2015-00022	6/30/2015	18,200,000	2,600,000	15,900,000	36,700,000
SRR-LWP-2015-00042	9/30/2015	17,600,000	2,580,000	15,900,000	36,080,000
SRR-LWP-2016-00004	12/31/2015	17,700,000	2,490,000	15,900,000	36,090,000
SRR-LWP-2016-00016	4/4/2016	17,478,485	2,435,024	15,922,075	35,835,584
SRR-LWP-2016-00031	6/30/2016	17,300,000	2,340,000	15,900,000	35,540,000
SRR-LWP-2016-00045	9/30/2016	16,800,000	2,340,000	15,900,000	35,040,000
SRR-LWP-2017-00005	12/29/2016	16,500,000	2,400,000	15,900,000	34,800,000
SRR-LWP-2017-00033	3/30/2017	16,600,000	2,380,000	15,900,000	34,880,000
SRR-LWP-2017-00057	9/30/2017	16,300,000	2,760,000	15,900,000	34,960,000

Figure B-1: Volume History (2005 to 2017) for Tank 1

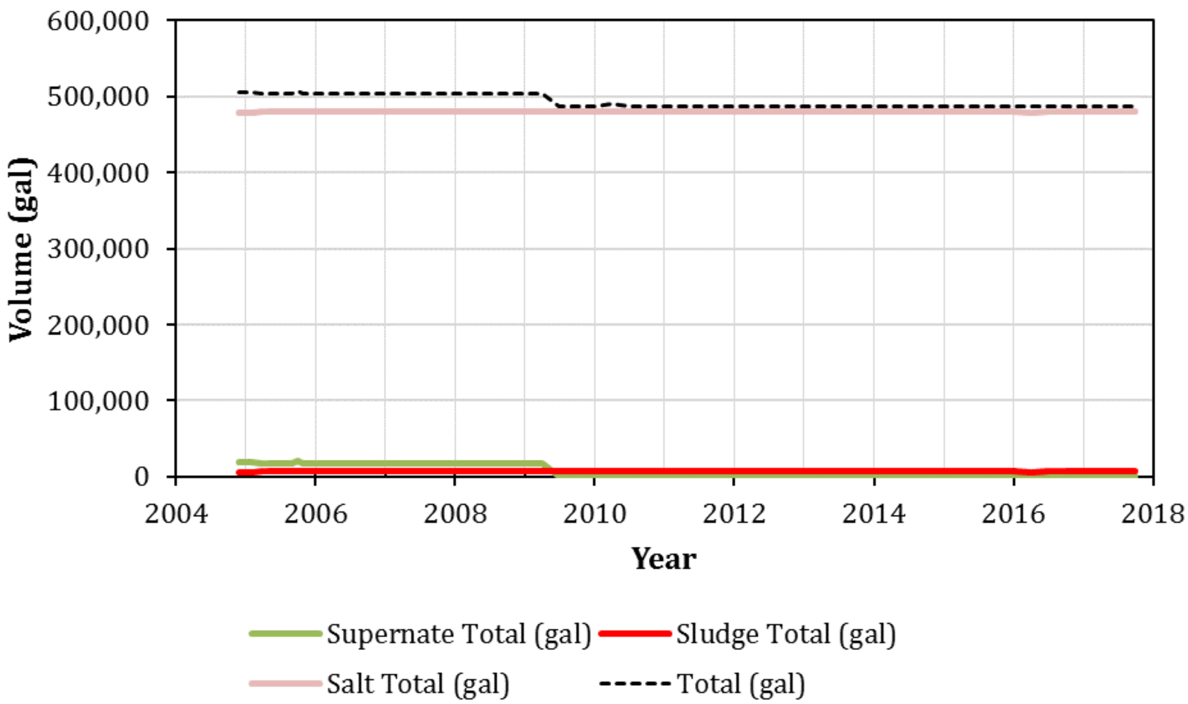


Figure B-2: Volume History (2005 to 2017) for Tank 2

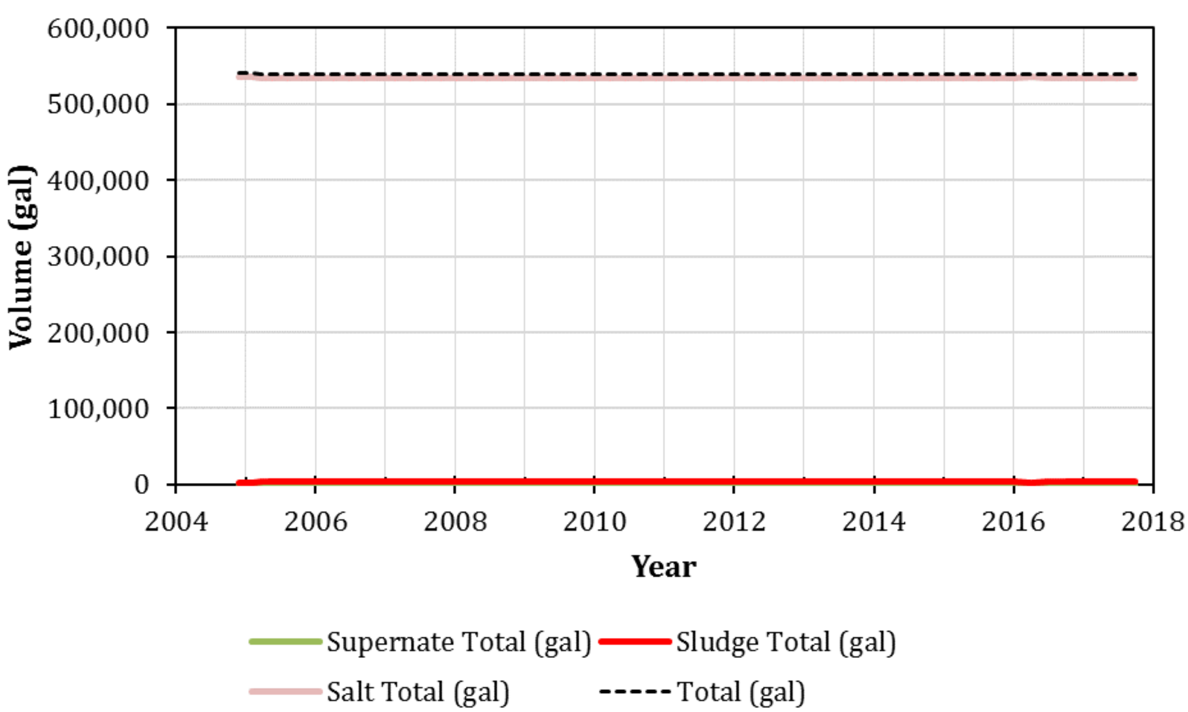


Figure B-3: Volume History (2005 to 2017) for Tank 3

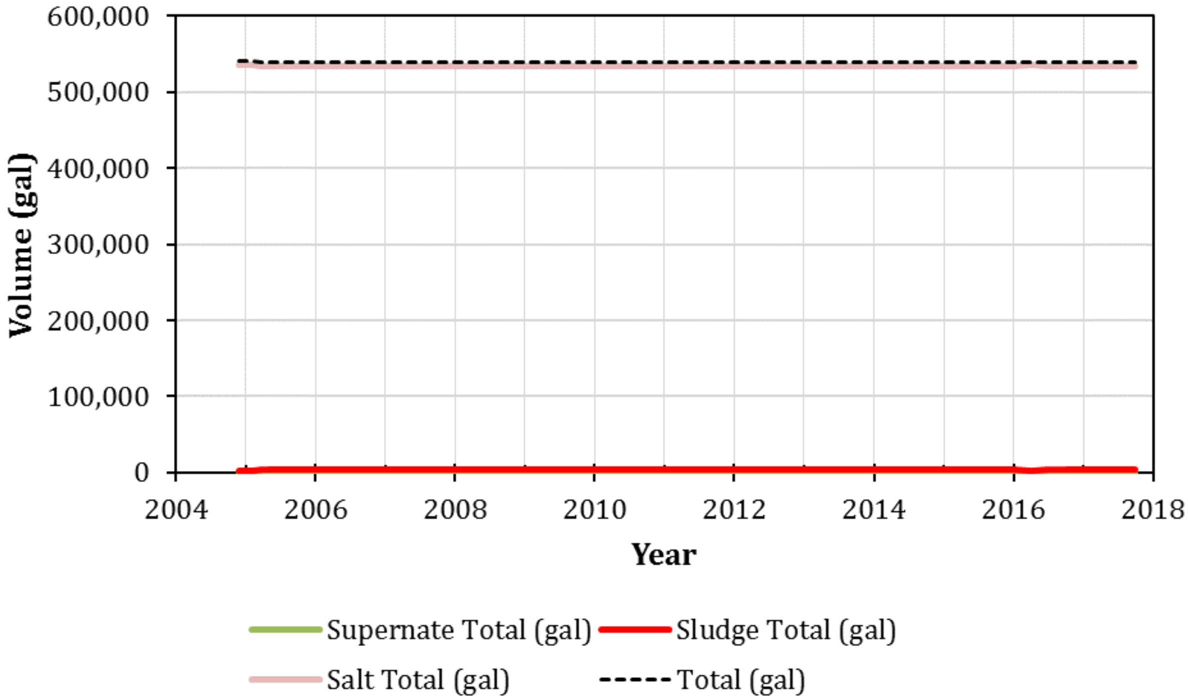


Figure B-4: Volume History (2005 to 2017) for Tank 4

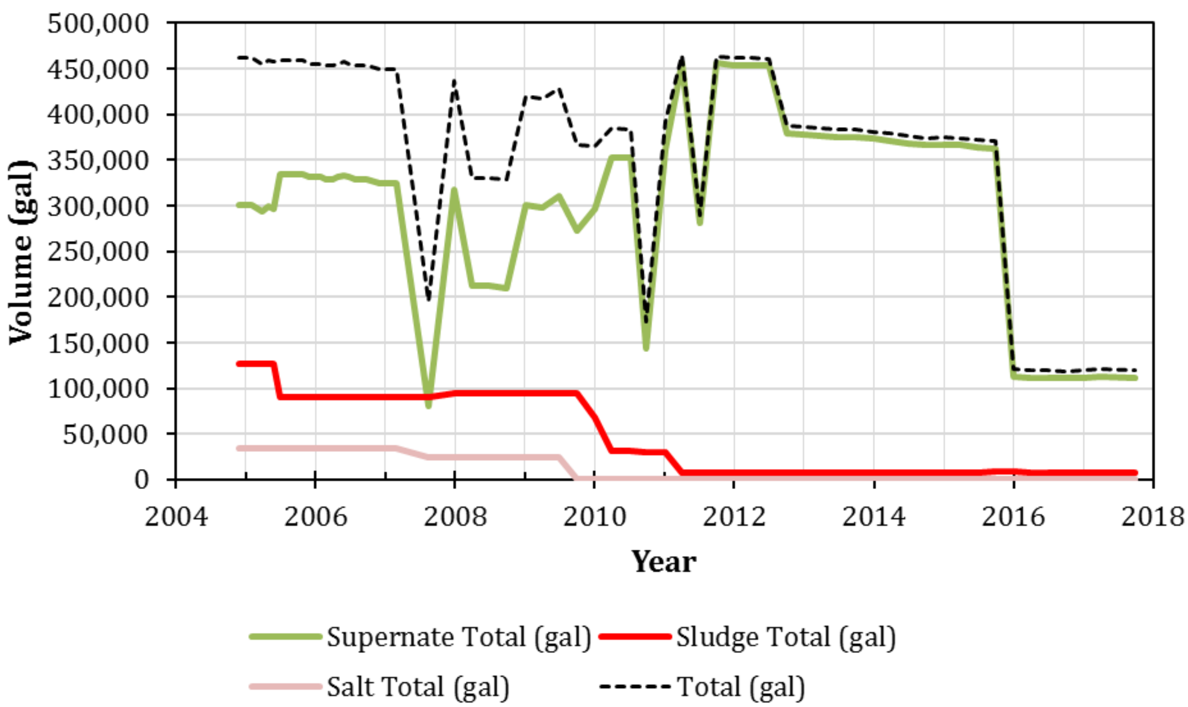


Figure B-5: Volume History (2005 to 2017) for Tank 5

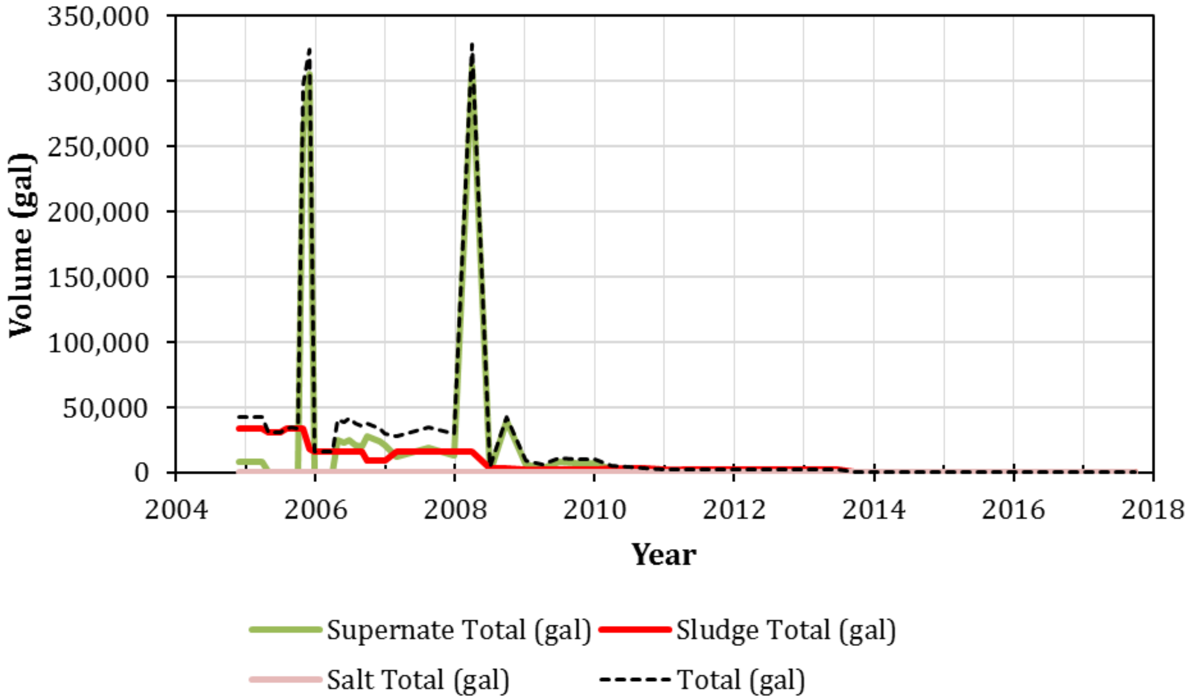


Figure B-6: Volume History (2005 to 2017) for Tank 6

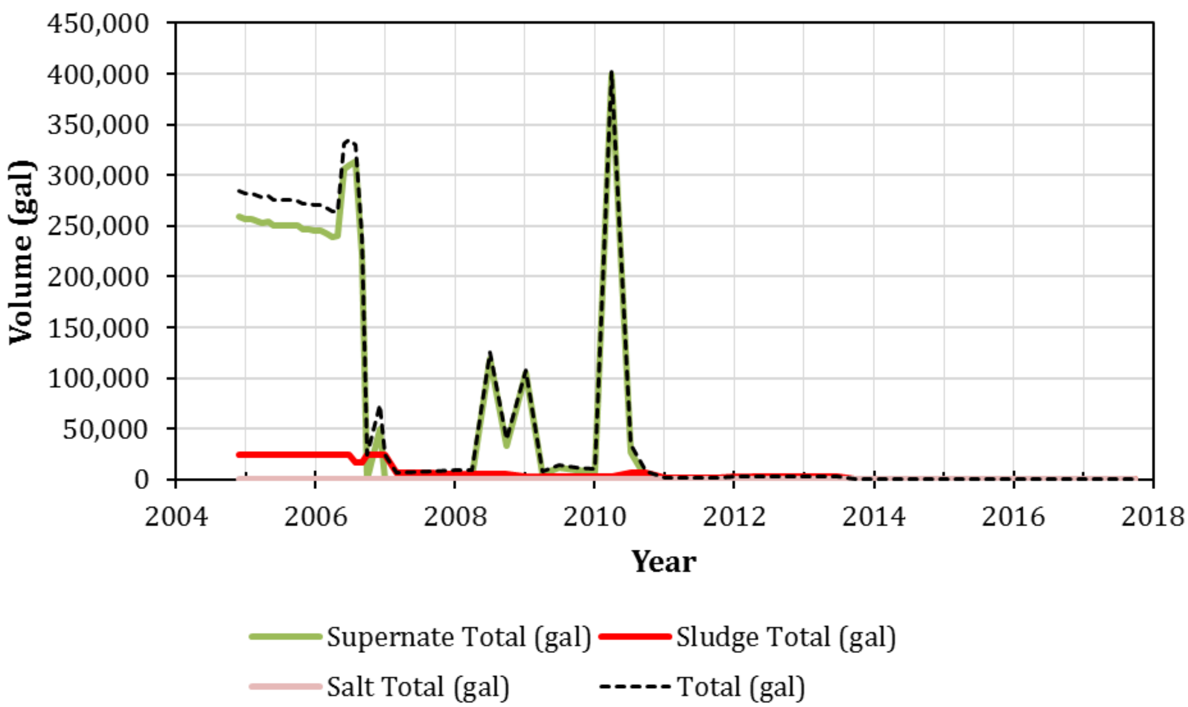


Figure B-7: Volume History (2005 to 2017) for Tank 7

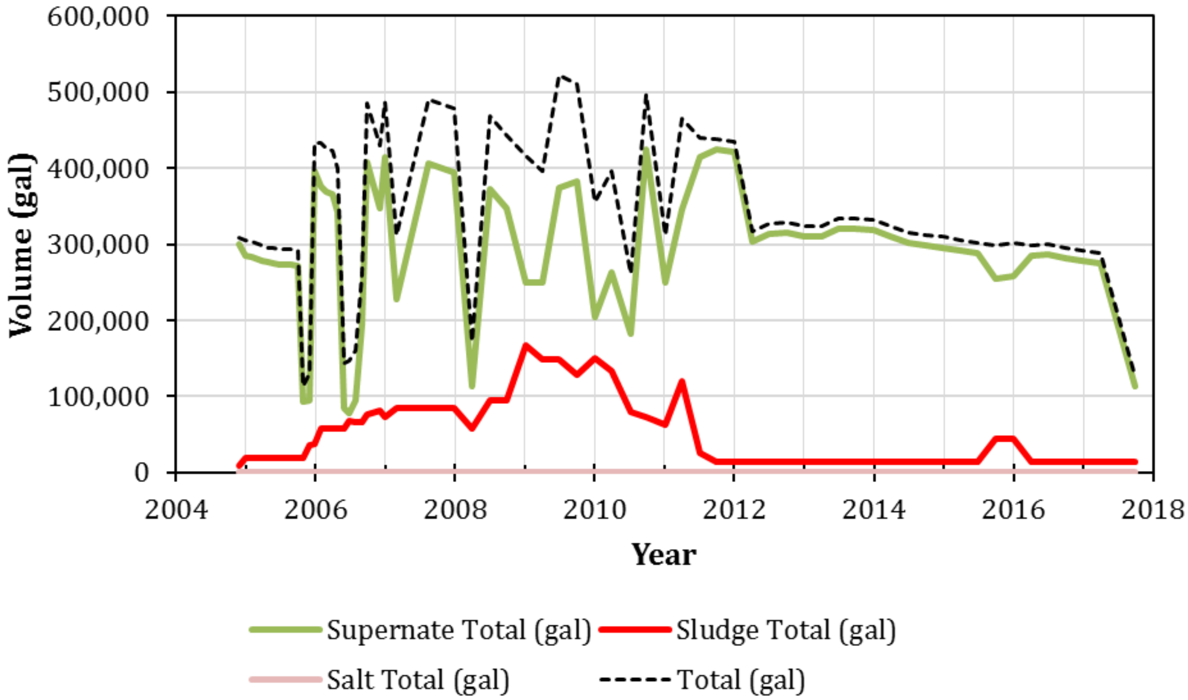


Figure B-8: Volume History (2005 to 2017) for Tank 8

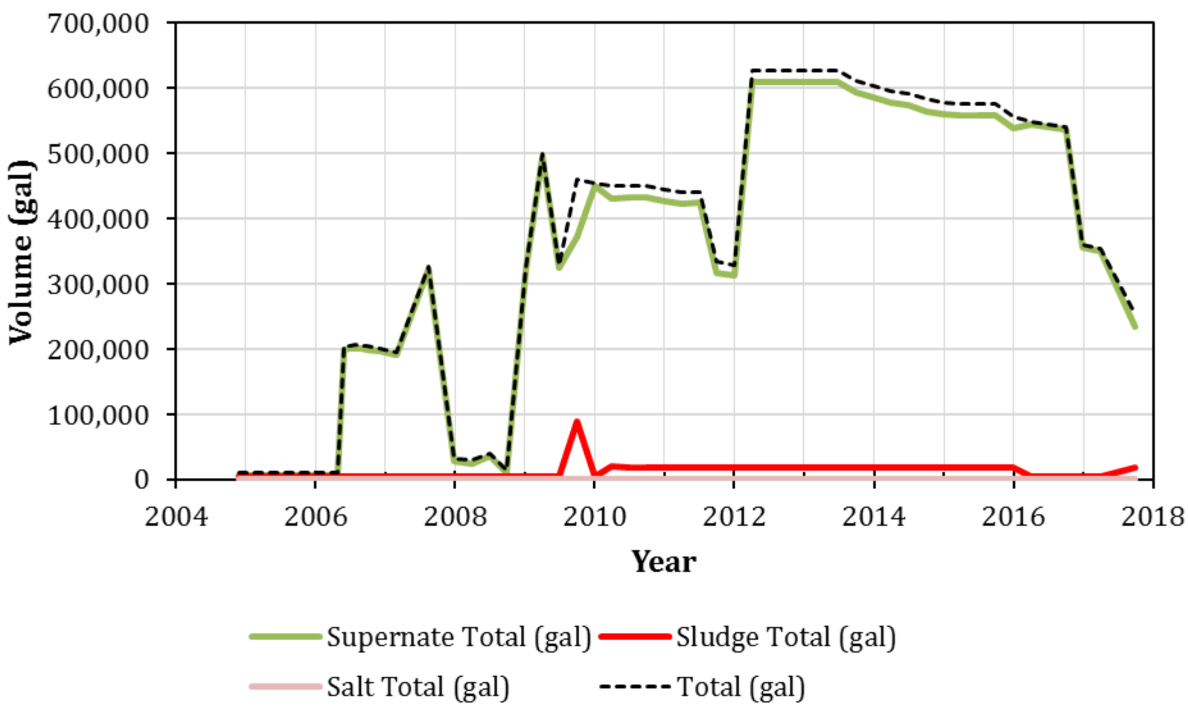


Figure B-9: Volume History (2005 to 2017) for Tank 9

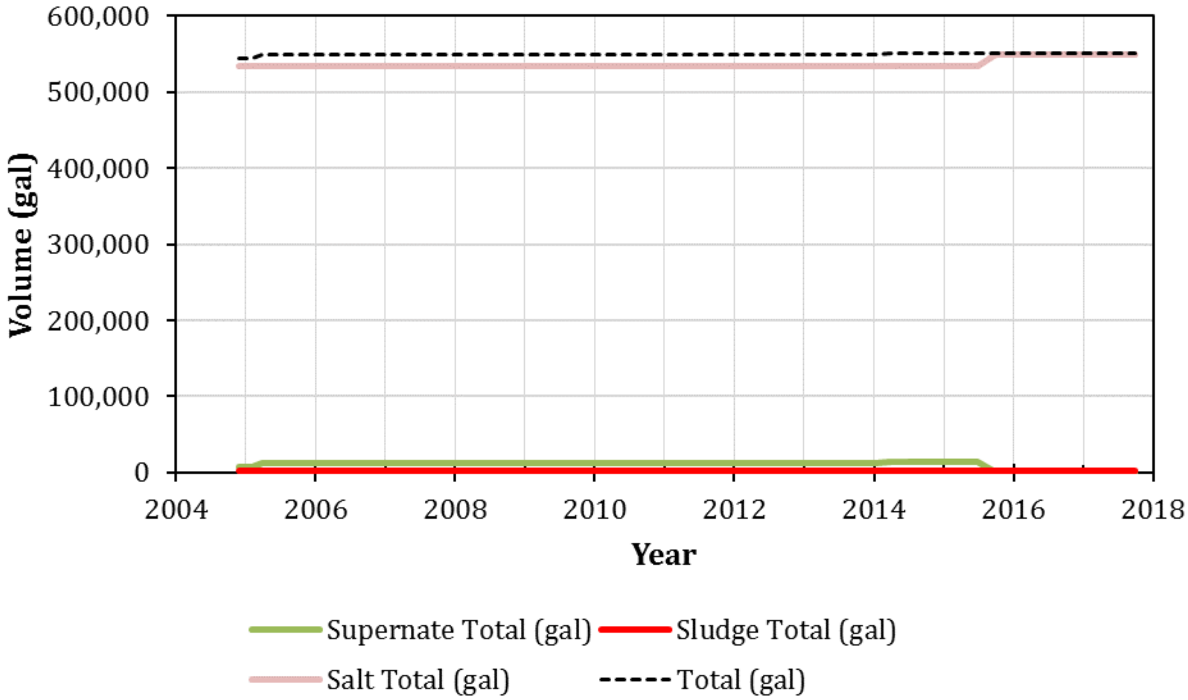


Figure B-10: Volume History (2005 to 2017) for Tank 10

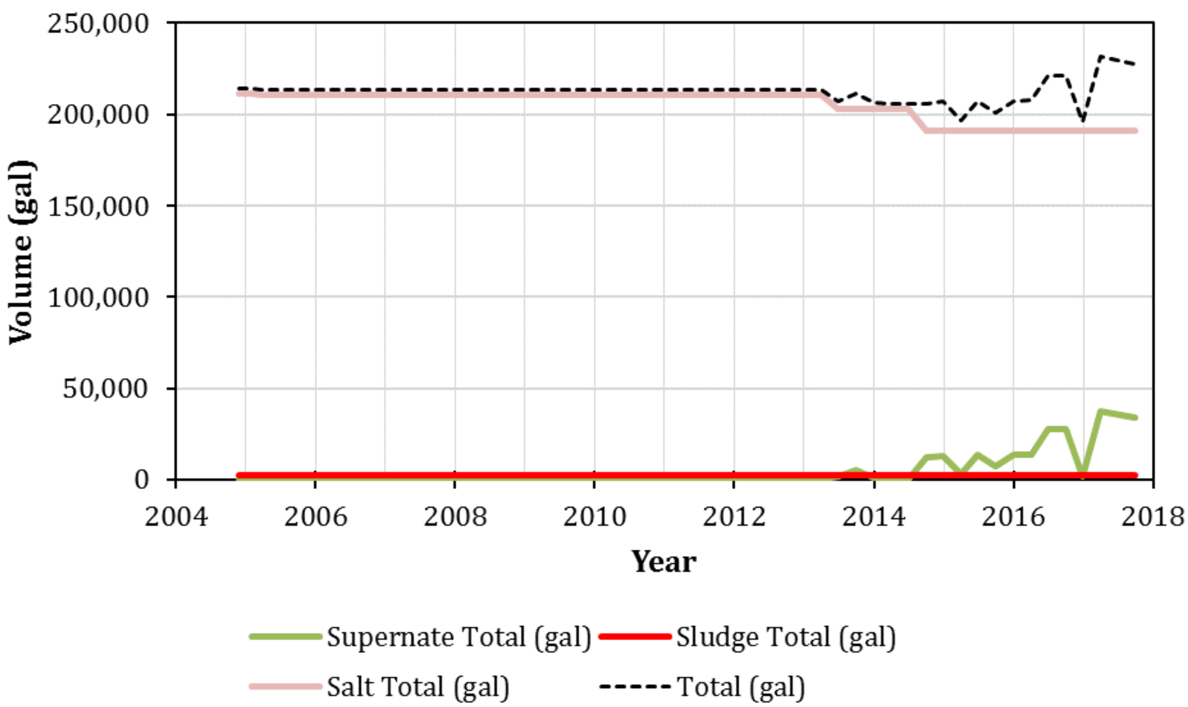


Figure B-11: Volume History (2005 to 2017) for Tank 11

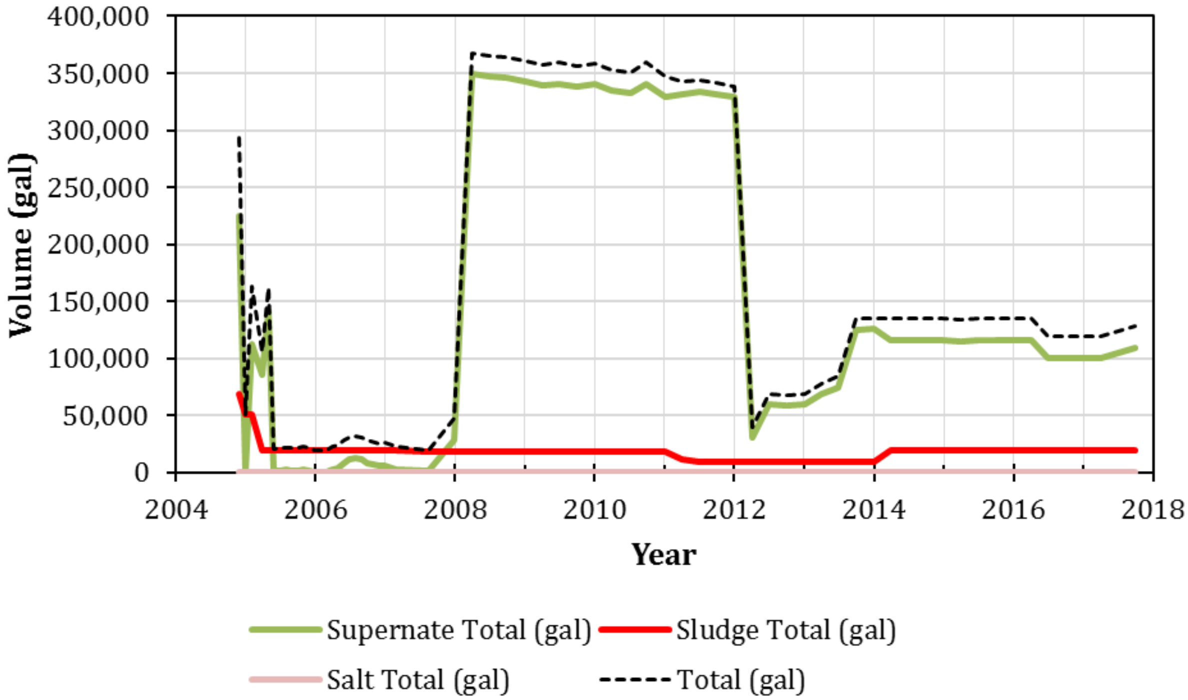


Figure B-12: Volume History (2005 to 2017) for Tank 12

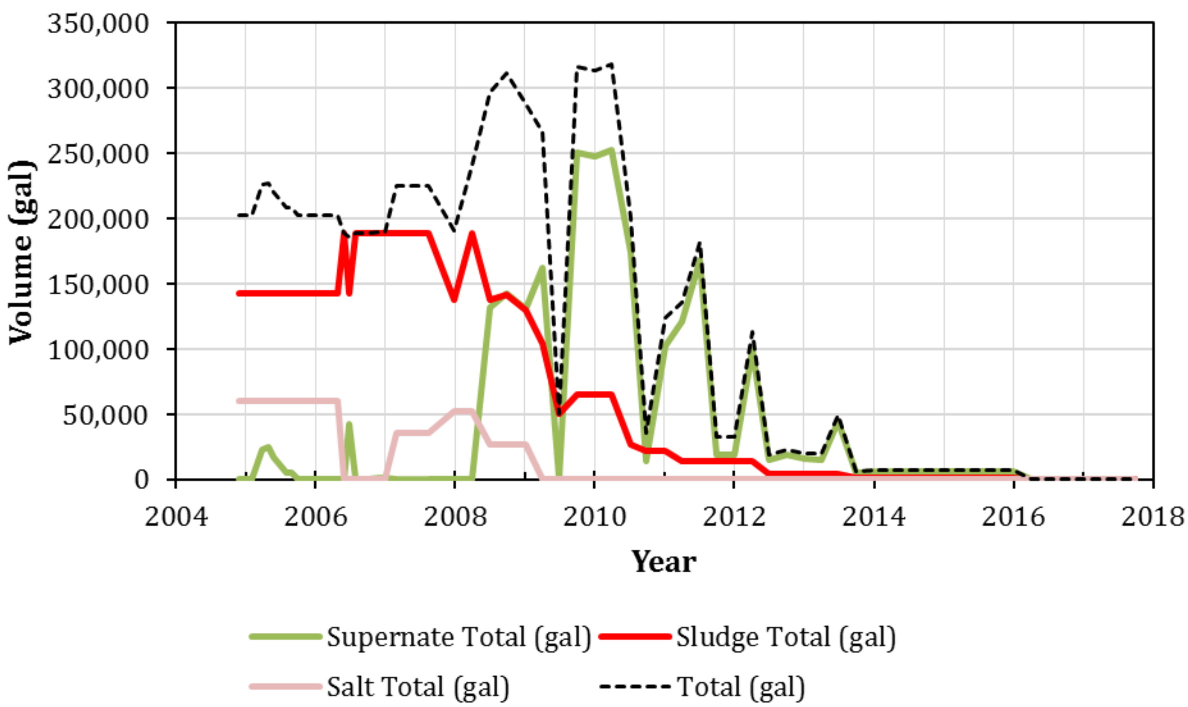


Figure B-13: Volume History (2005 to 2017) for Tank 13

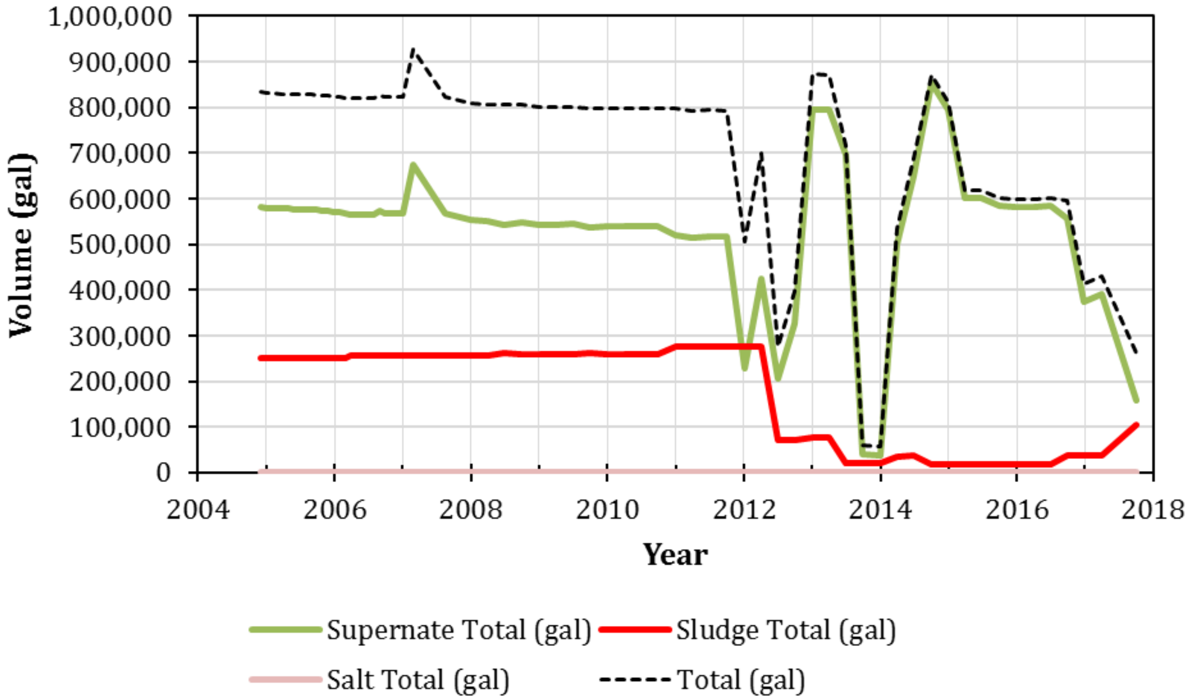


Figure B-14: Volume History (2005 to 2017) for Tank 14

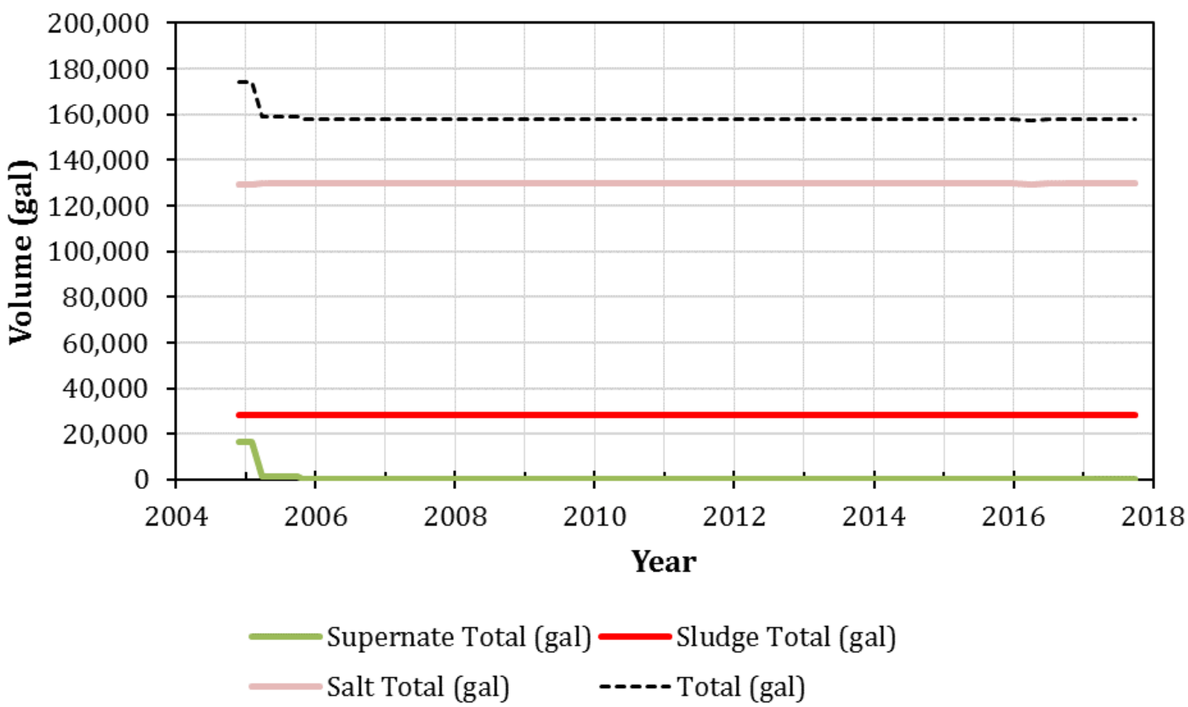


Figure B-15: Volume History (2005 to 2017) for Tank 15

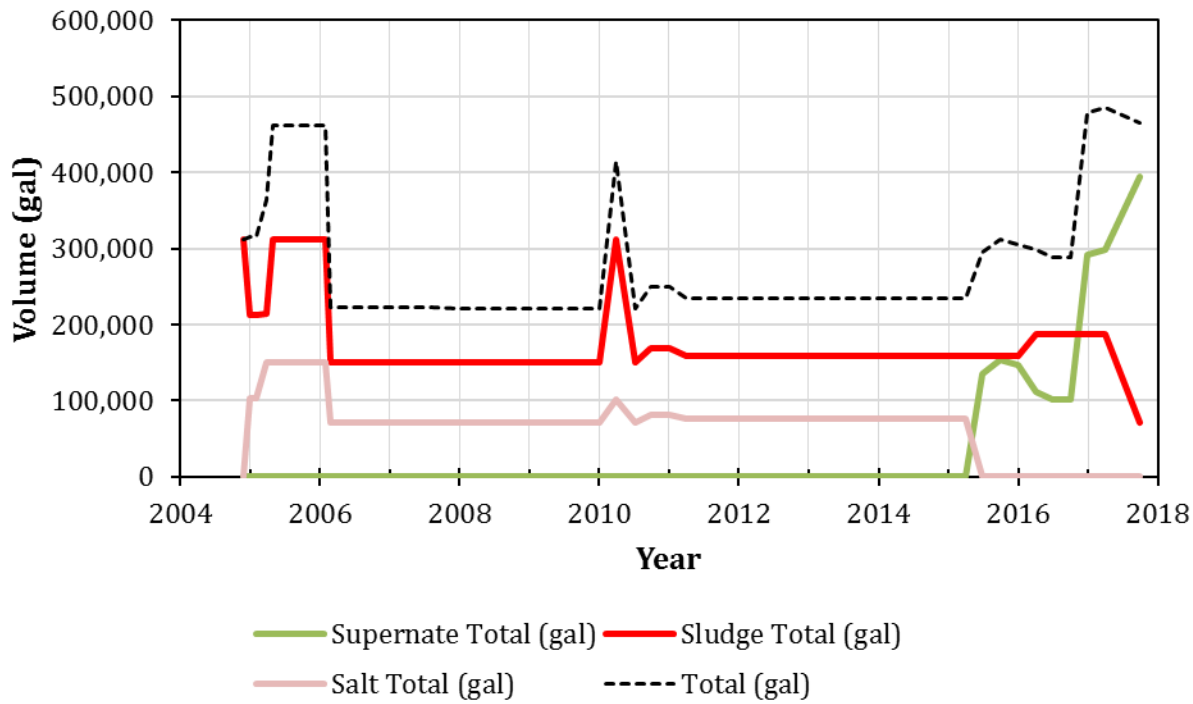


Figure B-16: Volume History (2005 to 2017) for Tank 16

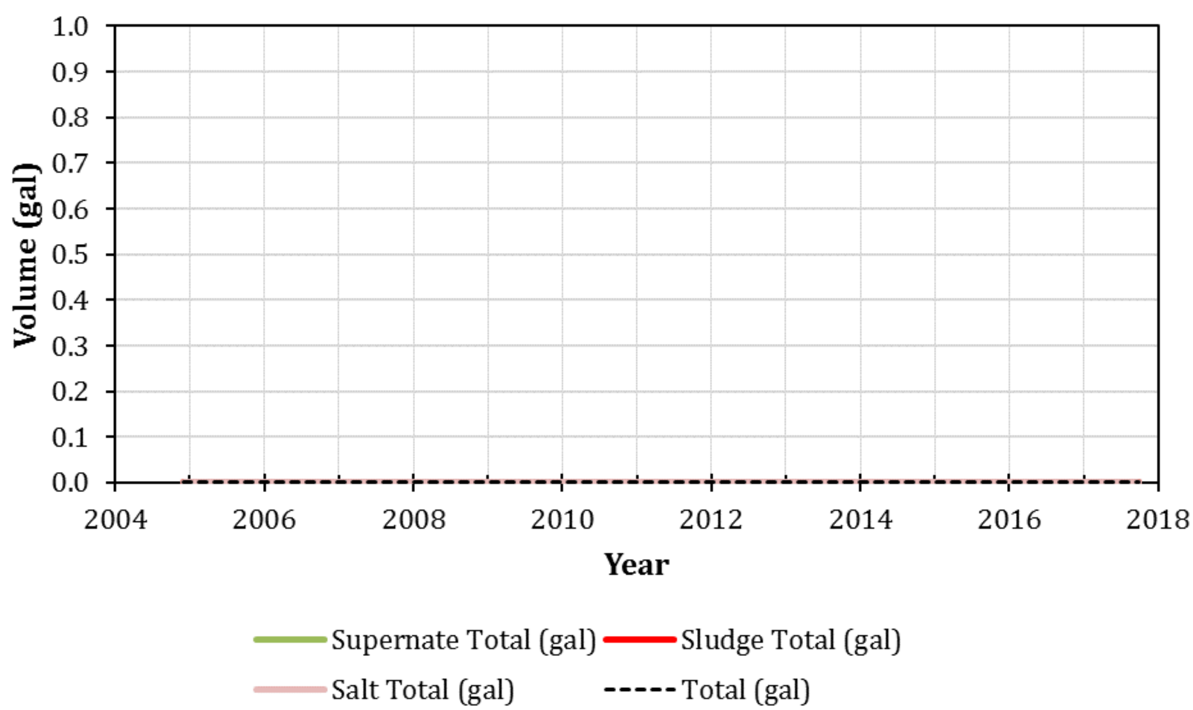


Figure B-17: Volume History (2005 to 2017) for Tank 17

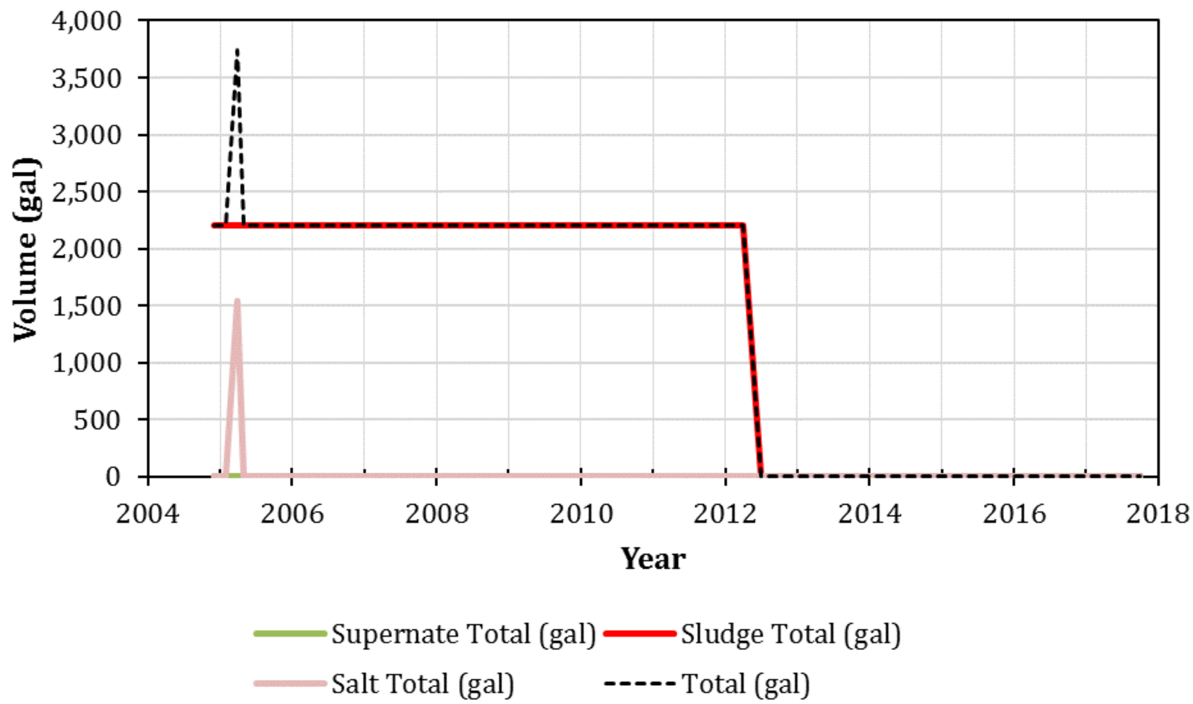


Figure B-18: Volume History (2005 to 2017) for Tank 18

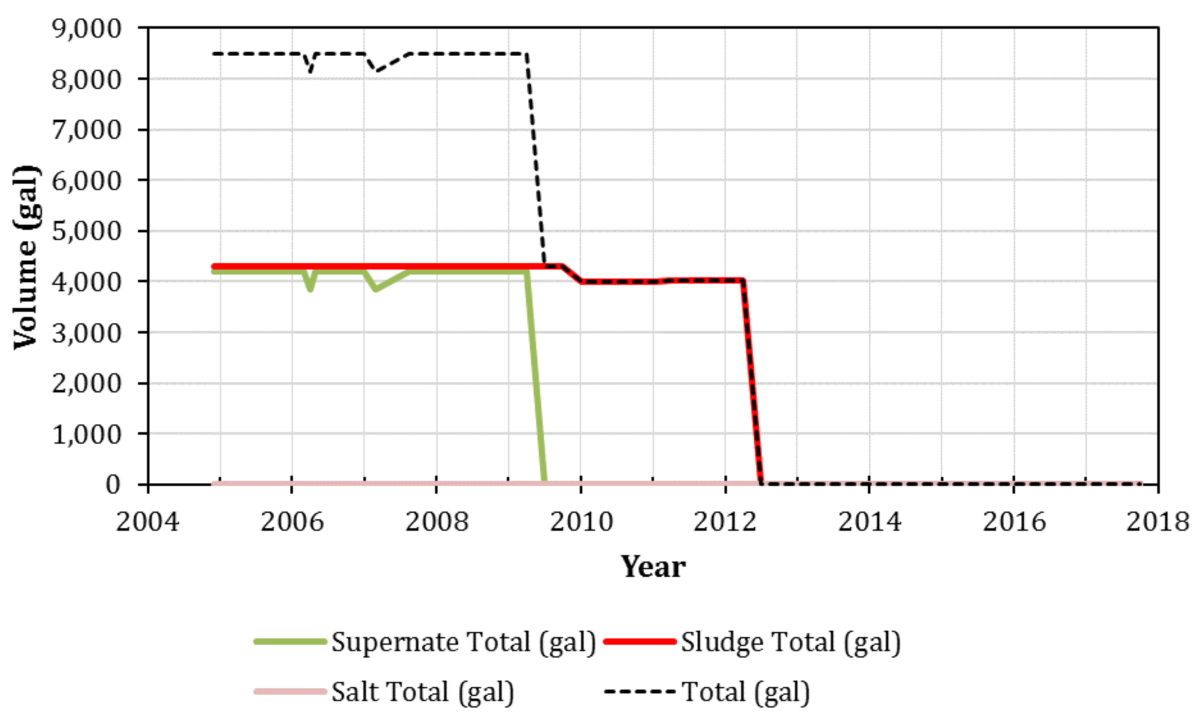


Figure B-19: Volume History (2005 to 2017) for Tank 19

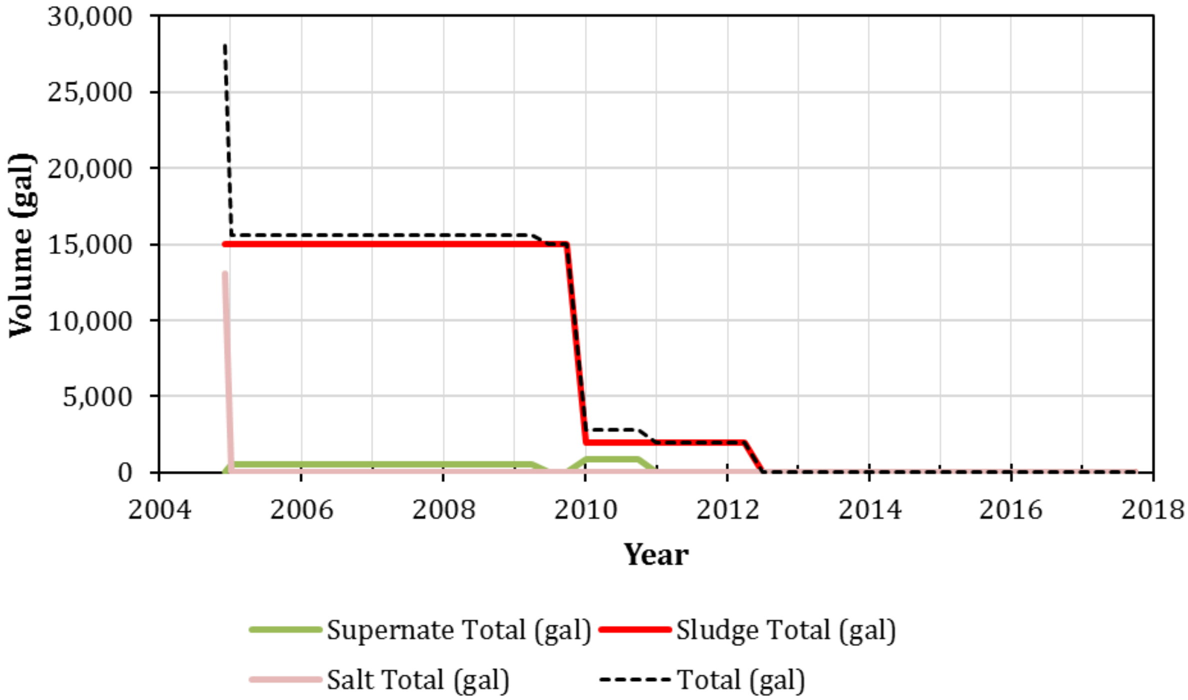


Figure B-20: Volume History (2005 to 2017) for Tank 20

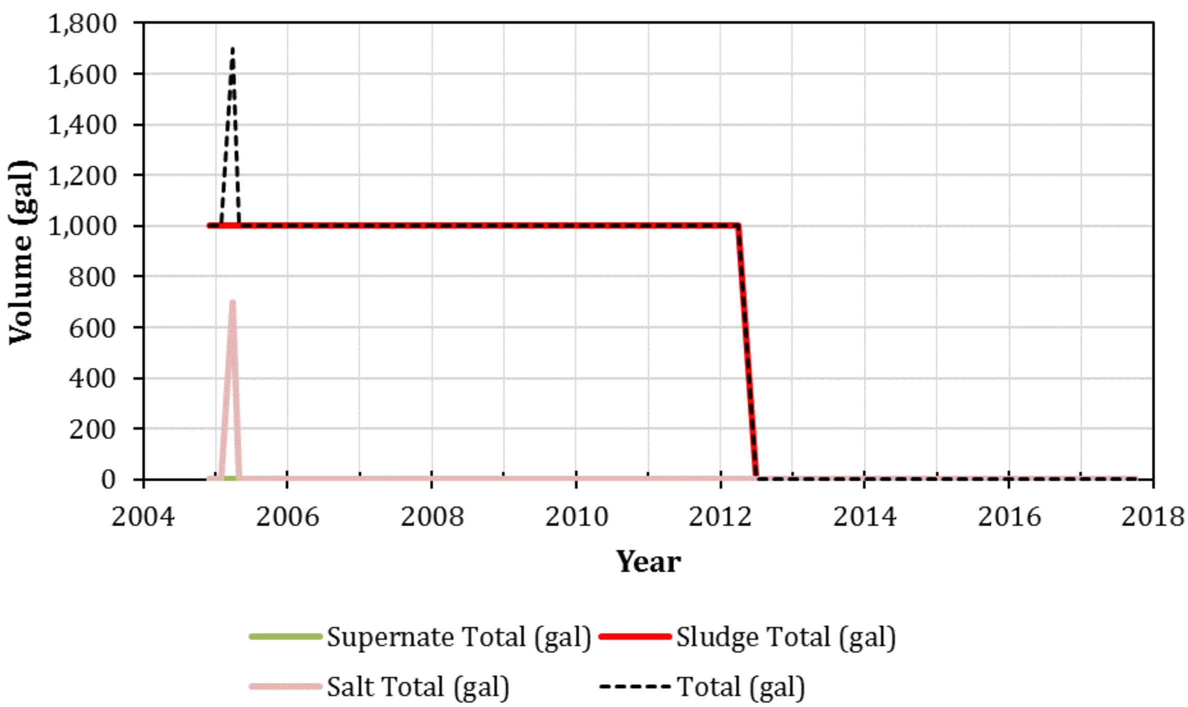


Figure B-21: Volume History (2005 to 2017) for Tank 21

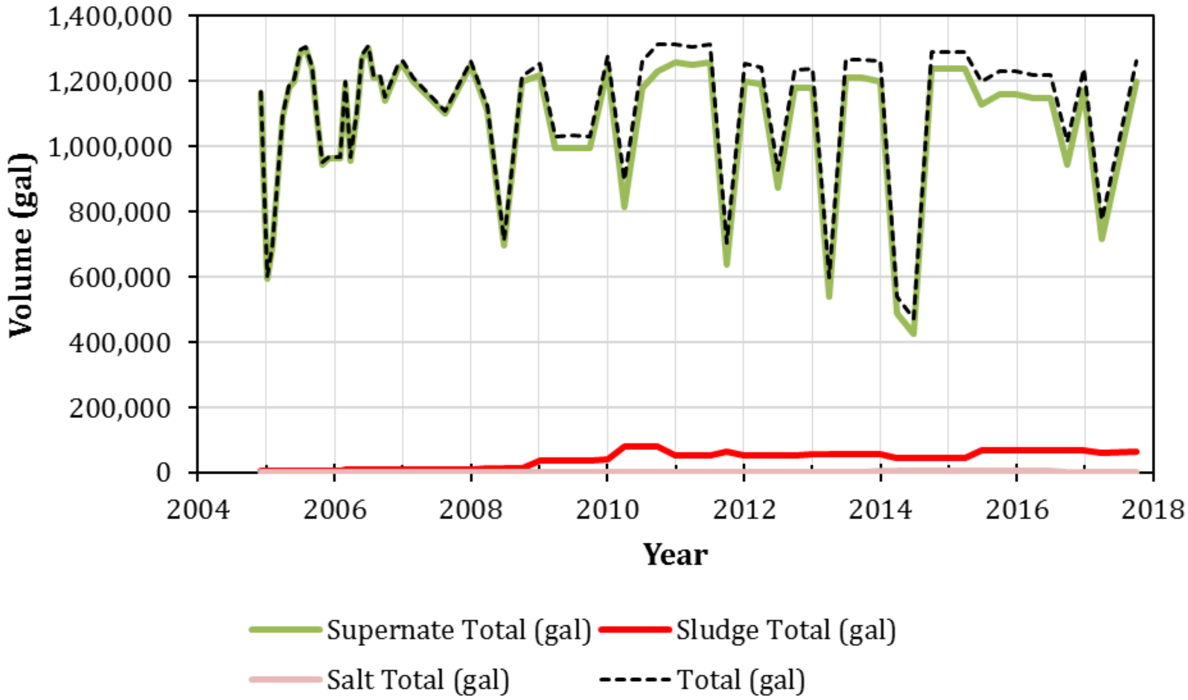


Figure B-22: Volume History (2005 to 2017) for Tank 22

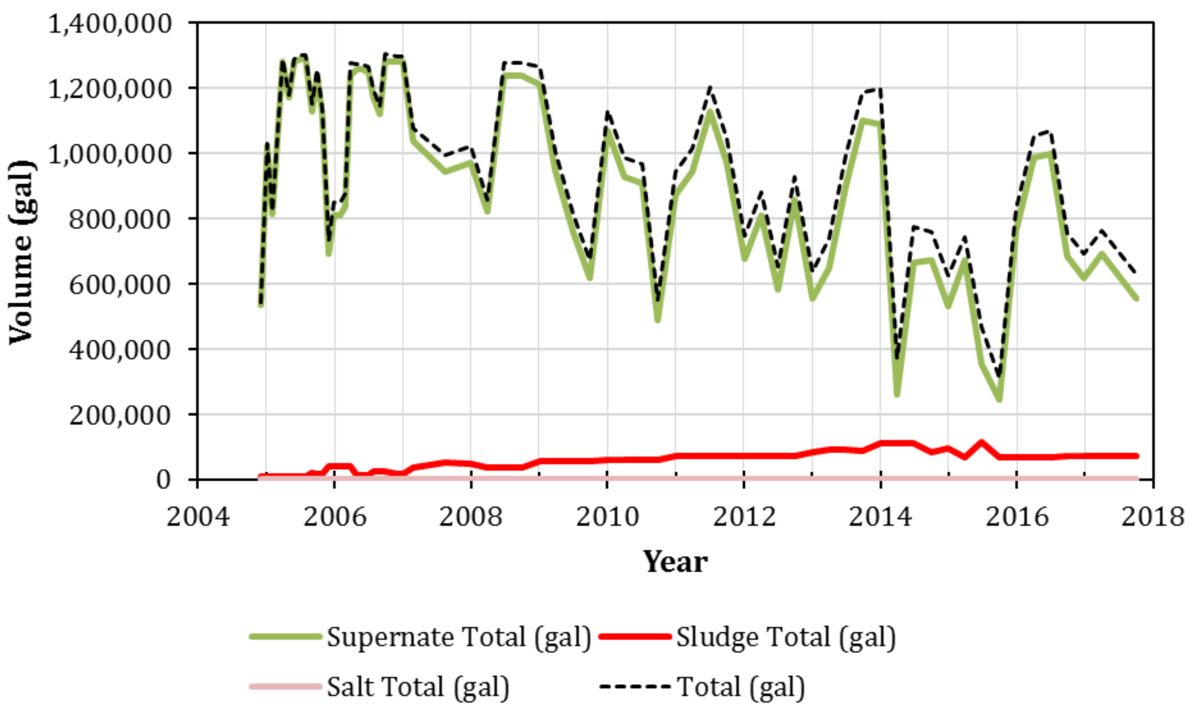


Figure B-23: Volume History (2005 to 2017) for Tank 23

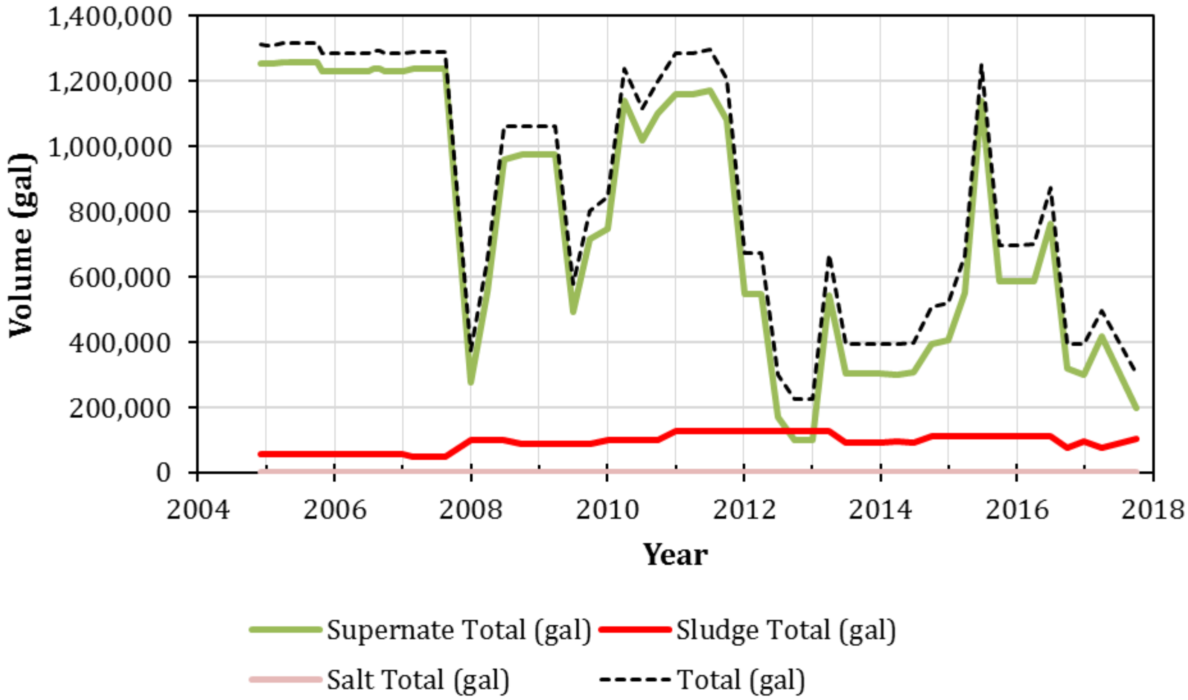


Figure B-24: Volume History (2005 to 2017) for Tank 24

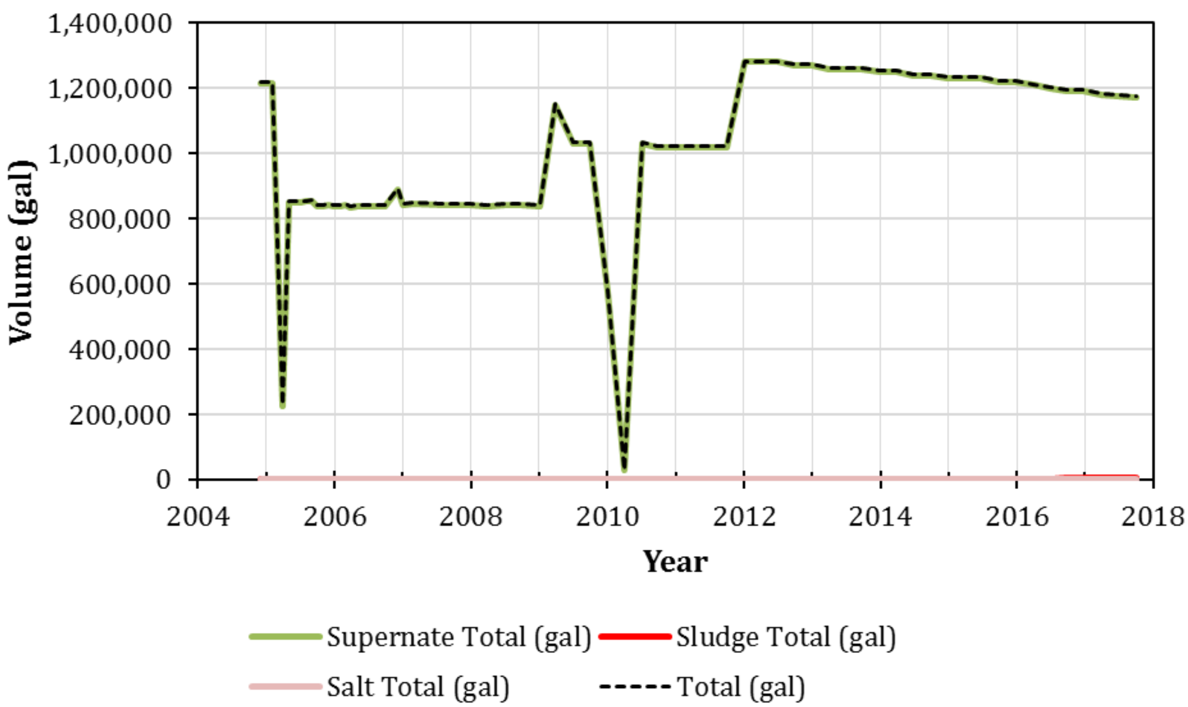


Figure B-25: Volume History (2005 to 2017) for Tank 25

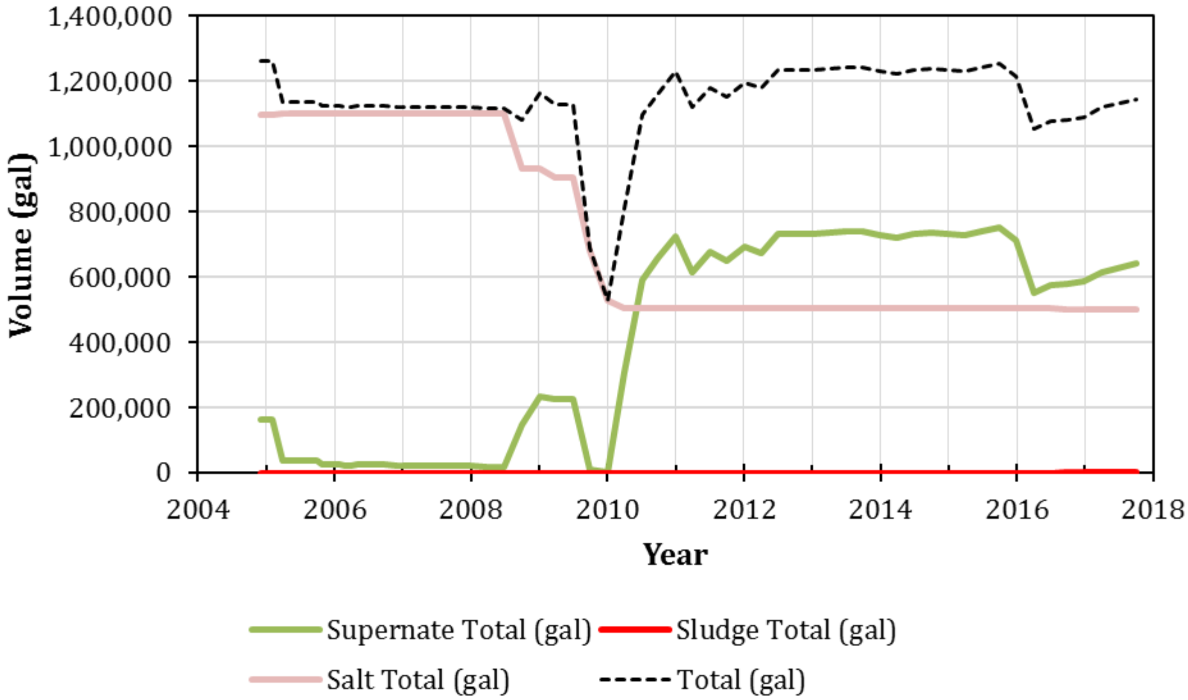


Figure B-26: Volume History (2005 to 2017) for Tank 26

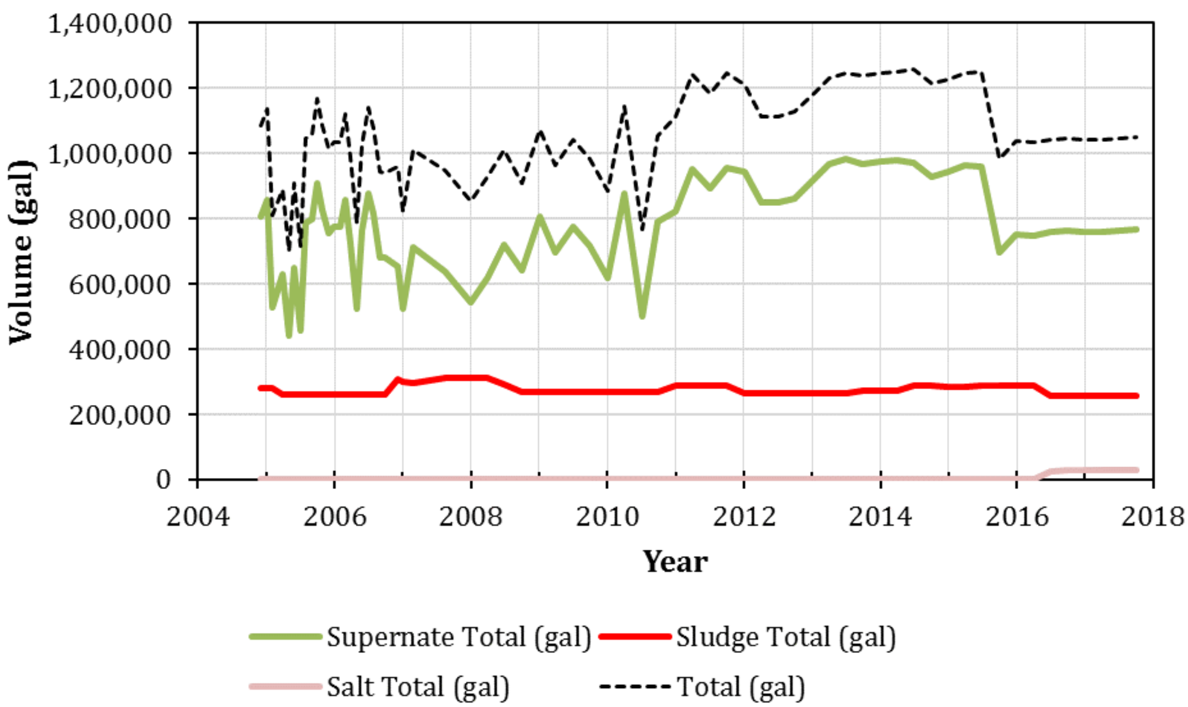


Figure B-27: Volume History (2005 to 2017) for Tank 27

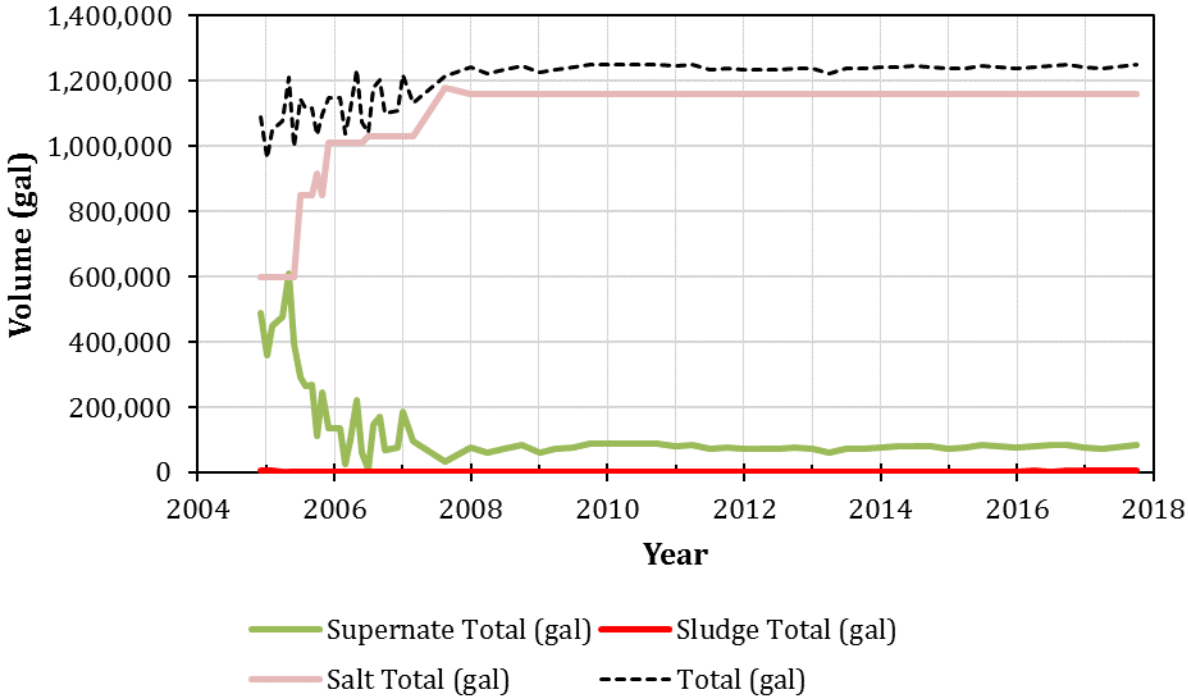


Figure B-28: Volume History (2005 to 2017) for Tank 28

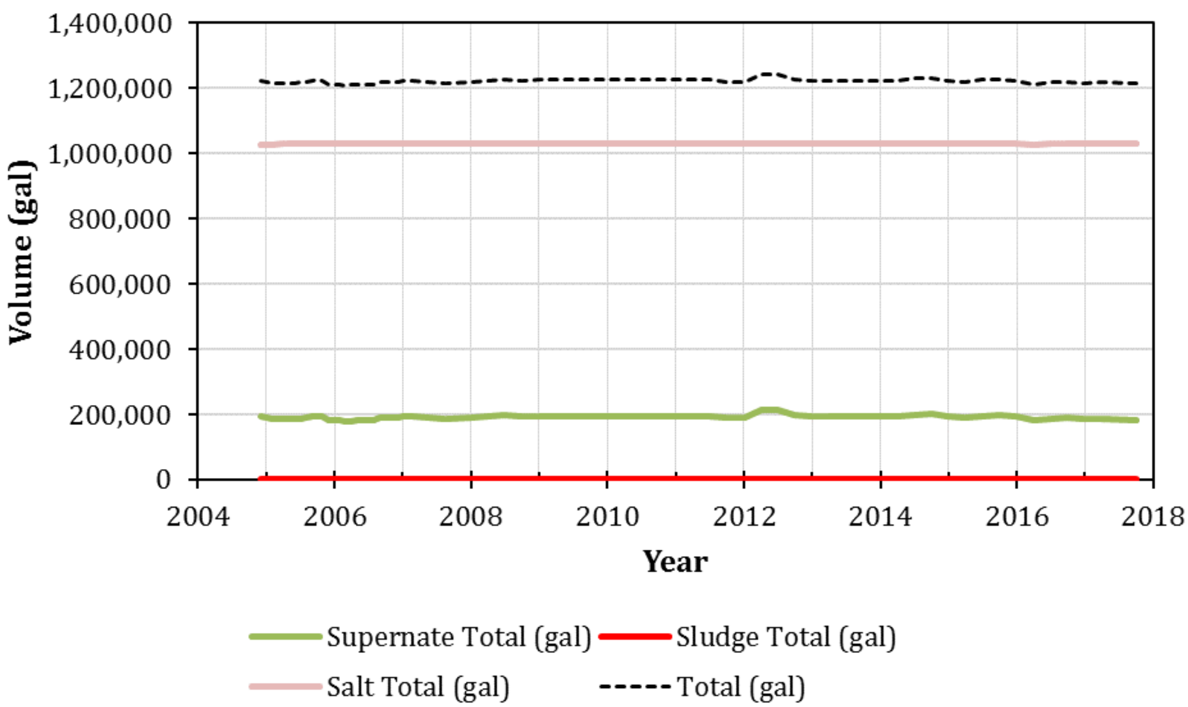


Figure B-29: Volume History (2005 to 2017) for Tank 29

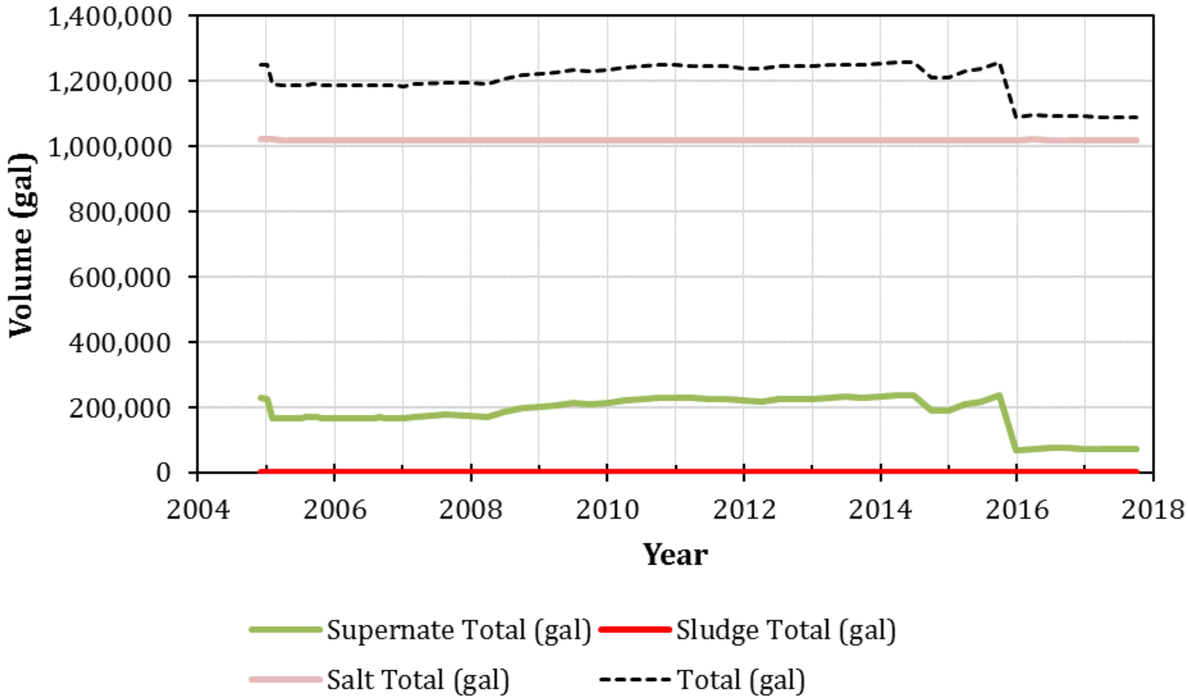


Figure B-30: Volume History (2005 to 2017) for Tank 30

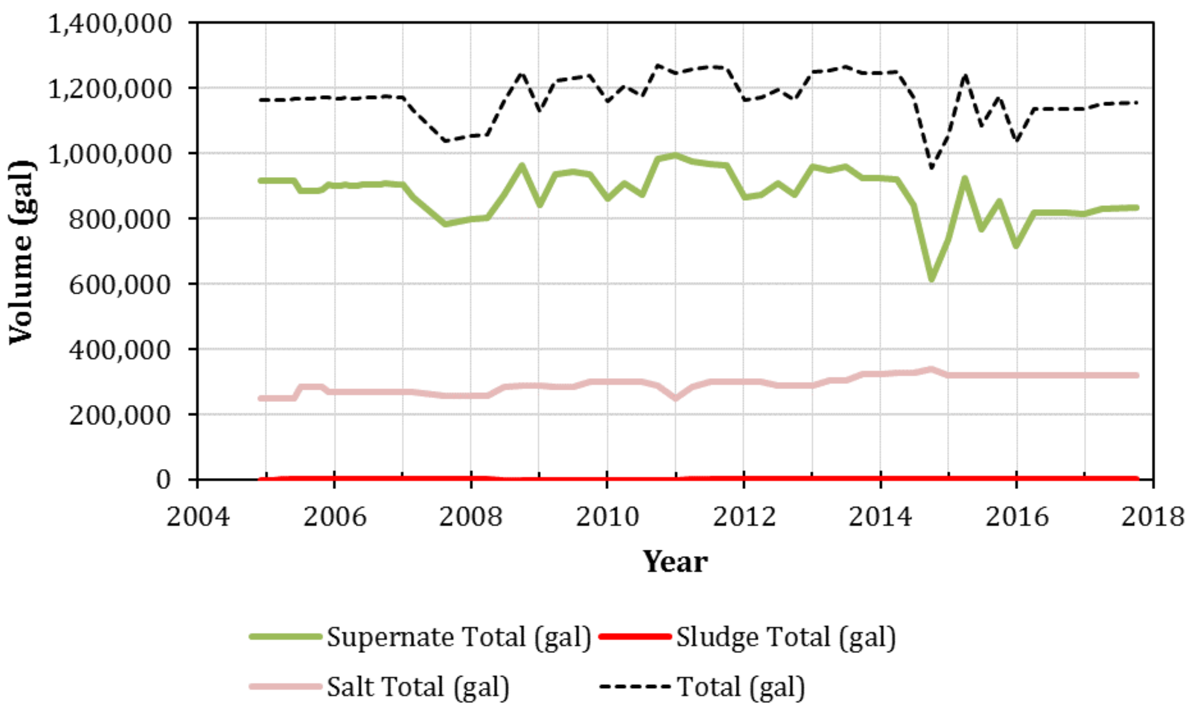


Figure B-31: Volume History (2005 to 2017) for Tank 31

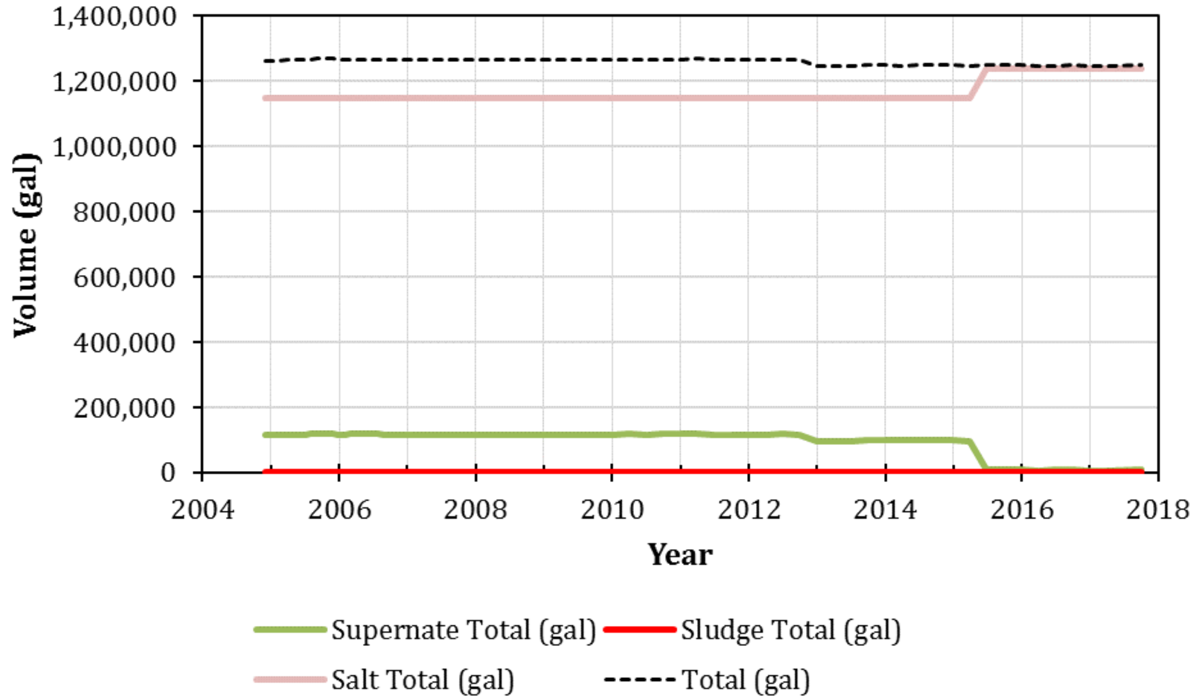


Figure B-32: Volume History (2005 to 2017) for Tank 32

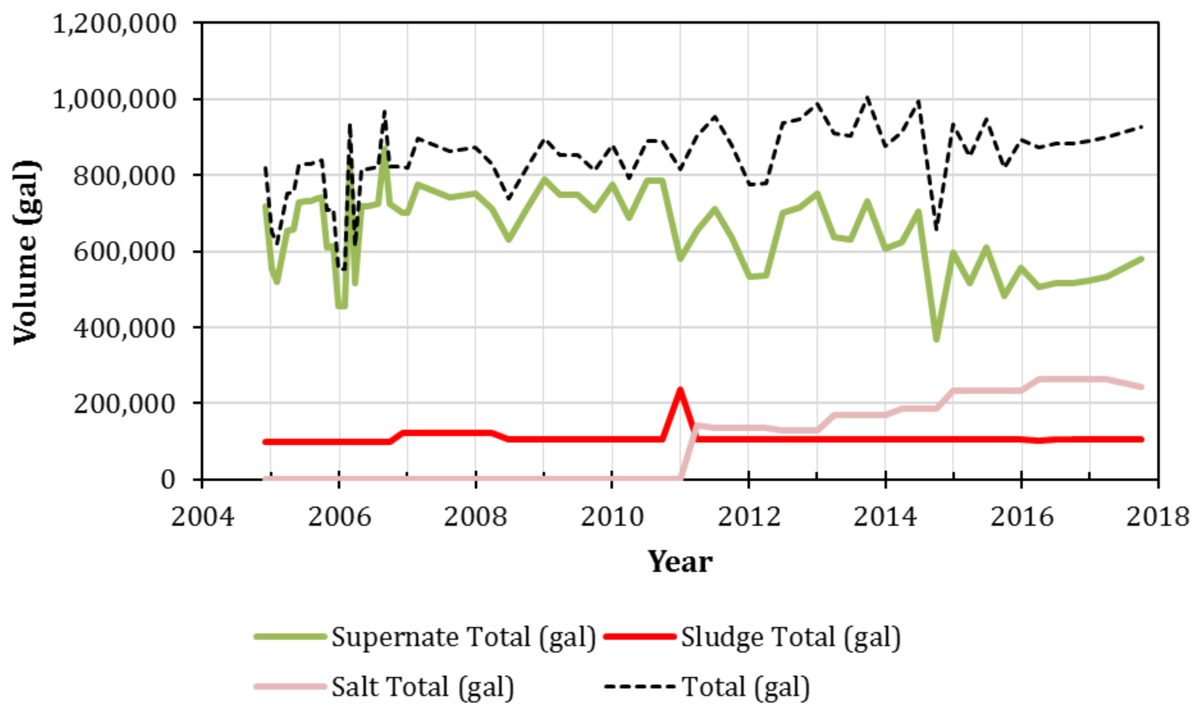


Figure B-33: Volume History (2005 to 2017) for Tank 33

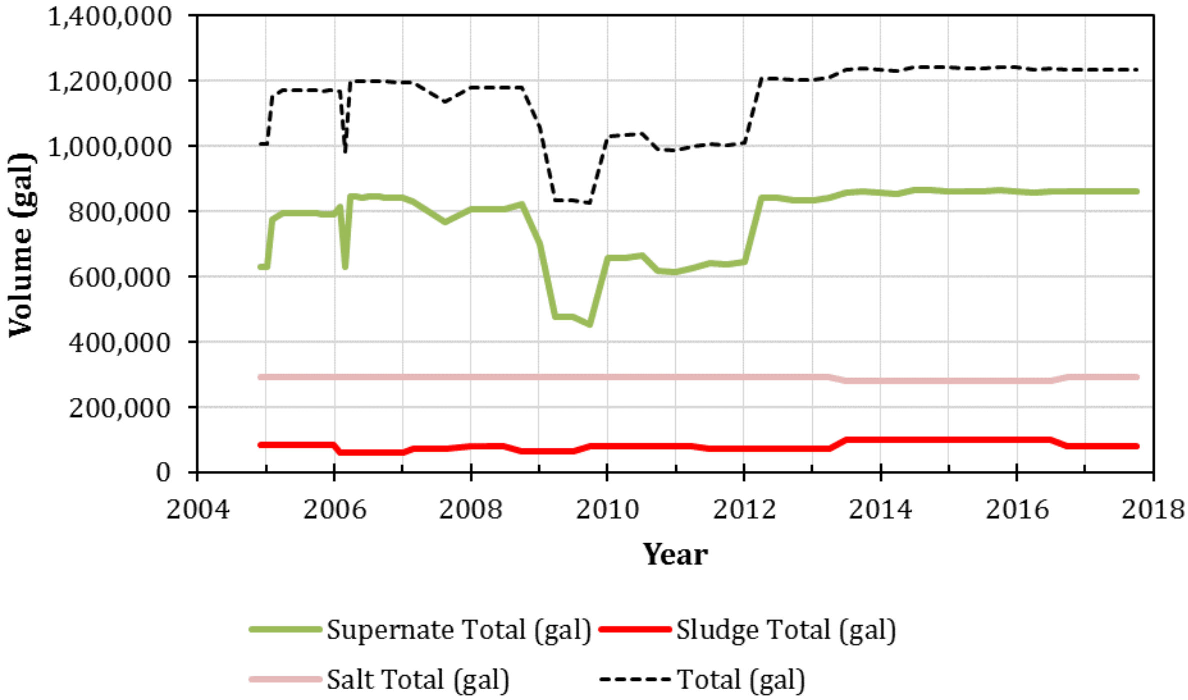


Figure B-34: Volume History (2005 to 2017) for Tank 34

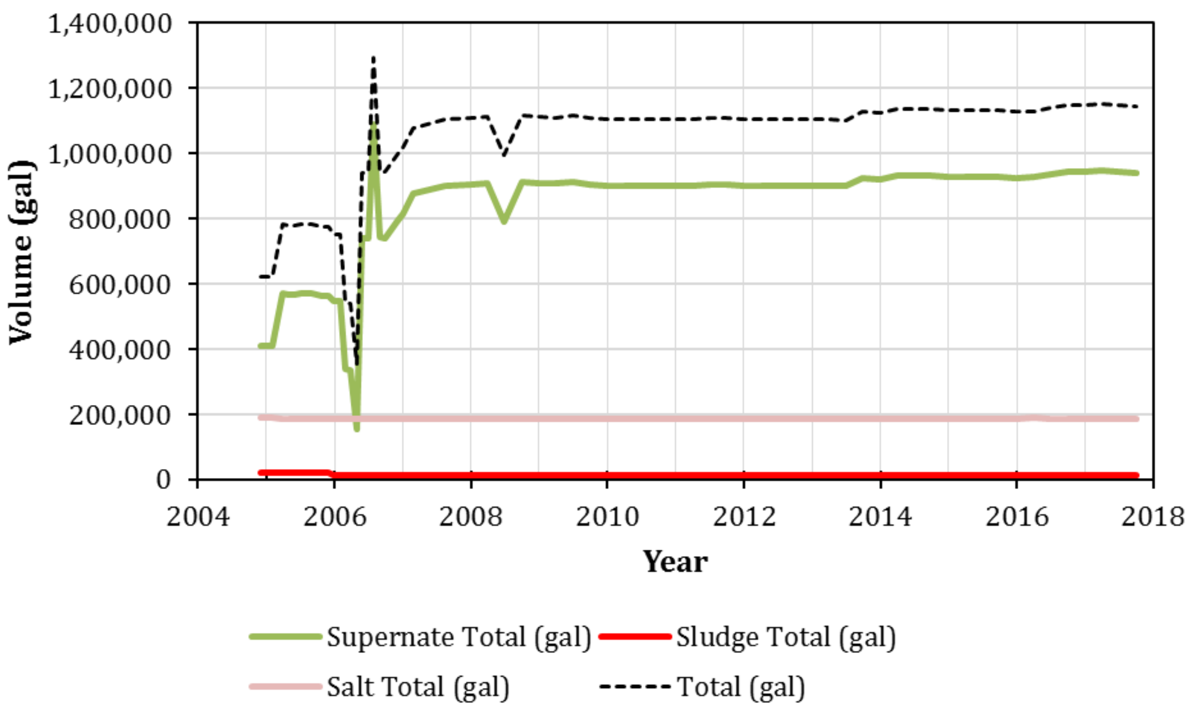


Figure B-35: Volume History (2005 to 2017) for Tank 35

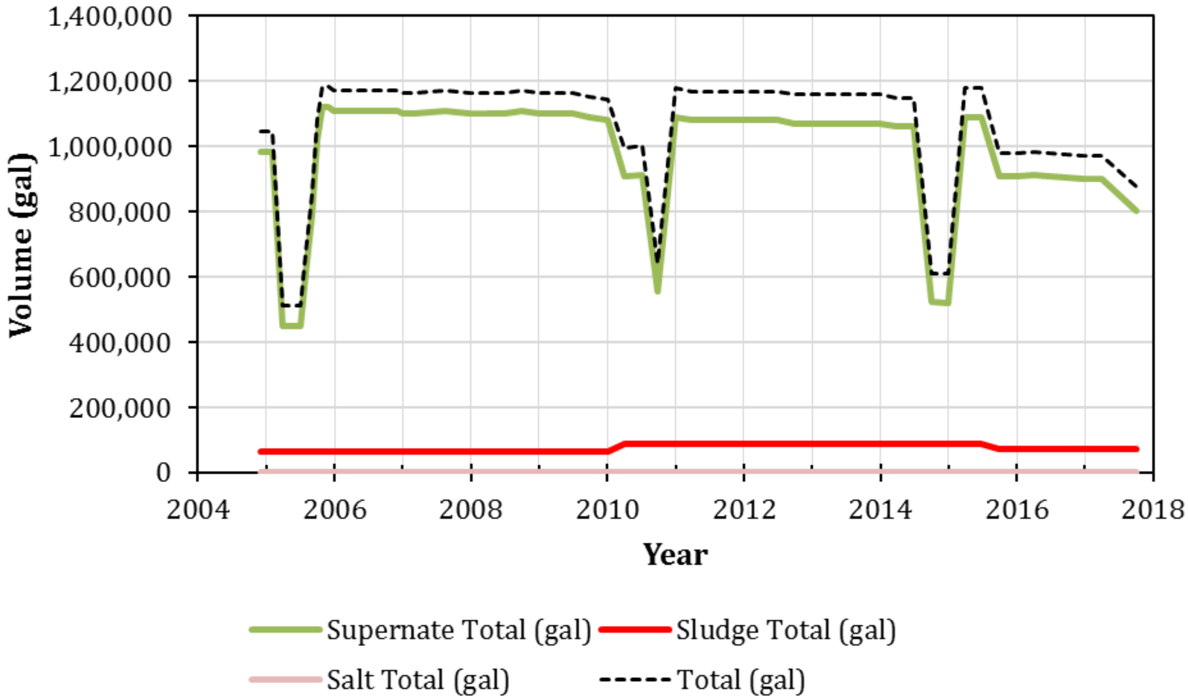


Figure B-36: Volume History (2005 to 2017) for Tank 36

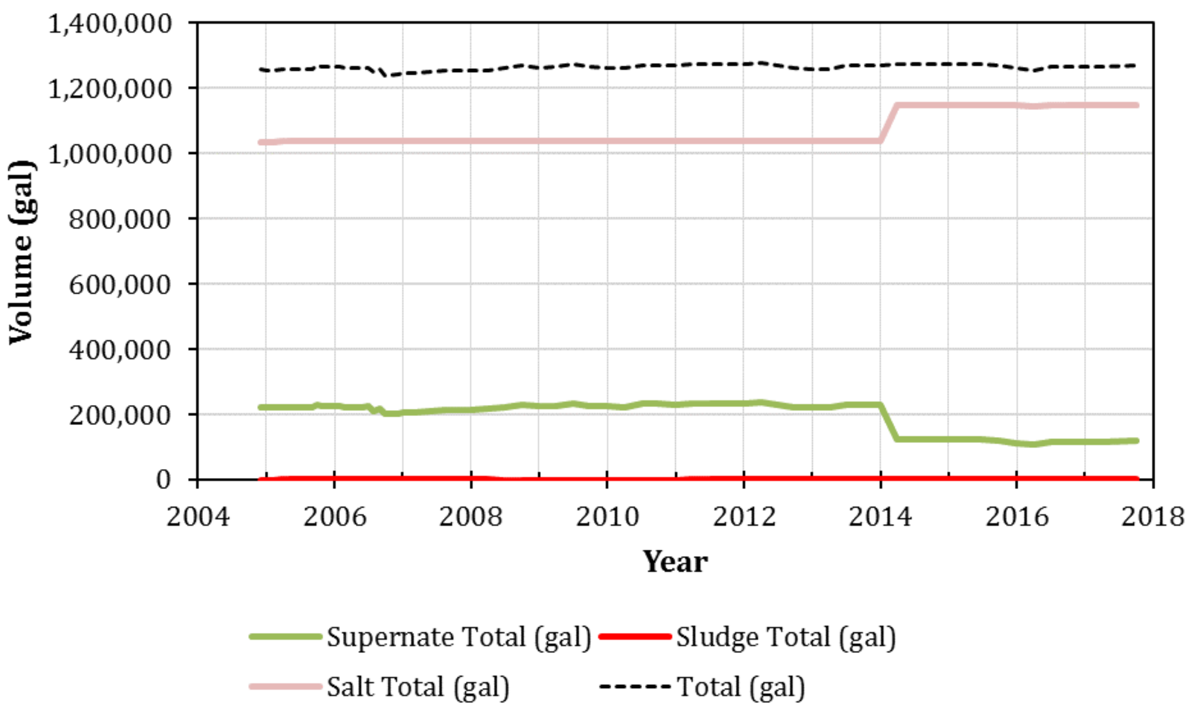


Figure B-37: Volume History (2005 to 2017) for Tank 37

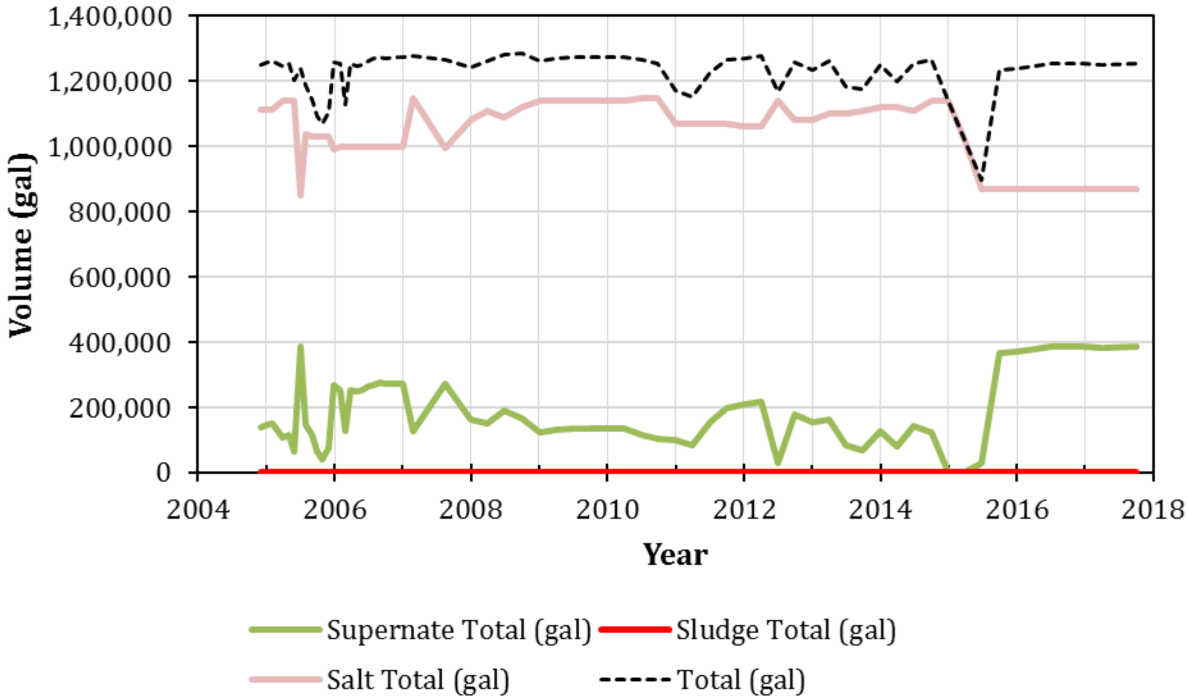


Figure B-38: Volume History (2005 to 2017) for Tank 38

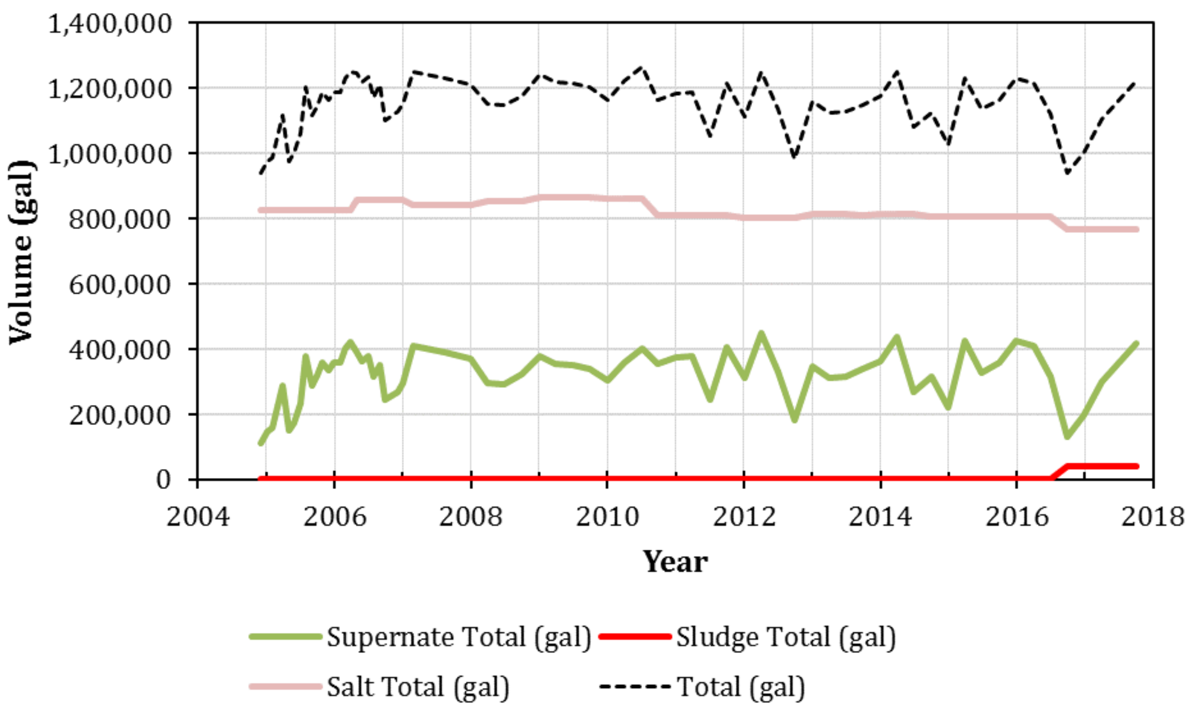


Figure B-39: Volume History (2005 to 2017) for Tank 39

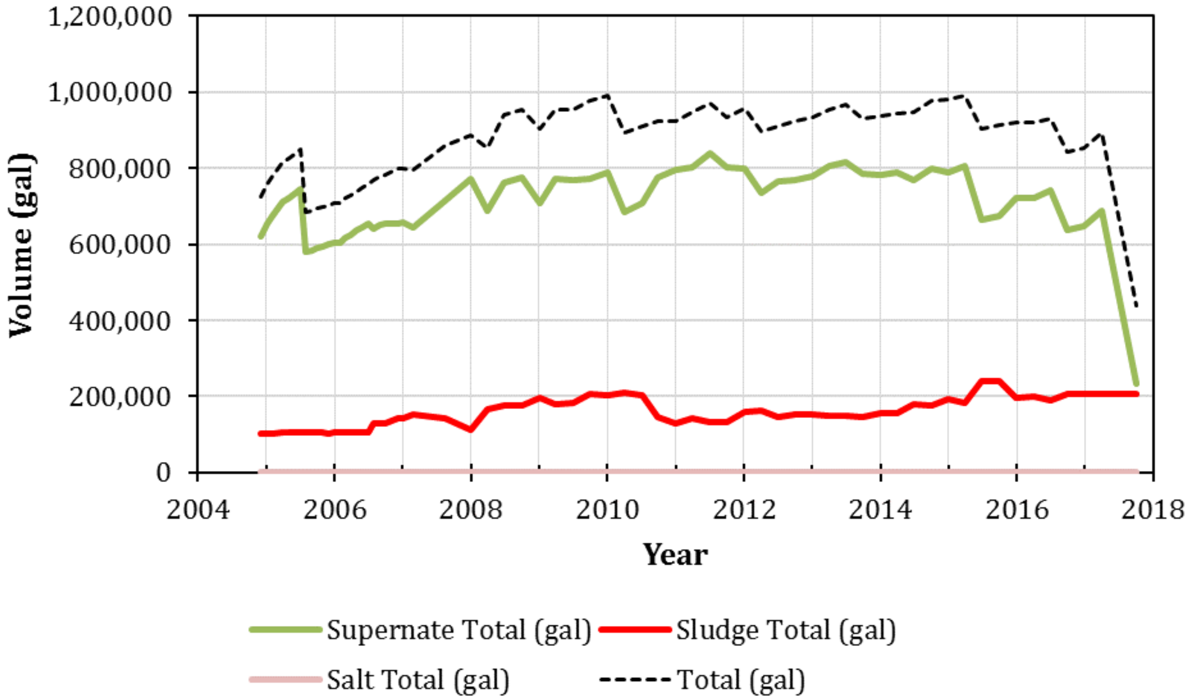


Figure B-40: Volume History (2005 to 2017) for Tank 40

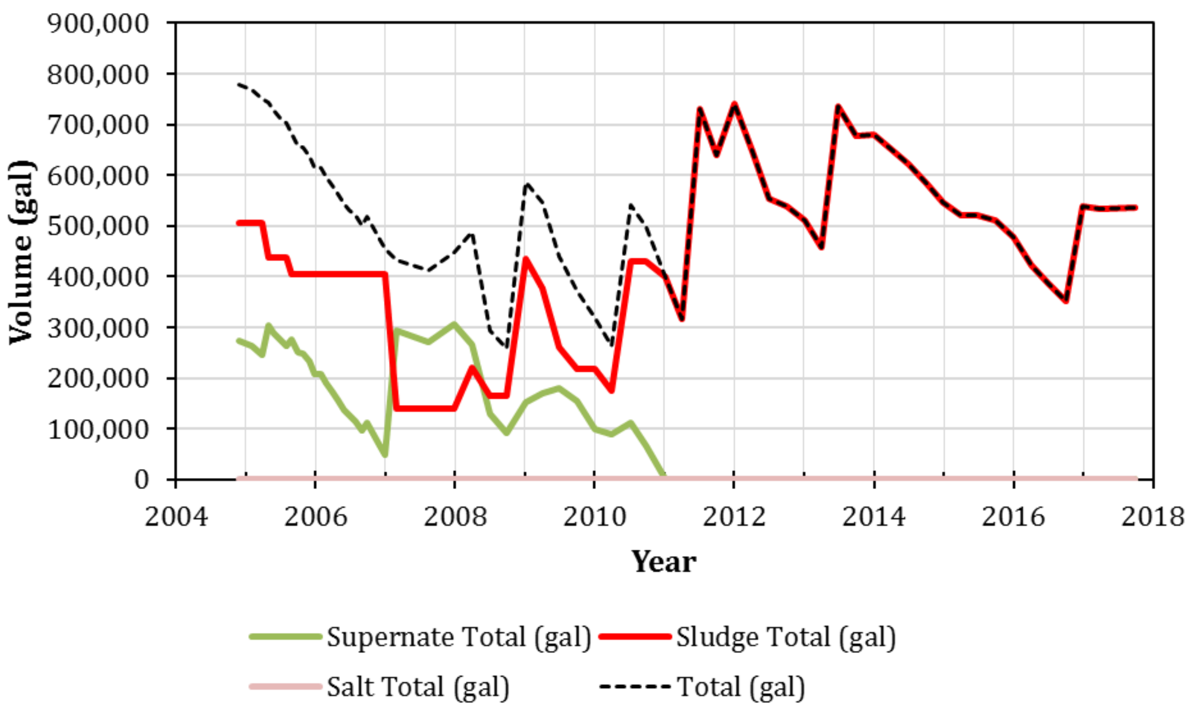


Figure B-41: Volume History (2005 to 2017) for Tank 41

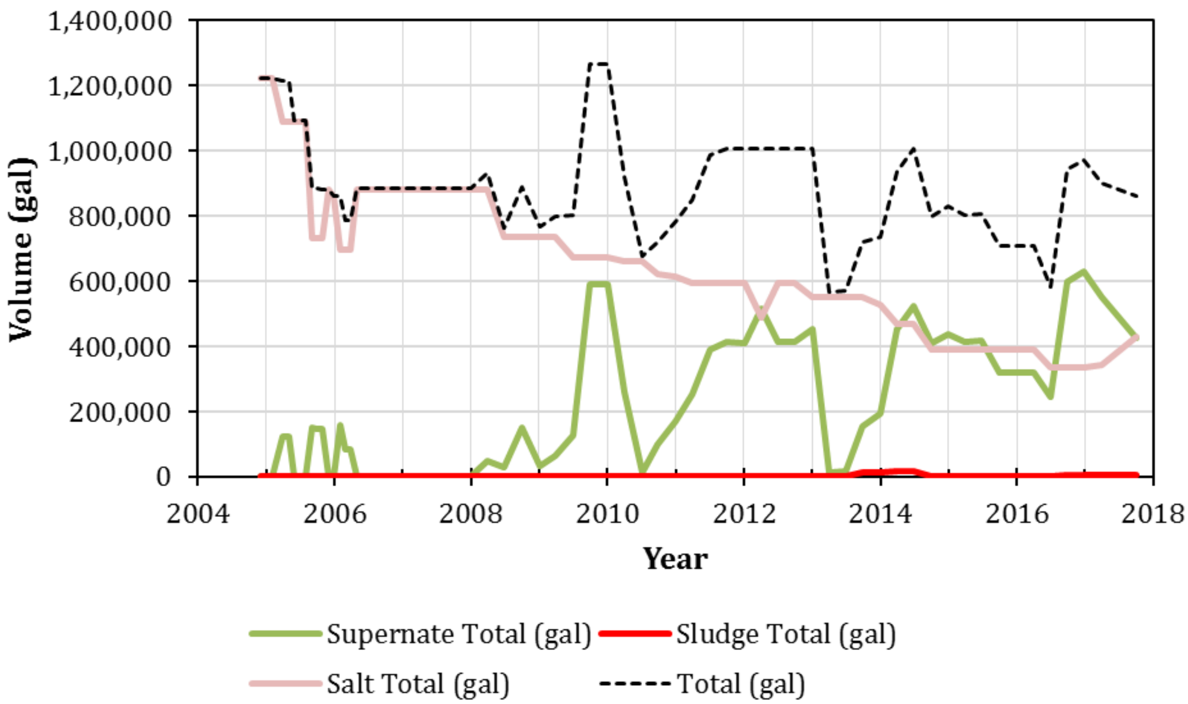


Figure B-42: Volume History (2005 to 2017) for Tank 42

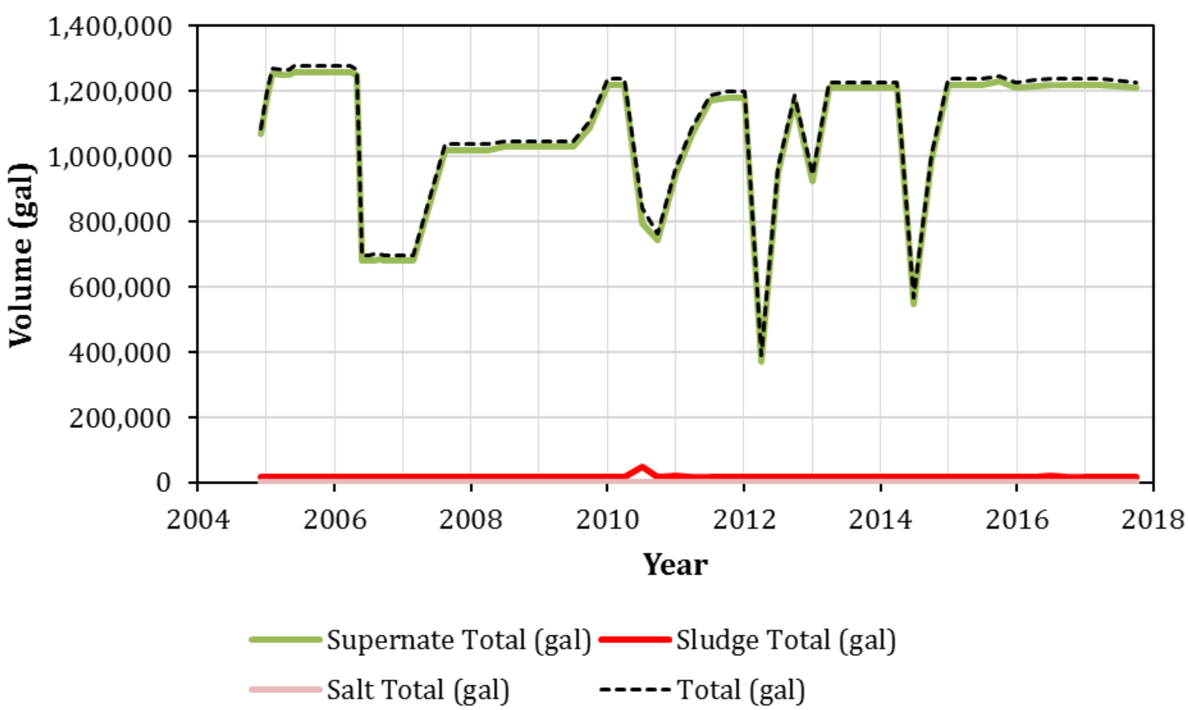


Figure B-43: Volume History (2005 to 2017) for Tank 43

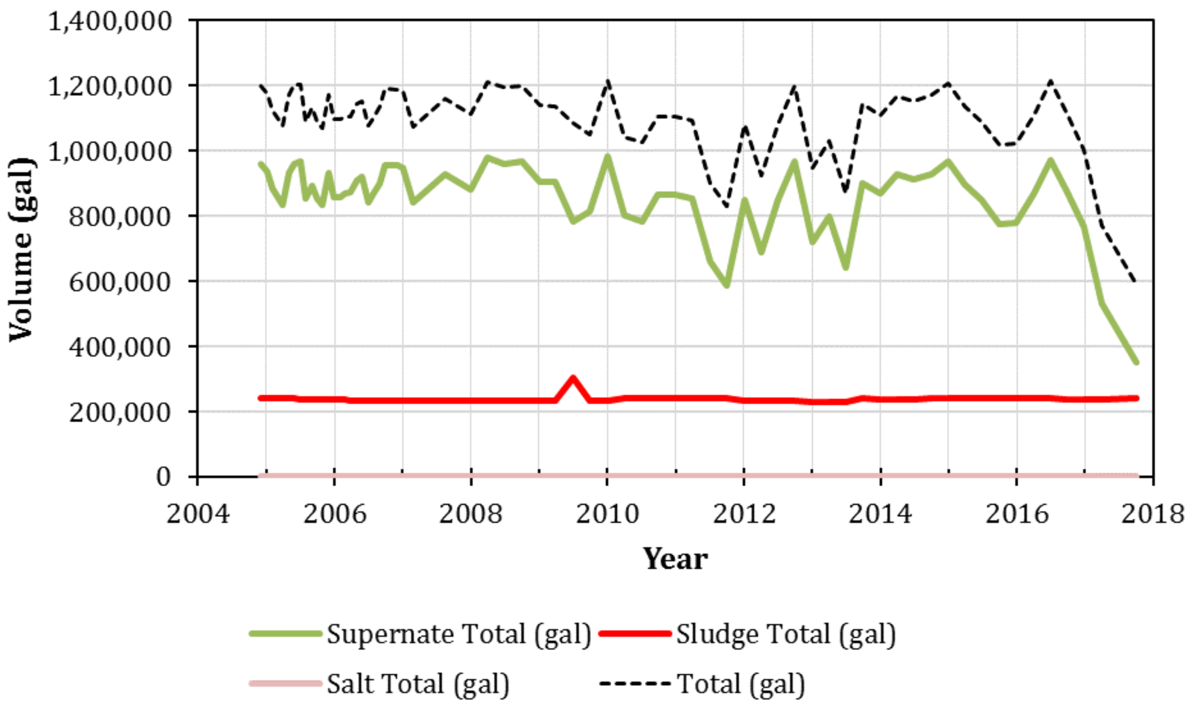


Figure B-44: Volume History (2005 to 2017) for Tank 44

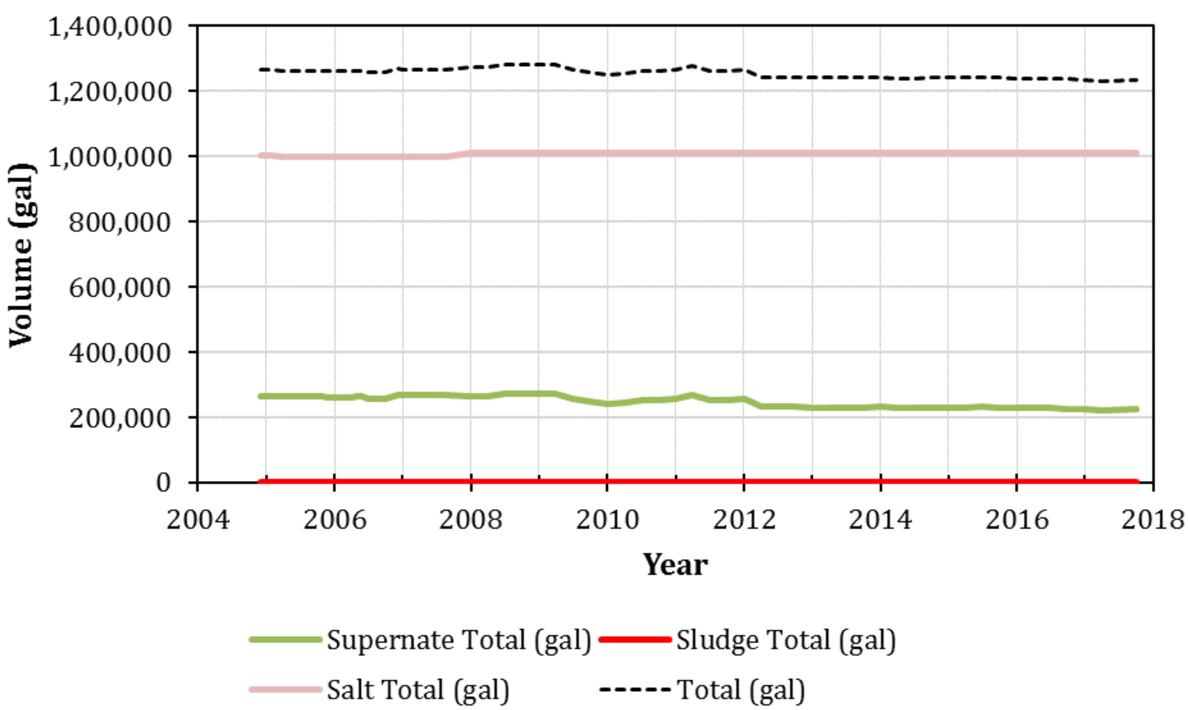


Figure B-45: Volume History (2005 to 2017) for Tank 45

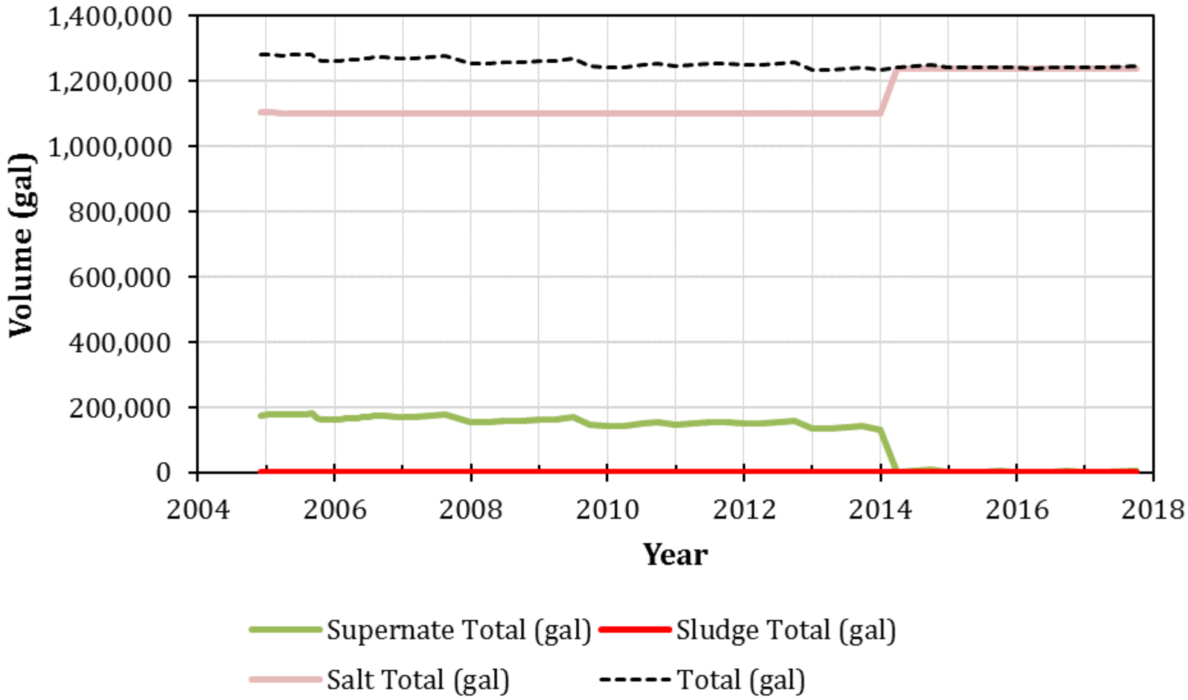


Figure B-46: Volume History (2005 to 2017) for Tank 46

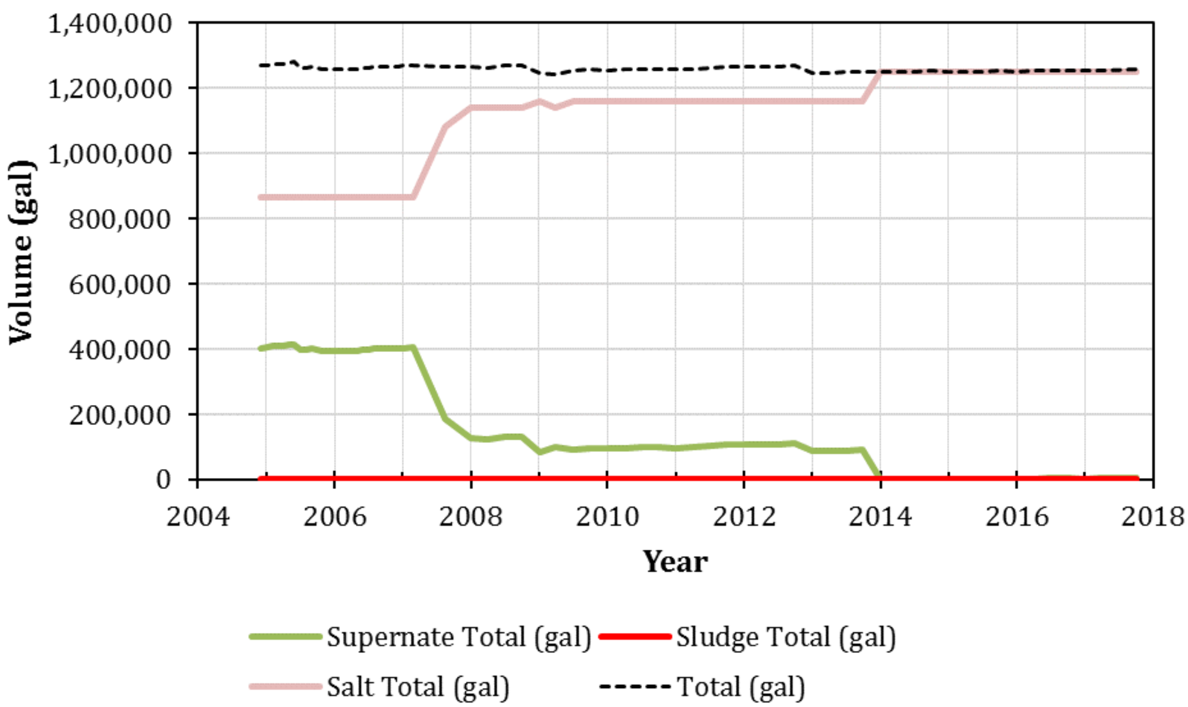


Figure B-47: Volume History (2005 to 2017) for Tank 47

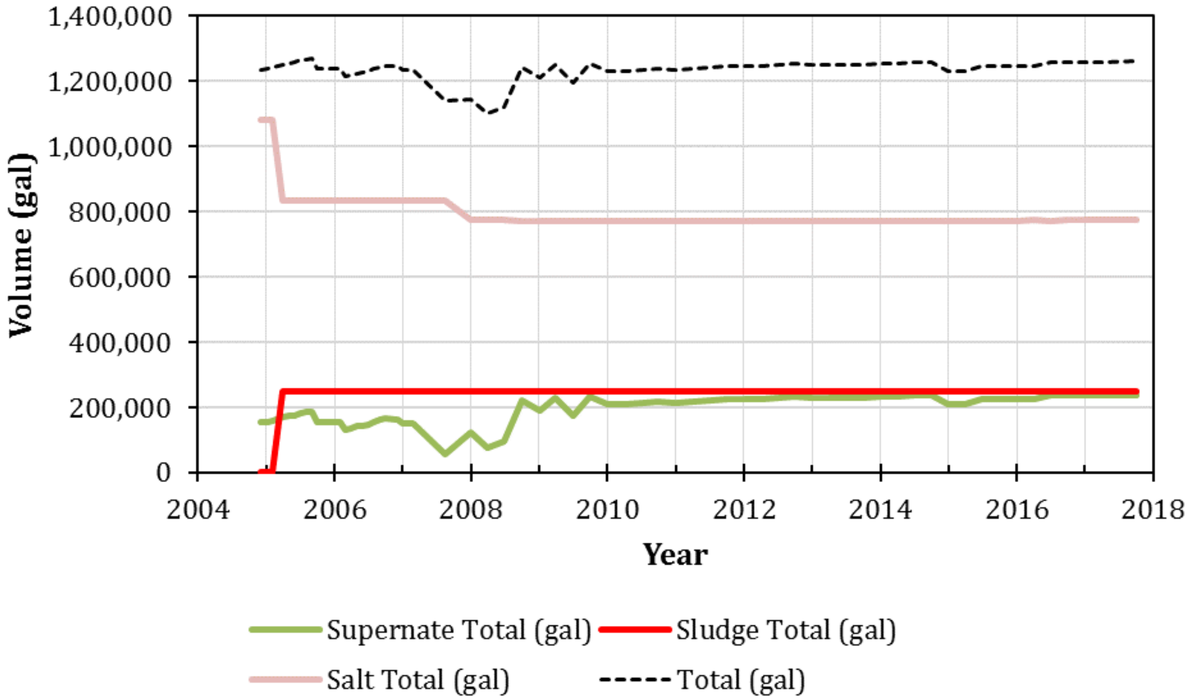


Figure B-48: Volume History (2005 to 2017) for Tank 48

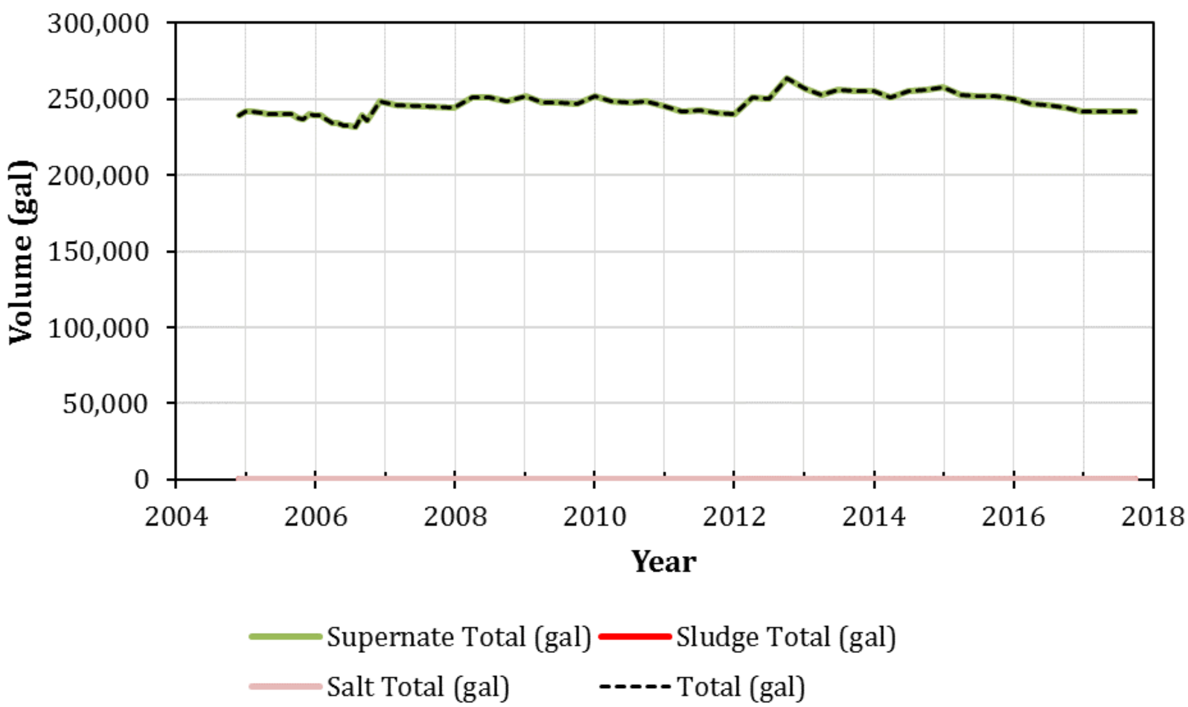


Figure B-49: Volume History (2005 to 2017) for Tank 49

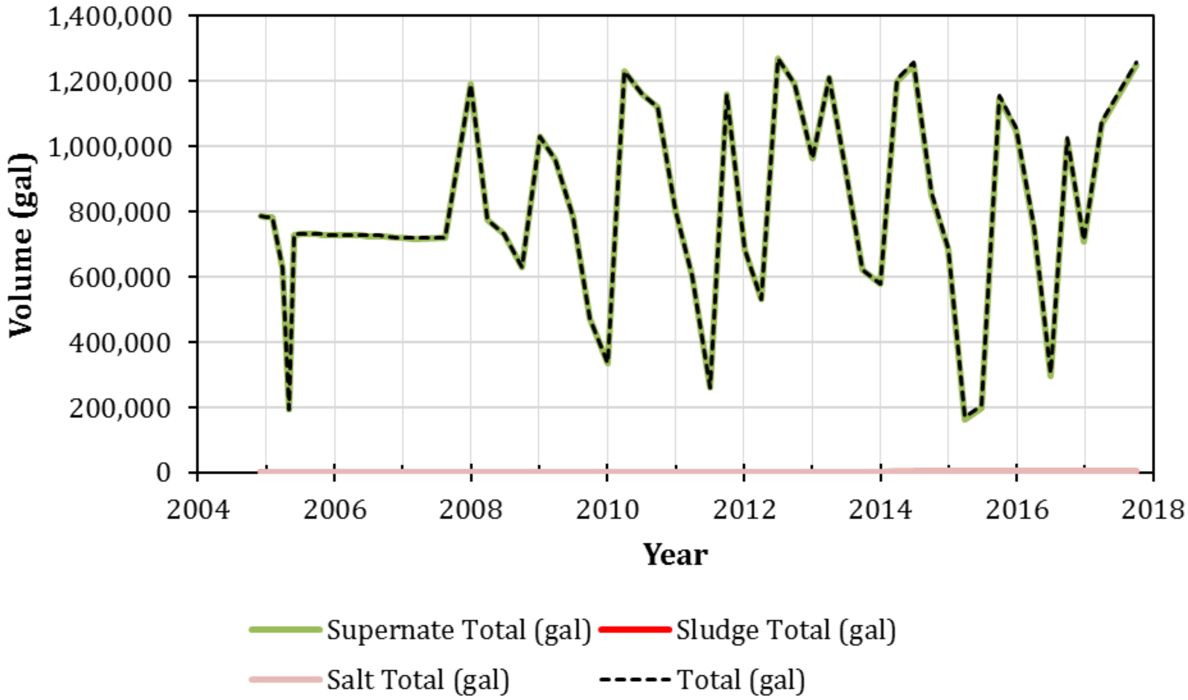


Figure B-50: Volume History (2005 to 2017) for Tank 50

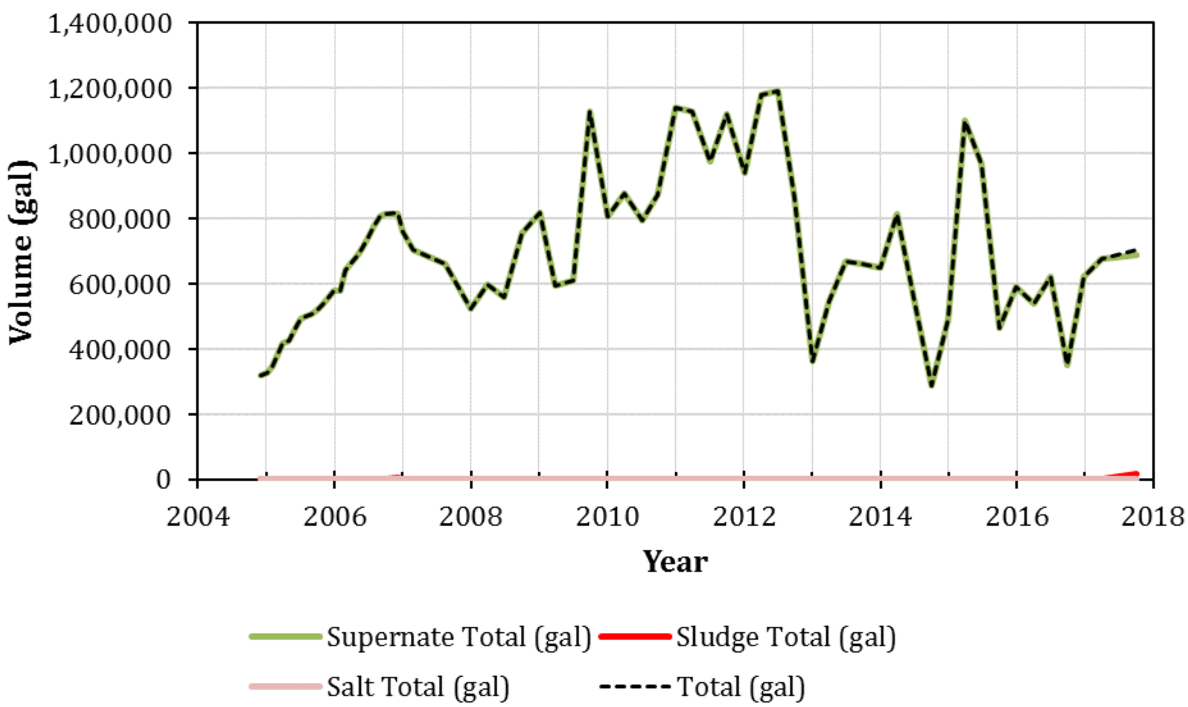
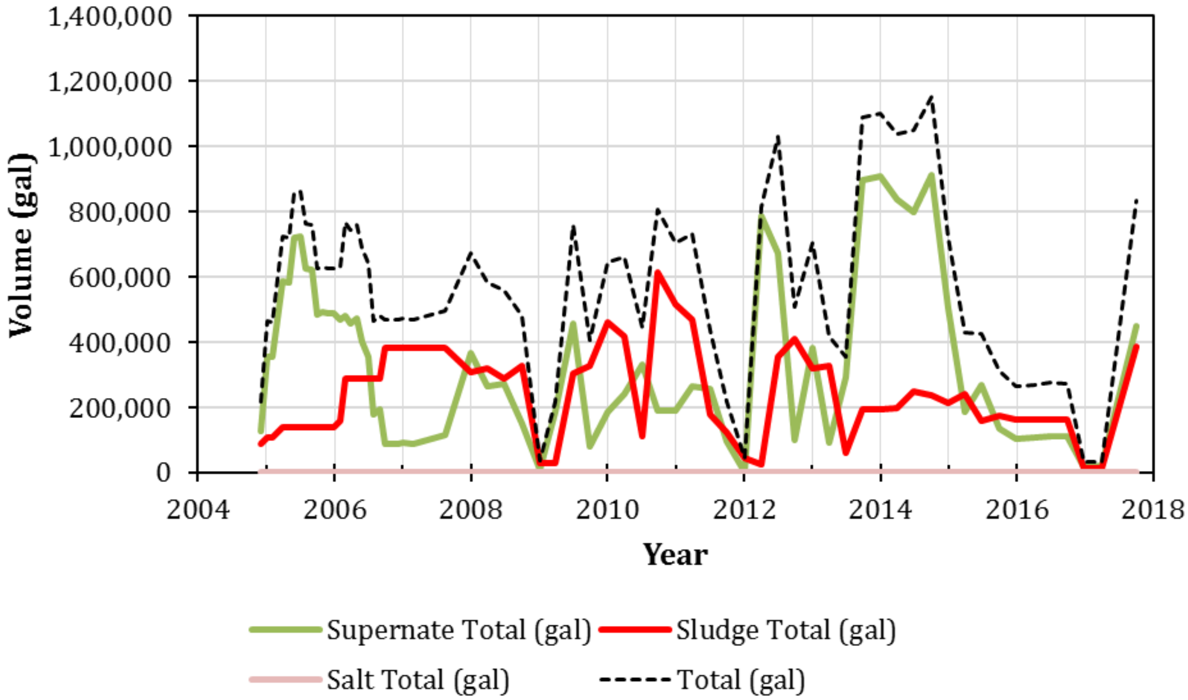


Figure B-51: Volume History (2005 to 2017) for Tank 51



The data that was used to generate these figures was reviewed to determine when the volumes for specific waste phases within each tank became steady (i.e., no significant changes to the volumes). These dates are identified in Table B-2 and were used in the I-129 inventory analysis to determine whether recent sample data was applicable or not applicable.

Table B-2: Dates of Last Substantial Waste Volume Change

Tank	Supernate	Sludge	Salt
Tank 1	1/2/2013	Not Determined	Not Determined
Tank 2	3/31/2005	Not Determined	Not Determined
Tank 3	3/31/2005	Not Determined	Not Determined
Tank 4	12/31/2015	3/31/2011	9/30/2009
Tanks 5 & 6	Not Applicable. Tank(s) closed.		
Tank 7	9/30/2017	4/4/2016	Not Determined
Tank 8	9/30/2017	9/30/2017	Not Determined
Tank 9	9/30/2015	Not Determined	Not Determined
Tank 10	3/30/2017	Not Determined	9/30/2014
Tank 11	9/30/2013	3/31/2014	Not Determined
Tank 12	Not Applicable. Tank(s) closed.		
Tank 13	9/30/2017	9/30/2017	Not Determined
Tank 14	10/31/2005	Not Determined	Not Determined
Tank 15	9/30/2017	9/30/2017	6/30/2015
Tanks 16 to 20	Not Applicable. Tank(s) closed.		
Tank 21	9/30/2017	9/30/2017	9/30/2016
Tank 22	9/30/2017	9/30/2015	Not Determined
Tank 23	9/30/2017	9/30/2017	Not Determined
Tank 24	1/3/2012	9/30/2016	Not Determined
Tank 25	4/4/2016	9/30/2016	1/5/2010
Tank 26	12/31/2015	6/30/2016	6/30/2016
Tank 27	9/30/2017	9/30/2016	8/14/2007
Tank 28	Not Determined	Not Determined	Not Determined
Tank 29	12/31/2015	Not Determined	Not Determined
Tank 30	4/4/2016	3/31/2011	12/31/2014
Tank 31	6/30/2015	Not Determined	6/30/2015
Tank 32	9/30/2017	3/31/2011	9/30/2017
Tank 33	4/2/2012	9/30/2016	Not Determined
Tank 34	9/30/2008	12/31/2005	Not Determined
Tank 35	3/31/2015	9/30/2015	Not Determined
Tank 36	6/30/2015	9/30/2016	3/31/2014
Tank 37	9/30/2015	Not Determined	6/30/2015
Tank 38	9/30/2017	9/30/2016	9/30/2010
Tank 39	9/30/2017	9/30/2016	Not Determined
Tank 40	1/3/2011	12/29/2016	Not Determined
Tank 41	9/30/2017	9/30/2016	9/30/2017
Tank 42	12/31/2014	9/30/2010	Not Determined
Tank 43	9/30/2017	9/30/2009	Not Determined
Tank 44	4/2/2012	Not Determined	Not Determined
Tank 45	9/30/2017	Not Determined	3/31/2014
Tank 46	9/30/2017	Not Determined	1/2/2014
Tank 47	6/30/2015	3/31/2005	12/31/2007
Tank 48	10/1/2012	Not Determined	Not Determined
Tank 49	9/30/2017	Not Determined	3/31/2014
Tank 50	3/30/2017	9/30/2017	Not Determined
Tank 51	9/30/2017	9/30/2017	Not Determined

Not Determined = Samples Earlier than 12/1/2004 may be appropriate. For analysis purposes, it is assumed that substantial volume transfers occurred in every waste tank just before December 1, 2004

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APPENDIX C
MODEL DISTRIBUTION RECOMMENDATION

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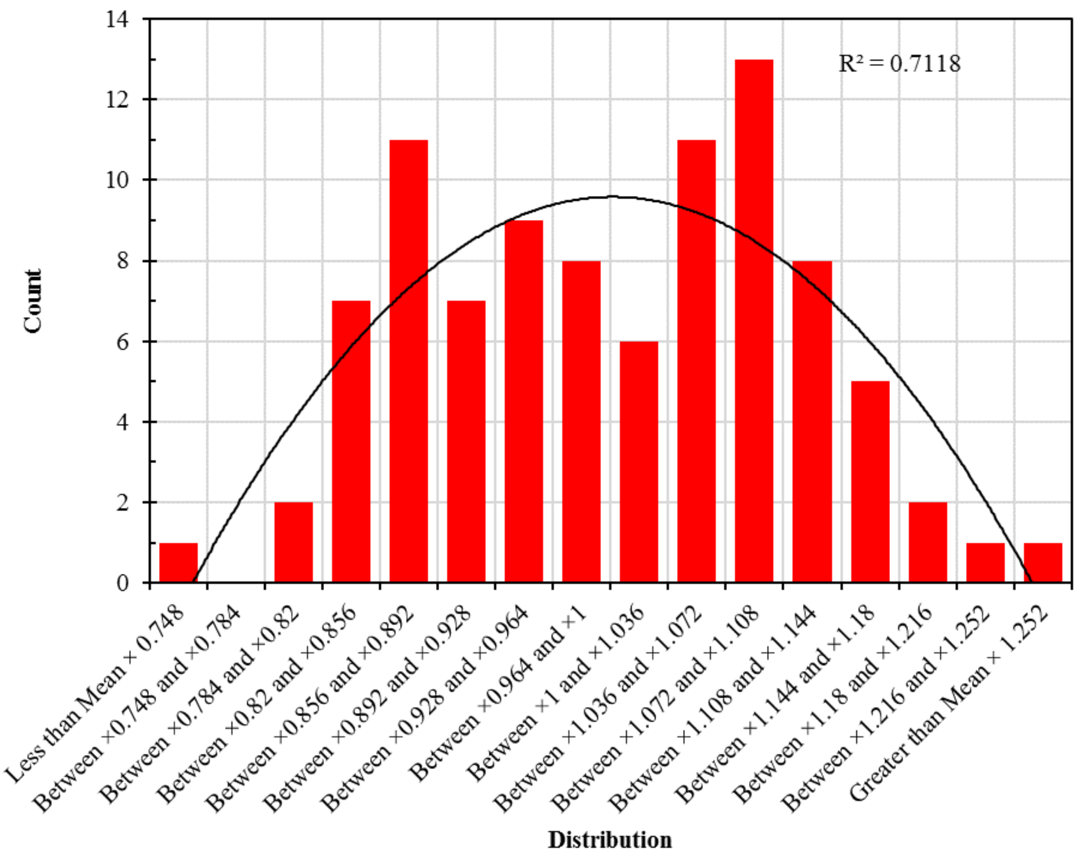
APPENDIX C. MODEL DISTRIBUTION RECOMMENDATION

This appendix provides a recommendation for a sampling distribution for Tc99 inventory, to use when modeling. This distribution is developed based on analysis of the normalized data set in Section 2. Specifically, Figure 2.6-2 presented the number of sampled data points falling within increments of 0.5 standard deviations (σ) from the mean (μ) along both normal and log-normal distributions. The log-normal distribution provides a more "bell-shaped" representation of the data points, indicating a better fit of the distributions.

Where Figure 2.6-2 binned the samples according to the standard deviation, Figure C-1 uses the same sample data, but applies more discrete bins as a function of multipliers on the logarithmic mean. These bins start with a multiplier of 0.748 times the logarithmic mean then increases the multiplier in increments of 0.036.

This figure shows the range of data variability for Tc-99 (from a minimum of 0.748 × the logarithmic mean, to a maximum of 1.252 × the logarithmic mean).

Figure C-1: Logarithmic Distribution Behavior of Sampled Concentrations of Tc-99, Based on Increments of 0.036 × Logarithmic Mean



Given these ranges and the logarithmic behavior of this data, it is recommended that probabilistic modeling apply the following:

$$r^{P} \tag{Eq. C-1}$$

where r is a recommended inventory value (or best guess) in Ci and *P* is a probabilistically sampled model element with a normal distribution, a mean of 1.0, a standard deviation of 0.115, a minimum of 0.73 and a maximum of 1.27.

Section 5.1 recommends a realistic modeling inventory of 2.24+04 Ci. Due to the limited standard deviation, applying Equation C-1 to this value results in a minimum inventory of approximately 1.55E+03 Ci and a maximum inventory of approximately 3.30E+05 Ci when sampling 5,000 realizations. The middle 50% of the results (i.e., from the 25^{th} percentile to the 75^{th} percentile) exhibit a range from approximately 1.1E+04 Ci to 4.8E+04 Ci, which is a reasonable range of uncertainty, given this improved understanding of Tc-99 data.