SRR-CWDA-2015-00077
Revision 2

Evaluation of I-129 Concentration Data to Improve Liquid Waste Inventory Projections

February 2018

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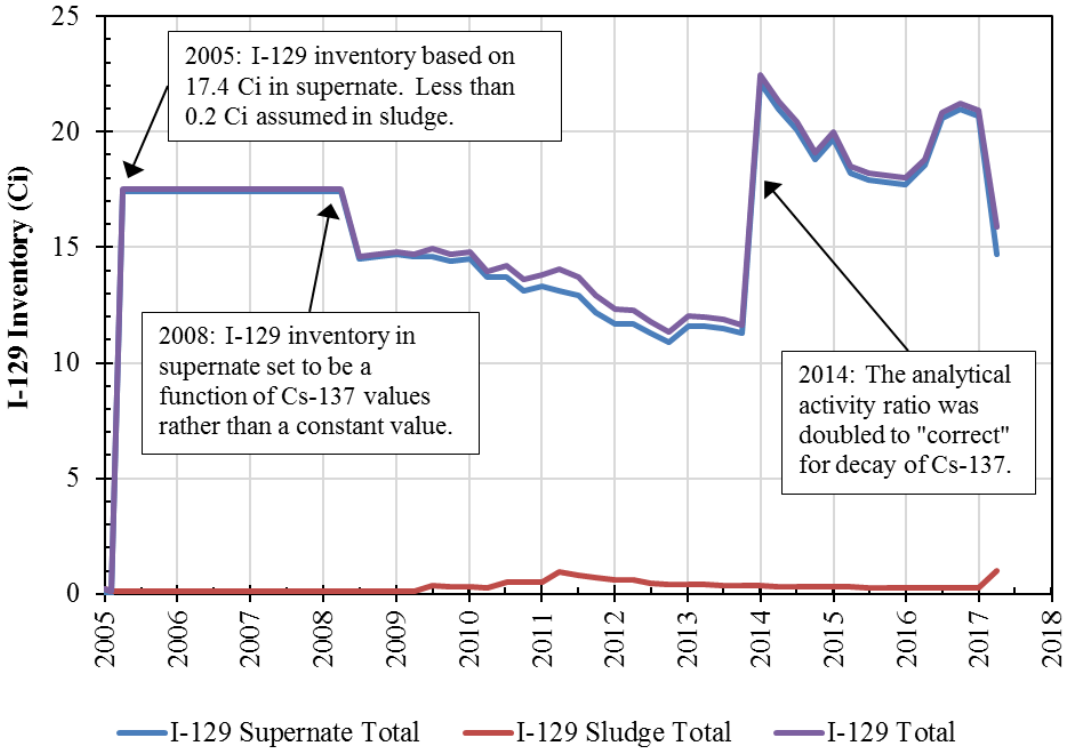
REVISION SUMMARY

REV. #	DESCRIPTION	DATE OF ISSUE
0	Initial Issue	July 2015
1	Incorporates additional data. Applies approaches similar to those described in Revision 1 of the *Evaluation of Tc-99 Concentration Data to Improve Liquid Waste Inventory Projections* (SRR-CWDA-2015-00123).	February 2017
2	Incorporated data from 2017 sample analyses.	February 2018

EXECUTIVE SUMMARY

Performance Assessment (PA) and Special Analysis (SA) modeling of the Saltstone Disposal Facility (SDF) have demonstrated that the radionuclide I-129 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 Savannah River Site (SRS) Waste Characterization System (WCS) is the primary input for periodic "Curie and Volume Inventory Reports", which are used to estimate the I-129 inventory in the tank farms (see Figure ES-1), and thus what is available for transfer to the SDF. The WCS relies heavily on a series of assumptions to develop estimates of the I-129 inventory. Specifically, the inventory of I-129 in supernate is based on a constant fraction of the Cs-137 data. [SRR-LWP-2016-00045] For I-129 in sludge, the inventory is based on fresh waste receipt compositions. [WSRC-TR-94-0562] Finally, WCS assumes that there is no I-129 in salt waste.

Figure ES-1: Total I-129 Inventory in the Tank Farms (WCS Projection)



Relying on Cs-137 data provides inconsistent results because Cs-137 is a relatively short-lived isotope (with a half-life of approximately 30 years), whereas I-129 is a long-lived isotope (with a half-life greater than 15 million years). As such, the I-129 inventory projections showed an unrealistic year-to-year decline (see Figure ES-1, between 2008 and 2014) as the Cs-137 decays.

Given the importance of I-129 in estimating doses within SDF performance modeling, improved methods for projecting I-129 inventories are necessary. This report examines sampled concentration values of I-129 (and associated Cs-137) to develop a recommendation for a more

defensible basis for projecting inventory values. Based on the revised methodology, the total I-129 inventory within the tank farms is projected to be 15.7 Ci.

The 2009 SDF PA (SRR-CWDA-2009-00017) and the FY2013 SDF SA (SRR-CWDA-2013-00062) both modeled approximately 25 Ci of I-129 will be disposed within the SDF, while the FY2014 SDF SA (SRR-CWDA-2014-00006) and FY2016 SDF SA (SRR-CWDA-2016-00072) both modeled approximately 12 Ci of I-129. This decrease is a reflection of the impact of Cs-137 decay on the inventory projection.

For future modeling, this report recommends similar values: for "realistic" models 15.9 Ci is recommended; this value represents I-129 already disposed at SDF plus the total soluble inventory in the tank farms. For "compliance" models an inventory of 16.6 Ci is recommended; this value represents I-129 already disposed at SDF plus the total soluble and insoluble inventory in the tank farms. Finally, for "defense-in-depth" models an inventory of 24.4 Ci is recommended; this value represents I-129 already disposed at SDF plus the total tank farm inventory increased by 50%.

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ACRONYMS/ABBREVIATIONS

CFR	Code of Federal Regulations
DWPF	Defense Waste Processing Facility
FTF	F-Tank Farm
FY	Fiscal Year
HAW	High Activity Waste
HTF	H-Tank Farm
LAW	Low Activity Waste
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
WCS	Waste Characterization System
WDA	Waste Disposal Authority

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1.0 INTRODUCTION

This document provides an analysis of I-129 concentrations in liquid waste at the Savannah River Site (SRS). The purpose of this analysis is to project the final amount (in curies) of I-129 that are 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 I-129 for final disposal within the Saltstone Disposal Facility (SDF). Based on an analysis of historical estimates of I-129, the total I-129 inventory is expected to be between 0.4 Ci and 42 Ci (see Section 2). A value of 15.7 Ci is recommended as the current tank farm inventory based on a set of analytically determined concentrations (see Section 4).

The general approach followed these steps:

(1) Quantify the relationship between Cs-137 and I-129 to provide a basis for using Cs-137 samples as a surrogate for estimating I-129 concentrations (Section 3);

(2) Use the current Cs-137 concentrations (Appendix A) and the relationship between Cs-137 and I-129 to estimate the I-129 concentrations (Section 4.1);

(3) Use the current tank farm volumes (Appendix A) and the estimated I-129 concentrations to provide a preliminary I-129 inventory estimate in the tank farms (Section 4.2); and

(4) For tanks with recent I-129 sample data, replace the estimated concentrations with the known values from recent sample data (Section 4.3); and

(5) Use the estimated and known concentration values with the current tank farm volumes to develop a recommended I-129 inventory estimate (Section 4.3).

Section 1.1 demonstrates that the Waste Characterization System (WCS) has shown significant variability in the projected I-129 inventories for the tank farms. Section 1.2 demonstrates the importance of I-129 relative to meeting performance objectives in SDF modeling. Section 1.3 introduces intermediate data used within various analyses in later sections. Section 2 provides a summary of the historical I-129 projections. Section 3 offers an analysis of sampled tank concentrations, to-date, and a recommended approach for determining future I-129 inventory estimates. Finally, Section 4 uses the recommended approach to provide a current inventory estimate.

1.1 Variability in I-129 Estimates

Prior to 2005, the WCS only projected inventory values for I-129 within waste tank sludge. No waste tank estimates were developed for I-129 within supernate or salt waste. In March 2005, the WCS incorporated I-129 into the supernate inventories based on the report: *Supernatant Phase Iodine-129 Inventory*. [CBU-PIT-2005-00050] The 2005 report projected 17.4 Ci of I-129 inventory in the supernatant phase for the tank farms, which combined with a low activity sludge inventory to produce an estimate of approximately 17.5 Ci for the entire tank farm.

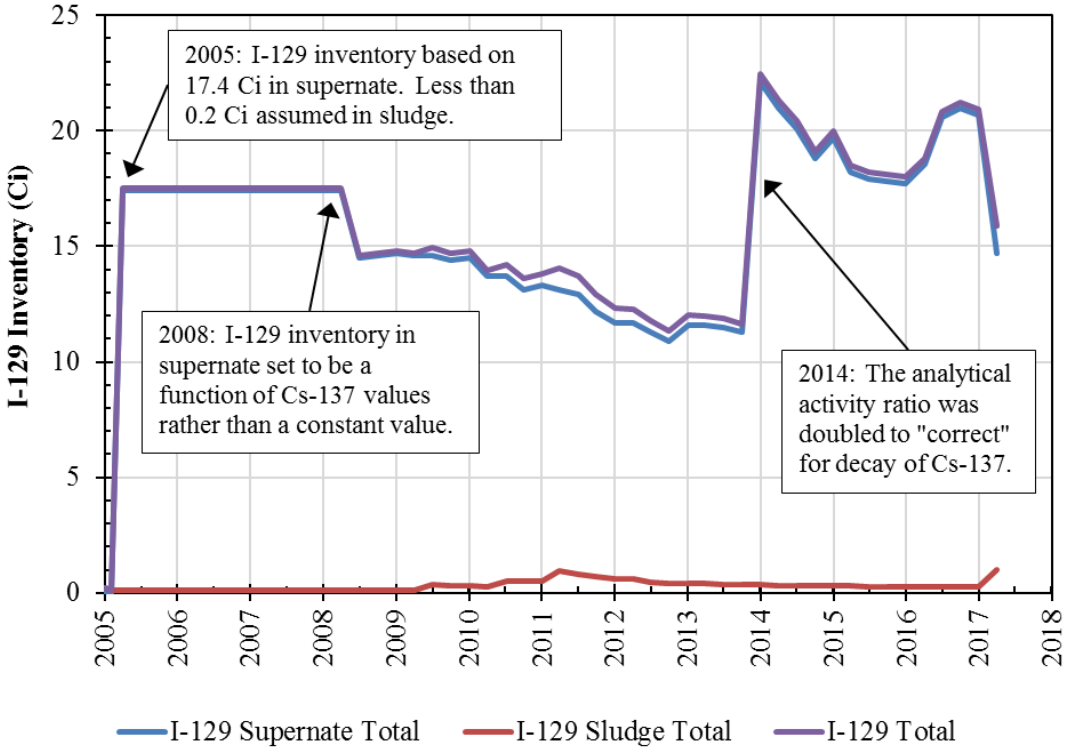
The inventory projection method used in 2005 also suggested that I-129 concentrations within individual waste tanks could be projected as a function of an analytical activity ratio, using I-129-to-Cs-137 activity ratios. [CBU-PIT-2005-00050] As shown in Figure 1-1, between March 2005 and June 2008, the activity ratios were not applied, rather a constant value of 17.6 Ci was assumed.

Starting in July 2008, the suggested I-129-to-Cs-137 analytical activity ratio was applied. [LWO-CES-2008-00034]

This approach is not ideal because Cs-137 has a half-life of approximately 30 years, whereas I-129 has a half-life of more than 15 million years. Because three years had passed from the development of the 2005 estimate and the time that it was actually implemented into the WCS, the Cs-137 inventory had decayed resulting in a seemingly instantaneous drop in the projected I-129 inventory in 2008. In January 2014, it was determined that the decay of Cs-137 was impacting the I-129 estimates. To "correct" for this decay, the I-129-to-Cs-137 analytical activity ratio was doubled, resulting in the projected I-129 inventory nearly doubling, from about 12 Ci in September 2013 to more than 20 Ci in January 2014. [SRR-LWP-2013-00066; SRR-LWP-2014-00001]

Historically, variability in the I-129 inventory has been more of a function of the methods applied for projecting the values rather than the actual variability of sampled data. Using measured concentrations from sampled waste to develop a new approach will mitigate this variability.

Figure 1-1: Total Curies of I-129 within the Tanks Farms (WCS Projection)



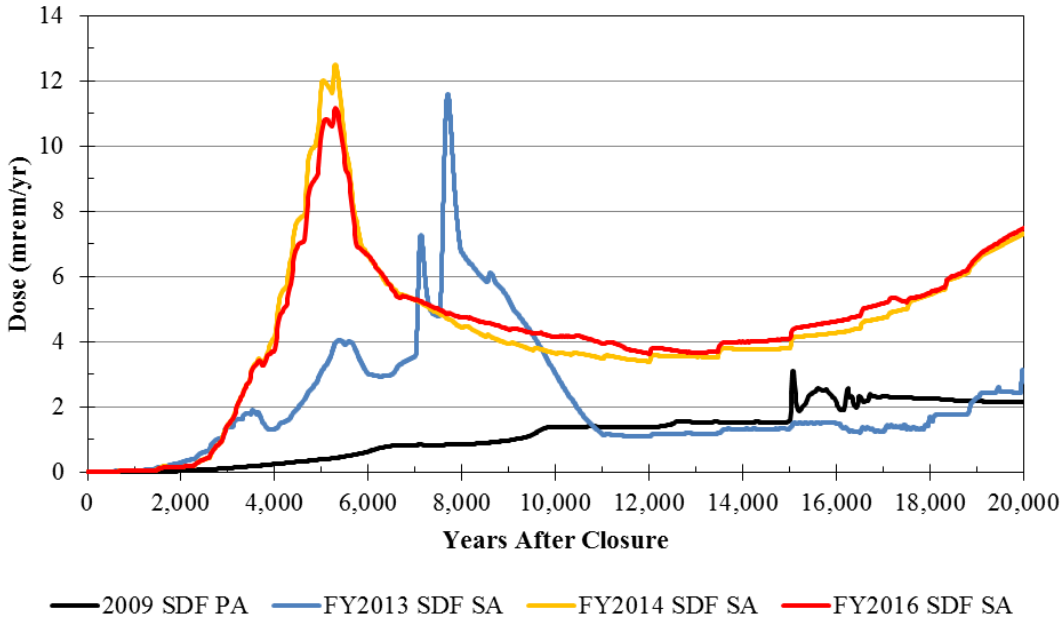
1.2 Importance of I-129 in Meeting Performance Objectives

The method used to project I-129 inventories is important because I-129 is an important dose contributor in performance modeling. Specifically, Performance Assessment (PA) and Special Analysis (SA) modeling of the SDF have demonstrated that I-129 is important relative to meeting performance objectives related to doses. [SRR-CWDA-2009-00017, SRR-CWDA-2013-00062, SRR-CWDA-2014-00006, SRR-CWDA-2016-00072] According to these performance

objectives, doses to a representative member of the public (MOP) shall not exceed 25 mrem/yr total effective dose equivalent per DOE M 435.1-1 and 10 CFR 61.

Figure 1-2 shows calculated doses to the MOP from SDF PA and SA modeling (i.e., the 2009 SDF PA, the FY2013 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 25 Ci of I-129 will be disposed within the SDF (based on conservative inventory assumptions), while the FY2014 SDF SA and FY2016 SDF SA both assumed only about 12 Ci based on data from the WCS in September 2013. [SRR-LWP-2013-00066] Despite the differences in the models (e.g., inventory values, facility layout), all of the SAs show peak doses that are near 11 or 12 mrem/yr within 10,000 years (almost half the MOP performance objective). These peaks correspond to the releases of I-129.

Figure 1-2: Comparison of the 100-Meter MOP Peak All-Pathways Dose within 20,000 Years for the 2009 SDF PA, FY2013 SDF SA, FY2014 SDF SA, and FY2016 SDF SA



[Source: Figure ES.0-1 from SRR-CWDA-2016-00072]

Table 1-1 shows that the peak doses from each of these models are driven primarily by contributions from I-129.

Table 1-1: I-129 Contributions to the MOP Peak All-Pathways Dose within 20,000 Years for the 2009 SDF PA, FY2013 SDF SA, and FY2014 SDF SA

	2009 SDF PA[a]	FY2013 SDF SA[b]	FY2014 SDF SA[c]	FY2016 SDF SA[d]
Modeled I-129 Inventory (Ci)	24.7	24.8	12.2	12.2
Peak Dose (mrem/yr)	3.1	11.6	12.5	11.2
Peak from I-129 (mrem/yr)	2.7	11.4	10.9	9.7
I-129 Percent of Peak Dose	87%	98%	87%	87%

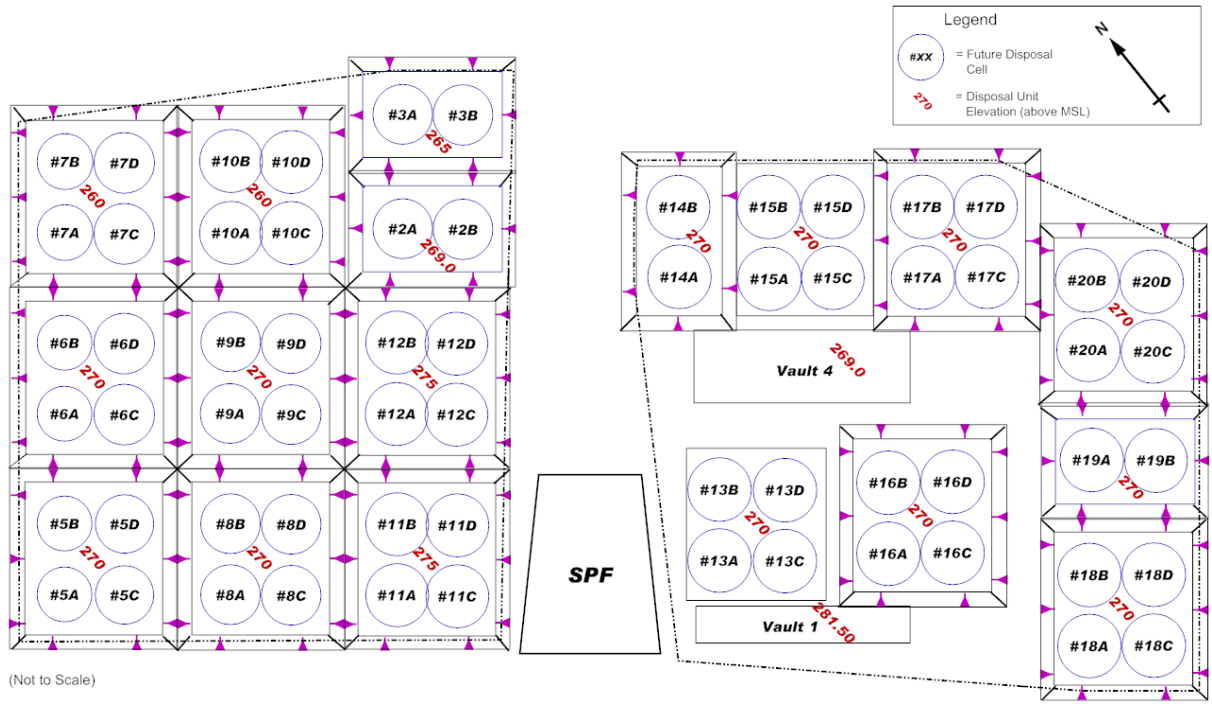
Notes: (a) SRR-CWDA-2009-00017
(b) SRR-CWDA-2013-00062
(c) SRR-CWDA-2014-00006
(d) SRR-CWDA-2016-00072

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 1-3); 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 1-4). 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 I-129 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 I-129 inventory is closer to the points of assessment, resulting in higher peak doses from I-129. Also, by comparing Figures 1-3 and 1-4 it is apparent that the newer layout (first 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 approximately half the I-129 inventory, the FY2014 and FY2016 SDF SAs still showed peak doses that were very similar in magnitude to those from the FY2013 SDF SA.

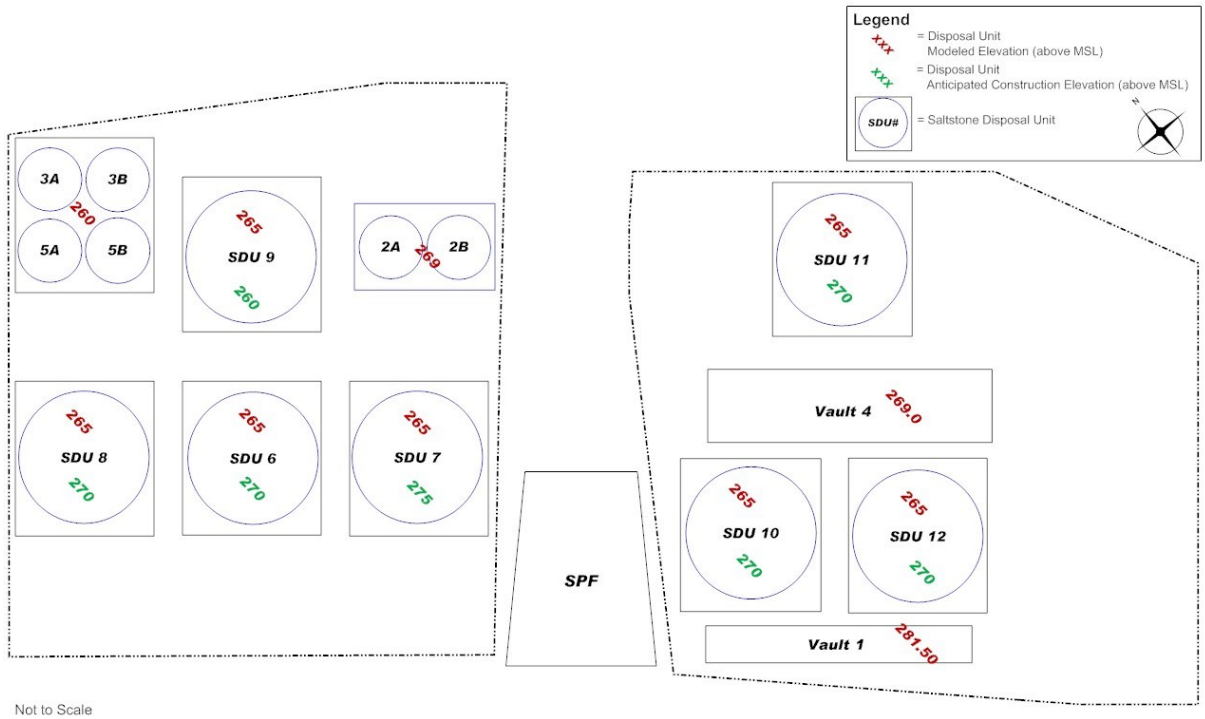
Because the dose results are within an order of magnitude of the performance objectives, and historical projections of I-129 have shown significant variability, it is important to develop a more reliable approach for estimating the total I-129 inventory that is both reasonable and defensible.

Figure 1-3: Layout of SDF as Modeled in the 2009 SDF PA and the FY2013 SDF SA



Note: Numbering of the units were placeholders and may not match the final disposal unit numbering.

Figure 1-4: Layout of SDUs as Modeled in the FY2014 SDF SA



1.3 Intermediate Data Used to Inform Analyses

Section 2 describes historical projections of I-129 inventories while Section 3 analyzes sample data from multiple waste tanks to develop an informed recommendation, presented in Section 4, for projecting I-129 inventories. Both Section 2 and Section 4 include analyses that rely on additional intermediate data. Specifically, this section provides (1) curies of I-129 that are known to be currently disposed at SDF and (2) curies of I-129 that are known to be left in place as residual inventory within tanks that are closed.

1.3.1 Curies of I-129 Disposed at SDF

As of September 2017, the SDF has received 0.85 Ci of I-129. This value is based on recent inventory values from the *Determination of the SDF Inventory through 9/30/2017*, which used the SDF-WIDE Model described in the *Saltstone Disposal Facility Waste Inventory Disposed Estimator Model Report*. [SRR-CWDA-2017-00079; SRR-CWDA-2015-00003] For each of the total inventory estimates provided within this report, the contribution sent to SDF is also considered. Table 1-2 summarizes the cumulative number of I-129 curies disposed over time, as determined via the SDF-WIDE Model.

Table 1-2: Cumulative Inventory of I-129 Disposed at SDF

Fiscal Year	I-129 Disposed at SDF (Ci)
1990	0.01
1991	0.02
1992	0.03
1995	0.05
1996	0.20
1997	0.21
2002	0.25
2003	0.36
2007	0.37
2008	0.39
2009	0.41
2010	0.43
2011	0.46
2012	0.50
2013	0.60
2014	0.65
2015	0.68
2016	0.83
2017	0.85

[SRR-CWDA-2017-00079]

1.3.2 Curies of I-129 Remaining in Waste Tanks that are Removed from Service

As of 2018, eight waste tanks have been emptied and removed from service. The I-129 within the residual waste of these 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 provides the residual tank waste inventories for I-129 within these waste tanks.

Table 1-3: Residual Tank Waste Inventories for I-129

Tank	Year Closed	I-129 (Ci)	Reference
Tank 5	2013	2.2E-03	SRR-CWDA-2012-00106
Tank 6	2013	3.0E-03	SRR-CWDA-2012-00106
Tank 12	2016	3.8E-02	SRR-CWDA-2015-00075
Tank 16	2015	1.5E-02	SRR-CWDA-2014-00106
Tank 17	1997	1.4E-06	WSRC-TR-97-0066
Tank 18	2012	2.7E-04	SRR-CWDA-2010-00124
Tank 19	2012	2.2E-04	SRR-CWDA-2010-00124
Tank 20	1997	2.6E-07	WSRC-TR-96-0267
	Total	**0.06**	

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2.0 PREVIOUS PROJECTIONS OF I-129 INVENTORY

Previous projections of I-129 inventory were based on a limited number of measured samples such that the projections often relied heavily on assumptions. Regardless, each recommendation has its own merits with regard to the pedigree of the data. By reviewing the past projections and developing an understanding of each approach, the previous data can be used to better inform future approaches for projecting I-129 inventories.

Table 2-1 provides a summary of past projections of the total I-129 inventory within the SRS tank farms. This table is followed by a brief discussion of each projection.

Table 2-1: Historical Inventory Projections for I-129

Reference	Projected I-129 Inventory in SRS Tank Farms and SDF (Ci)	Year	Section
DPST-82-759	18.9	1982	2.1
DPST-84-343	9.12	1984	2.2
WSRC-RP-92-1360	20.0	1992	2.3
WSRC-TR-96-0264	0.37	1996	2.4
WSRC-RP-2003-00323	15.0	2003	2.5
CBU-PIT-2005-00033	42.1	2005	2.6
CBU-PIT-2005-00050	17.8	2005	2.6
SRNL-STI-2012-00479	0.68	2012	2.8
SRR-LWP-2016-00045	22.1	2016	2.7

Collectively, these historical projections have a median of 17.8 Ci and a mean of 16.2 Ci. Qualitatively, these historical values indicate that a reliable projection would likely be between 10 Ci and 20 Ci.

2.1 Projected I-129 Inventory Based on 1982 Information

In August of 1982, the *Update of Chemical and Radiochemical Composition of Decontaminated Soluble Waste from the Precipitation Process* reported that limited experimental data was available for I-129. [DPST-82-759] Using supernate samples that were collected in 1976 from Tanks 11, 12, and 15, a maximum supernate concentration of 700 pCi/g of salt was estimated.

The 1982 report also provided dry weight concentrations of 17.4 g/L of sludge solids and 353 g/L of soluble salts. [DPST-82-759] Conservatively assuming that soluble salts are the same as supernate, the I-129 concentration in sludge and supernate was estimated to be 1.22E-08 Ci/L and 2.47E-07 Ci/L, respectively. Salt solids are assumed to have a negligible amount of I-129.

700 pCi/g of salt × 17.4 g of sludge/L = 1.22E+04 pCi/L (1.22E-08 Ci/L) in sludge

700 pCi/g of salt × 353 g of salt/L = 2.47E+05 pCi/L (2.47E-07 Ci/L) in supernate

This only provides estimates in terms of concentrations (i.e., total curies were not projected); however, volume estimates from approximately the same period were applied to these concentrations to project a total tank farm inventory for I-129. In August 1977, the *Description of Aged Savannah River Plant Waste* estimated 2.18E+07 gallons (8.27E+07 L) of waste in the tanks farms, with 1.74E+06 gallons (6.60E+06 L) of that being sludge. [DPST-77-425] Based on these

values, it is assumed that the supernate waste and the salt waste have a total combined volume of 2.12E+07 gallons (8.02E+07 L). Using these volumes, 18.9 Ci of I-129 were present in the tank farms.

1.22E-08 Ci/L × 6.602E+06 L = 0.0804 Ci in sludge

2.47E-07 Ci/L × 8.017E+07 L = 18.8 Ci in supernate and salt

0.08 Ci (sludge) + 18.8 Ci (supernate and salt) = 18.9 Ci (total)

2.2 Projected I-129 Inventory Based on 1984 Information

In February of 1984, the report *I-129 in SRP High Level Waste and Saltstone*, applied a more informed approach to estimating the I-129 inventory. [DPST-84-343] The previous evaluation developed concentration estimates based on maximum concentrations from samples taken from three H-Area waste tanks (using samples collected in 1976 from Tanks 11, 12, and 15) then applied the maximum concentration to all wastes in both tank farms; however, this newer report indicates that due to "the nature of processes at [the Savannah River Site] … most of the I-129 in the waste is in the H-Area waste tanks." [DPST-84-343, pg. 2]

The 1984 report provides the values from the sampling of Tanks 11, 12, and 15 that were used to develop the maximum concentration used in the 1982 projection. These supernate samples showed 7.6E-08 Ci/L, 2.5E-07 Ci/L, and 2.9E-08 Ci/L of I-129, respectively. [DPST-84-343] Further, additional supernate samples were taken from Tanks 30 and 32, as well as salt samples from Tanks 9 and 10. Tank 30 contained 3.0E-07 Ci/L of I-129 and Tank 32 contained 9.6E-08 Ci/L of I-129. Tank 30 was more concentrated than Tank 32 (by a factor of 3.1) because the sample analyzed was "as-received" high activity waste (HAW) while the Tank 32 waste is more characteristic of low activity waste (LAW). The salt samples from Tanks 9 and 10 were less than the detection limit of 5 pCi/g of salt, confirming that I-129 is highly soluble and unlikely to precipitate in salts. [DPST-84-343]

Based on this more informed approach, a total of 9.12 Ci of I-129 was estimated for the tank farms, of which only 1.3 Ci came from F-Area waste tanks. [DPST-84-343, Table IV]

2.3 Projected I-129 Inventory Based on 1992 Information

Unlike the previous estimates which were based on tank farm concentrations and volumes, the 1992 estimate is based on final disposal (i.e., SDF concentrations and volumes). In December of 1992, a *Radiological Performance Assessment for the Z-Area Saltstone Disposal Facility* was prepared. [WSRC-RP-92-1360] Section 2.6.3.2 provided a derived I-129 concentration for a "nominal blend" of 20 Ci within the disposed saltstone. [WSRC-RP-92-1360, Table 2.6-2] Given the purpose of this estimate, this value is expected to be conservative.

2.4 Projected I-129 Inventory Based on 1996 Information

In 1996, the *High Level Waste Characterization System (WCS)* report was issued (WSRC-TR-96-0264). This WCS report provided sludge compositions by isotopic species based upon various irradiated assemblies (see Table 2-2). Note that in this context, the term sludge does not indicate waste that has settled (i.e., separated from supernate), but refers to the fresh waste receipts (or sludge "slurry") from F-Canyon and H-Canyon before separation of waste phases.

Table 2-2: Fresh Waste Sludge Compositions of I-129

	HM HAW (Ci/gal)	HM LAW (Ci/gal)	HM Mixed (Ci/gal)	PUREX HAW (Ci/gal)	PUREX LAW (Ci/gal)	PUREX Mixed (Ci/gal)
I-129	2.76E-09	2.05E-10	1.99E-09	5.05E-09	3.07E-11	2.54E-09

[Source: WSRC-TR-96-0264, Table 4]

The highest concentration of I-129 (5.05E-09 Ci/gal) received as fresh waste was reported for PUREX in high activity waste. To be conservative, this value is assumed as the I-129 concentration in all waste.

Attachment B of the 1996 report *High Level Waste Characterization System (WCS)* estimates volumes of waste within each waste tank in 1996. These volumes sum to 3.38E+07 gal. Applying this volume to the assumed 5.05E-09 Ci/gal concentration results in a total I-129 inventory of 0.20 Ci.

5.05E-09 Ci/gal × 3.38E+07 gal = 0.17 Ci

Combined with the 0.20 Ci of I-129 that had been disposed at SDF through 1996 (see Section 1.3.1), this gives a total projected I-129 inventory of about 0.4 Ci.

0.17 Ci (total, tank farm) + 0.20 Ci (SDF disposal) = 0.37 Ci (total)

2.5 Projected I-129 Inventory Based on 2003 Information

In November 2003, a high level document was prepared to support the salt waste processing program development. [WSRC-RP-2003-00323] This programmatic document provided an estimate of 15 Ci of I-129 for SDF disposal. Although no basis was provided for the development of this value, it is consistent with most other estimates (see Section 2).

2.6 Projected I-129 Inventory Based on 2005 Information

In February of 2005, two reports were issued with projected I-129 inventories. [CBU-PIT-2005-00033; CBU-PIT-2005-00050] The first report made projections based on theoretical fission yield data and on the assumption that the I-129 supernatant phase concentration was constant in all waste tanks. [CBU-PIT-2005-00033] This report estimated 2.9 Ci of I-129 in sludge and 38.8 Ci of I-129 in supernate for a total of 41.7 Ci. Combined with the 0.364 Ci of I-129 that had been disposed at SDF through 2004 (see Section 1.3.1) gives a total projected inventory of 42.1 Ci for I-129.

38.8 Ci (tank farm supernate) + 2.9 Ci (tank farm sludge) + 0.364 Ci (SDF disposal) = 42.1 Ci (total)

After the first report was issued, additional I-129 data was identified and a second report was issued to reconcile the new data. [CBU-PIT-2005-00050] Accordingly, the second report is considered the more reliable estimate.

The second report from February 2005 projected the total I-129 inventory based upon sample data from five waste tanks (Tanks 21, 22, 23, 24, and 50). [CBU-PIT-2005-00050] For the waste tanks with sampled concentrations, the sample values were used to determine the inventory of I-129 within those tanks. For all other waste tanks, an analytical activity ratio (I-129-to-Cs-137) of 1.57E-07 was applied (see Table 2-3). Using this approach, the total estimated I-129 inventory was 17.4 Ci for supernate phase waste. [CBU-PIT-2005-00050, Section 1.2]

Combined with the 0.030 Ci of I-129 within sludge waste (estimated based on the data evaluated in Section 2.4) and the 0.364 Ci of I-129 that had been disposed at SDF through 2004 (see Section 1.3.1), this gives a total projected I-129 inventory of 17.8 Ci. Note that inventory in salt waste is assumed to be negligible for this estimate.

17.4 Ci (tank farm supernate) + 0.005 Ci (tank farm sludge) + 0.364 Ci (SDF disposal) = 17.8 Ci (total)

This value is more consistent with the other estimates than the conservative 42.1 curies projected in the first 2005 report.

Table 2-3: Supernate Phase I-129 Inventory, Based on CBU-PIT-2005-00050

Tank	Reported Cs-137 Inventory (Ci)	Projected I-129 Inventory (Ci)
1	3.33E+06	5.23E-01
2	1.21E+06	1.89E-01
3	1.22E+06	1.92E-01
4	3.52E+06	5.54E-01
5	4.93E+04	7.75E-03
6	9.98E+03	1.57E-03
7	2.40E+05	3.78E-02
8	7.06E+03	1.11E-03
9	1.22E+06	1.92E-01
10	8.22E+04	1.29E-02
11	2.61E+03	4.10E-04
12	4.16E+05	6.54E-02
13	1.18E+07	1.85E+00
14	1.25E+06	1.97E-01
15	No Supernate	No Supernate
16	No Supernate	No Supernate
17	CLOSED	CLOSED
18	1.38E+02	2.16E-05
19	2.12E+02	3.33E-05
20	CLOSED	CLOSED
21	Cs-137 not used	1.73E-03
22	Cs-137 not used	2.04E-03
23	Cs-137 not used	3.22E-03
24	Cs-137 not used	3.53E-02
25	1.74E+06	2.74E-01
26	5.59E+06	8.78E-01
27	5.10E+06	8.02E-01
28	2.22E+06	3.48E-01
29	4.73E+05	7.43E-02
30	1.06E+07	1.67E+00
31	5.23E+06	8.22E-01
32	5.26E+06	8.27E-01
33	2.91E+06	4.58E-01
34	1.42E+06	2.22E-01
35	4.15E+06	6.53E-01
36	1.11E+07	1.74E+00
37	4.60E+06	7.22E-01
38	1.89E+05	2.97E-02
39	8.35E+05	1.31E-01
40	5.19E+04	8.16E-03
41	3.51E+05	5.51E-02
42	1.23E+07	1.93E+00
43	1.47E+05	2.30E-02
44	2.99E+06	4.70E-01
45	2.55E+06	4.01E-01
46	5.02E+06	7.89E-01
47	6.72E+05	1.06E-01
48	1.72E+04	2.70E-03
49	5.39E+05	8.48E-02
50	Cs-137 not used	2.83E-03
51	2.17E+05	3.42E-02
Tank Farm Total	**1.11E+08**	**17.4**

2.7 Projected I-129 Inventory Based on the WCS Since 2005

By September 2013, the supernate inventory for I-129 projected by the WCS was less than 12 Ci. Relative to the 17.4 Ci of supernate estimated in 2005, this was a noticeable and unrealistic decline in the I-129 inventory. This significant decline is primarily attributed to the decay of Cs-137 and its impact on the analytical activity ratio. [SRR-LWP-2013-00066] Therefore, starting in January 2014, a "correction" was applied by doubling the analytical activity ratio from the initial value (from 1.57E-07 to 3.14E-07). [SRR-LWP-2014-00001; SRR-LWP-2016-00045]

This simplified correction is overly-conservative—given a Cs-137 decay rate of 30.2 years, a ratio closer to 2.0E-07 would have been more appropriate at this time. Further, this approach is still subject to the influence of Cs-137 decay. This year-to-year decrease in I-129 is unrealistic, indicating that these values are not reliable projections. Given the known limitation of the analytical activity ratio and the various values estimated in the past, an improved method for projecting inventories is warranted, as discussed in Section 3.

2.8 Projected I-129 Inventory Based on 2012 Information

In August 2012, an analysis of waste receipt samples was documented in *Chemical Differences Between Sludge Solids at the F and H Area Tank Farms*. [SRNL-STI-2012-00479] The analysis estimated total waste receipts from F-Canyon and from H-Canyon of 0.126 Ci of I-129.

Combined with the 0.496 Ci of I-129 that had been disposed at SDF through 2012 (see Section 1.3.1) and the 0.058 Ci estimated for I-129 in residual tank wastes (see Section 1.3.2), this gives a total projected I-129 inventory of 0.68 Ci.

0.126 Ci (tank farm) + 0.496 Ci (SDF disposal) + 0.058 Ci (Residual Tank Waste) = 0.68 Ci (total)

2.9 Projected I-129 Inventory Based on Tank 50 Slurry Sampling Through 2017

Tank 50 feeds waste into the Saltstone Production Facility for disposal at SDF. Quarterly samples of the waste in Tank 50 are collected and analyzed for concentrations, as provided in Table 2-4. Note that four samples (taken in September 2006, March 2008, July 2008, and March 2009) were omitted from this analysis because these measurements were below detection limits.

Despite the range of I-129 concentrations, the Tank 50 slurry samples typically show much lower values than would be projected based on the earlier estimates. The average concentration (linear mean) from all of the samples is 15.8 pCi/mL (see Figure 2-1), with a median value of 9.08 pCi/mL. This figure shows that most of the sampled concentrations measure below the arithmetic average. Further analysis of this data reveals that the values vary logarithmically. As such, it is more appropriate to present the concentrations on a log scale and to use the logarithmic mean, shown in Figure 2-2. The logarithmic mean of all the sampled values is 9.73 pCi/mL, which is much closer to the median of 9.08 pCi/mL, thus indicating that the logarithmic mean is more representative than the linear mean. However, in order to ensure conservatism in the projection, the linear mean value is assumed.

Table 2-4: Summary of Tank 50 Feed Concentrations for I-129

Date of Sample	Concentration (pCi/mL)
7/25/1990	5.7
7/15/1991	13.6
1/29/1992	6.46
8/13/1992	5.72
2/15/1994	3.7
6/9/1994	2.46
10/6/1994	42.98
2/10/1995	83.5
9/19/1995	97.4
4/26/1996	13.7
9/20/1996	3.05
1/14/1997	7.28
1/15/1997	7.87
4/22/1997	3.57
4/23/1997	6.19
10/28/1997	1.9
9/18/1998	55.2
10/5/1998	43.3
12/20/2002	4.69
7/17/2003	2.44
10/1/2004	2.15
2/1/2007	3.2
9/1/2007	3.23
7/1/2009	5.17
10/2/2009	5.68
1/8/2010	5.43
4/5/2010	4.47
7/1/2010	8.02
10/4/2010	5.74
1/5/2011	6.13
4/4/2011	4.74
7/7/2011	4.65
10/12/2011	5.96
1/25/2012	6.05
7/17/2012	10.9
10/9/2012	14.1
1/17/2013	12.4
4/3/2013	12.6
7/8/2013	14.3
10/29/2013	11.8
1/21/2014	14.9
4/9/2014	12.4
7/8/2014	11.1
10/2/2014	10.9
1/20/2015	10.8
4/9/2015	9.08
7/9/2015	12.8
10/29/2015	11.1
1/13/2016	14.4
4/6/2016	23.5
7/14/2016	35.3
10/4/2016	34.9
1/15/2017	40.4
4/19/2017	36
7/17/2017	32.3

[Source: SRR-CWDA-2015-00003]

Figure 2-1: Tank 50 Slurry Concentrations of I-129 (Linear Representation)

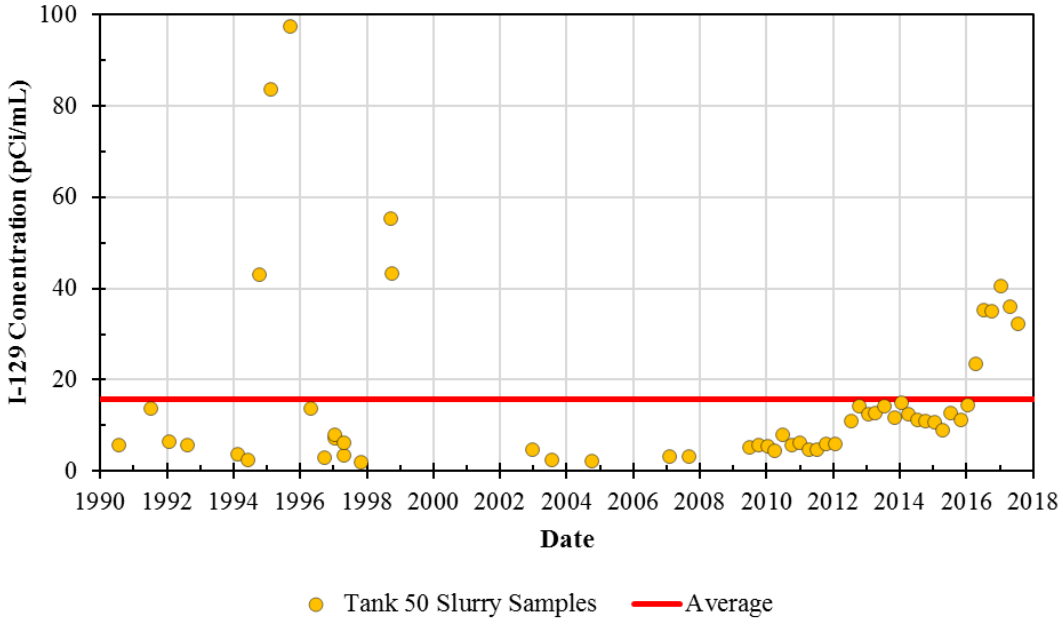


Figure 2-2: Tank 50 Slurry Concentrations of I-129 (Logarithmic Representation)

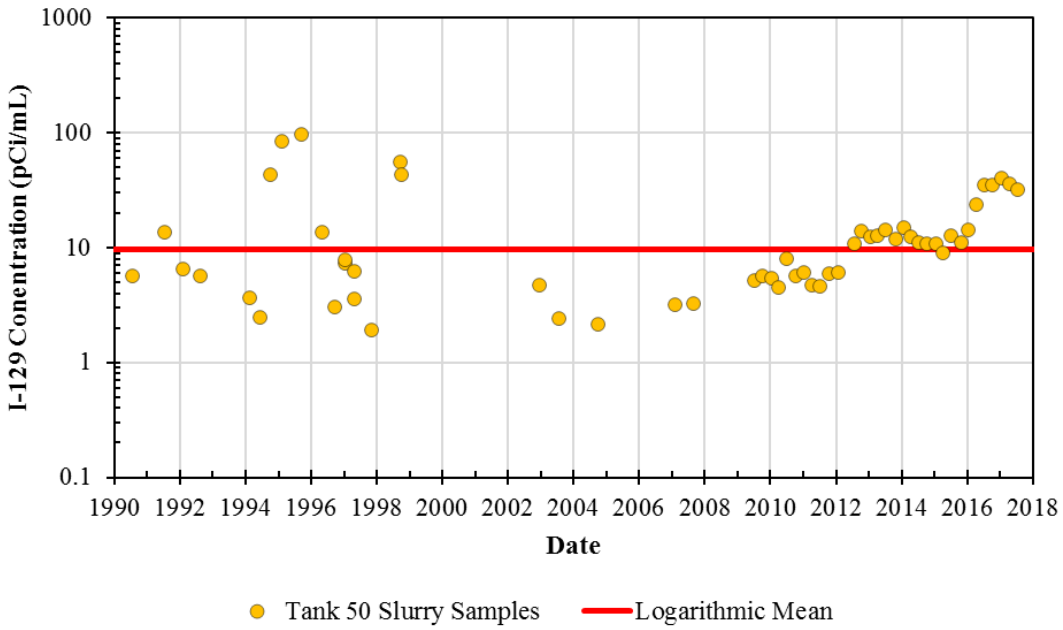
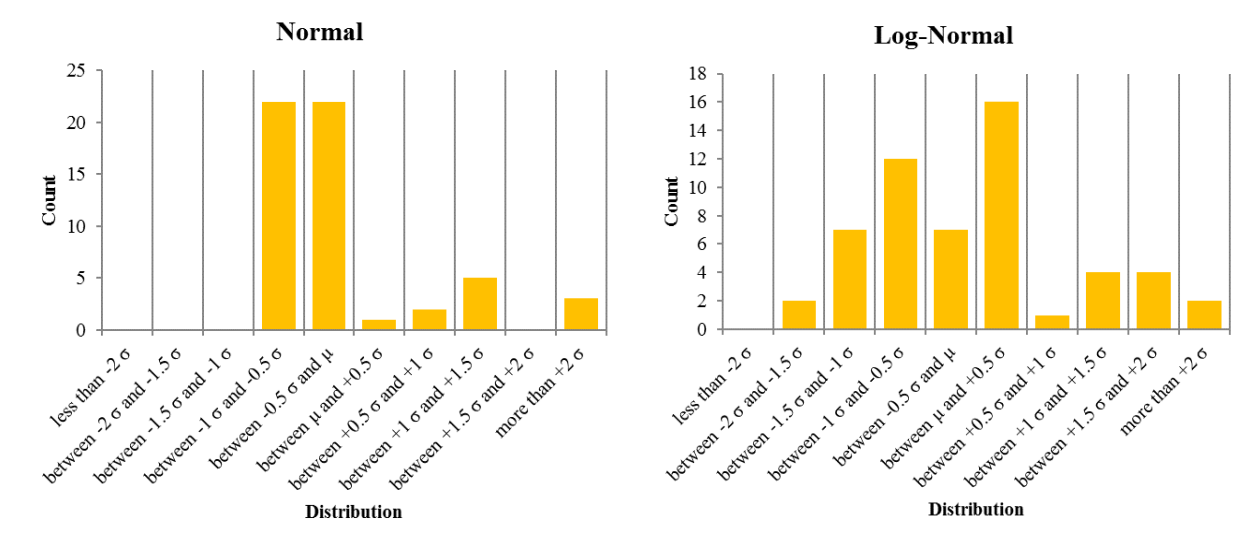


Figure 2-3 provides an alternative illustration of this distinctive behavior by presenting the number of sampled data points falling within increments of 0.5 standard deviations (σ) from the mean (μ) along normal versus log-normal distributions. Clearly, the log-normal distribution provides a more "bell-shaped" representation of the data points, indicating a better fit of the distribution.

Figure 2-3: Distribution Behavior of Tank 50 Concentrations of I-129



For this inventory projection, the linear mean of 15.8 pCi/mL (5.97E-08 Ci/gal) is assumed to be representative of all tank farm waste. To account for the increased volume required for salt batch preparations, this value was increased by a factor of three. This concentration was then applied to the total tank farm volume (3.50E+07 gal) from the September 2017 *Curie and Volume Inventory Report*. [SRR-LWP-2017-00057] Given this approach, the resulting inventory is 6.26 Ci of I-129 within the tank farms.

1.79E-07 Ci/gal (waste) × 3.50E+07 gal (total volume) = 6.26 Ci (tank farm inventory)

Combined with the 0.85 Ci of I-129 that had been disposed at SDF through 2017 (see Section 1.3.1) and the 0.058 estimated I-129 in residual tank wastes (see Section 1.3.2), this gives a total projected I-129 inventory of 7.16 Ci.

6.26 Ci (tank farm) + 0.85 Ci (SDF disposal) + 0.058 Ci (residual tank waste) = 7.18 Ci (total)

Despite a number of conservative assumptions in this approach, the inventory values projected using the concentrations from the SDF feed tank are lower than what has typically been projected.

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3.0 NORMALIZATION OF CONCENTRATION DATA

Previous projections of I-129 have been based on a fairly limited number of measured samples. By analyzing the available data, a predictive data model can be developed to improve I-129 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 3.1 presents the initial data, as sampled from the tank farms. In Section 3.2, the initial data is characterized and outliers are identified. In Section 3.3, the outlier data points were removed. Section 3.4 screens out samples with very low concentrations to prevent these entries from skewing results; this is a conservative approach. Section 3.5 identifies and removes the entries that reflect detection limits rather than actual measured I-129 values. Section 3.6 adjusts the I-129 data set for possible duplicate entries, by averaging very similar data points together (i.e., points sampled from the same tank on or near the same date), and assesses the remaining data to define the relationship between I-129 concentrations and Cs-137 concentrations. In Sections 3.7 and 3.8, samples of Cs-137 concentrations that do not include associated I-129 concentrations were included in the analysis, using the Cs-137 concentrations to generate surrogate values for I-129. Finally, Section 3.9 provides a high-level summary of the data normalization.

3.1 Initial Analysis of Available Concentration Data

Table 3-1 provides a summary of the historical I-129 concentrations and sample data (including the associated Cs-137 and Tc-99 concentrations) that are considered within this document. Similarly, Table 3-2 provides a summary of historical Cs-137 concentrations from samples in which I-129 was not analyzed. To ensure that the decay of Cs-137 or Tc-99 will not influence the analysis, the Cs-137 and Tc-99 concentrations in these tables have been decayed from the sample/analysis date to October 1, 2032. Due to the very long half-life of I-129 (approximately 1.57E+07 years), I-129 is not decayed in this dataset.

Table 3-1: Sampled Concentrations of I-129, Tc-99, and Cs-137

Tank	I-129 pCi/mL at Closure	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
11	7.60E+01	N/A	N/A	DPST-84-343	1/21/1976	N/A	Supernate
12	2.80E+02	N/A	N/A	DPST-84-343	1/21/1976	N/A	Supernate
9	< 1.77E+00	N/A	N/A	DPST-84-343	2/29/1984	2.000	Salt
10	< 1.77E+00	N/A	N/A	DPST-84-343	2/29/1984	2.000	Salt
15	2.90E+02	N/A	N/A	DPST-84-343	1/21/1976	N/A	Supernate
32	9.60E+01	N/A	N/A	DPST-84-343	2/29/1984	1.270	Supernate
30	3.00E+02	N/A	N/A	DPST-84-343	2/29/1984	1.650	Supernate
30	1.67E+02	N/A	N/A	SRNL-L3100-2017-00007	1/11/2017	1.371	Supernate
30	2.78E+02	N/A	N/A	SRNL-L3100-2017-00007	1/11/2017	1.477	Supernate
32	2.87E+02	N/A	N/A	SRNL-L3100-2017-00007	1/11/2017	1.439	Supernate
32	2.86E+02	N/A	N/A	SRNL-L3100-2017-00007	1/11/2017	1.495	Supernate
39	3.00E+01	N/A	N/A	SRNL-L3100-2017-00007	1/11/2017	1.209	Supernate
39	2.49E+01	N/A	N/A	SRNL-L3100-2017-00007	1/11/2017	1.204	Supernate

Table 3-1: Sampled Concentrations of I-129, Tc-99, and Cs-137 (Continued)

Tank	I-129 pCi/mL at Closure	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
23	< 1.35E+00	1.78E+02	2.84E+04	SRT-LWP-2003-00008	11/1/2002	N/A	Supernate
23	< 1.35E+00	1.78E+02	2.84E+04	WSRC-TR-2003-00112	11/1/2002	N/A	Supernate
24	8.69E+00	3.29E+02	1.39E+06	SRT-LWP-2003-00008	11/1/2002	N/A	Supernate
24	8.69E+00	3.29E+02	1.39E+06	WSRC-TR-2003-00112	11/1/2002	N/A	Supernate
23	< 2.39E+00	1.72E+02	4.48E+04	WSRC-TR-2003-00162, R0	3/20/2003	N/A	Supernate
30	3.78E+02	9.83E+05	1.18E+09	X-ESR-G-00004	5/12/2003	N/A	Supernate
30	< 5.15E+02	3.51E+05	4.21E+08	WSRC-TR-2004-00386, R1	5/12/2003	1.490	Supernate
46	< 1.36E+02	9.55E+04	2.59E+08	WSRC-TR-2004-00386, R1	6/23/2003	1.490	Supernate
46	< 3.94E+02	2.77E+05	7.50E+08	X-ESR-G-00004	6/23/2003	N/A	Supernate
41	1.35E+01	4.70E+04	5.09E+07	WSRC-TR-2003-00380, R1	7/10/2003	1.401	Supernate
39	< 8.78E+01	1.56E+06	3.78E+08	X-ESR-G-00004	7/10/2003	N/A	Supernate
39	< 1.14E+02	1.42E+06	3.44E+08	WSRC-TR-2004-00386, R1	7/11/2003	1.290	Supernate
37	< 4.30E+02	3.59E+05	7.09E+08	WSRC-TR-2004-00386, R1	10/10/2003	1.520	Supernate
37	< 1.03E+03	8.11E+05	2.10E+09	X-ESR-G-00004	10/10/2003	N/A	Supernate
49	< 1.56E+02	1.42E+05	3.00E+08	WSRC-TR-2004-00386, R1	10/20/2003	1.420	Supernate
13	2.33E+02	2.80E+05	8.43E+08	WSRC-TR-2004-00386, R1	10/20/2003	1.460	Supernate
49	< 2.65E+02	2.18E+05	6.94E+08	X-ESR-G-00004	10/20/2003	N/A	Supernate
13	5.36E+02	6.30E+05	1.82E+09	X-ESR-G-00004	10/20/2003	N/A	Supernate
23	4.91E-01	6.80E+01	2.72E+04	WSRC-TR-2005-00192, Rev. 1	2/15/2005	1.030	Supernate
23	6.67E-01	6.62E+01	2.94E+04	WSRC-TR-2005-00192, Rev. 1	2/15/2005	1.050	Supernate
49	< 1.35E+01	6.28E+04	6.83E+07	WSRC-TR-2005-00336	6/1/2005	1.370	Supernate
28	1.36E+02	1.99E+05	5.64E+08	WSRC-STI-2006-00151	2/15/2006	1.458	Supernate
28	< 1.79E+02	2.38E+04	5.39E+07	WSRC-STI-2006-00151	2/15/2006	N/A	Salt
25	< 3.94E+01	4.38E+04	7.44E+07	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	< 5.20E+01	2.88E+04	5.03E+07	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	< 6.05E+01	3.23E+04	6.26E+07	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	< 6.41E+01	1.17E+05	1.29E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	6.74E+01	7.64E+04	1.92E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	< 7.05E+01	1.02E+05	2.15E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	< 8.97E+01	9.25E+04	2.13E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	< 9.54E+01	1.66E+05	3.24E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	< 9.56E+01	8.54E+04	2.14E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
25	1.13E+02	1.42E+05	2.83E+08	WSRC-STI-2007-00123	6/7/2006	1.920	Salt
49	1.66E+01	7.16E+04	3.91E+07	WSRC-STI-2008-00117	12/7/2007	1.251	Supernate
49	1.88E+01	7.44E+04	4.06E+07	X-ESR-H-00120	12/7/2007	1.020	Supernate
51	8.33E+00	7.32E+03	8.52E+06	WSRC-STI-2008-00227	2/15/2008	1.200	Supernate
11	2.84E+01	6.45E+03	8.46E+06	WSRC-STI-2008-00227	2/15/2008	1.170	Supernate
23	< 2.61E+01	1.10E+04	1.31E+07	SRNS-TR-2008-00103	7/2/2008	1.178	Supernate
22	2.36E+00	6.93E+02	1.32E+05	SRNL-STI-2008-00446, rev 1	7/22/2008	1.024	Supernate
49	< 3.38E+01	6.89E+04	3.08E+07	SRNL-STI-2008-00446, rev 1	11/5/2008	1.273	Supernate
49	5.00E+01	6.89E+04	3.16E+07	X-ESR-H-00209, Rev. 0	1/5/2009	N/A	Supernate
24	2.79E+01	4.75E+04	5.87E+07	SRNL-STI-2009-00805	7/28/2009	N/A	Supernate
24	3.05E+01	4.78E+04	6.11E+07	X-ESR-H-00209, Rev. 0	7/28/2009	N/A	Supernate
21	1.03E+00	3.69E+02	1.65E+05	X-ESR-H-00209, Rev. 0	8/17/2009	N/A	Supernate

Table 3-1: Sampled Concentrations of I-129, Tc-99, and Cs-137 (Continued)

Tank	I-129 pCi/mL at Closure	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
21	< 1.03E+00	3.54E+02	1.61E+05	SRNL-STI-2009-00805	8/17/2009	N/A	Supernate
23	1.87E+01	2.41E+04	4.85E+07	SRNL-STI-2010-00017	11/16/2009	N/A	Supernate
23	1.88E+01	2.47E+04	4.95E+07	X-ESR-H-00209, Rev. 0	11/16/2009	N/A	Supernate
19	6.22E+00	4.34E+04	4.24E+08	SRNL-STI-2010-00439	2/1/2010	N/A	Residual
18	< 8.19E+00	3.40E+04	1.24E+08	SRNL-STI-2010-00386	2/1/2010	N/A	Residual
19	9.74E+00	5.54E+04	3.07E+08	SRNL-STI-2010-00439	2/1/2010	N/A	Residual
19	< 1.06E+01	3.55E+04	3.86E+08	SRNL-STI-2010-00439	2/1/2010	N/A	Residual
18	1.11E+01	3.67E+04	2.10E+08	SRNL-STI-2010-00386	2/1/2010	N/A	Residual
18	1.17E+01	2.90E+04	1.49E+08	SRNL-STI-2010-00386	2/1/2010	N/A	Residual
19	< 1.21E+01	3.55E+04	3.69E+08	SRNL-STI-2010-00439	2/1/2010	N/A	Residual
18	< 1.23E+01	4.13E+04	2.17E+08	SRNL-STI-2010-00386	2/1/2010	N/A	Residual
18	< 1.39E+01	5.02E+04	2.16E+08	SRNL-STI-2010-00386	2/1/2010	N/A	Residual
19	< 1.44E+01	3.61E+04	3.34E+08	SRNL-STI-2010-00439	2/1/2010	N/A	Residual
19	1.45E+01	3.16E+04	3.97E+08	SRNL-STI-2010-00439	2/1/2010	N/A	Residual
18	1.51E+01	4.79E+04	2.58E+08	SRNL-STI-2010-00386	2/1/2010	N/A	Residual
21	1.91E+01	2.06E+04	3.18E+07	SRNL-STI-2011-00061	9/23/2010	1.284	Supernate
21	1.30E+01	2.28E+04	3.64E+07	SRNL-STI-2012-00076	10/13/2011	1.301	Supernate
21	1.79E+01	2.17E+04	3.64E+07	SRNL-STI-2012-00707, Rev. 1	10/3/2012	1.304	Supernate
21	1.21E+01	1.67E+04	2.95E+07	SRNL-STI-2013-00437	5/16/2013	1.272	Supernate
35	1.23E+02	1.14E+05	3.19E+08	SRNL-STI-2013-00730	9/25/2013	1.267	Supernate
35	1.29E+02	1.06E+05	2.90E+08	SRNL-STI-2013-00730	9/25/2013	1.262	Supernate
16	2.94E+02	1.37E+05	1.18E+06	SRR-CWDA-2014-00071	1/1/2014	1.660	Residual
22	< 5.40E-01	2.87E+03	2.92E+06	SRNL-L3100-2014-00124	6/12/2014	N/A	Supernate
38	5.87E+00	1.48E+04	2.43E+07	SRNL-L3100-2014-00124	6/12/2014	N/A	Supernate
38	6.88E+00	1.40E+04	2.44E+07	SRNL-L3100-2014-00124	6/12/2014	N/A	Supernate
8	5.60E+01	4.80E+04	6.70E+07	SRNL-L3100-2014-00124	6/12/2014	N/A	Supernate
21	4.53E+01	5.76E+04	1.41E+08	SRNL-STI-2014-00561	9/18/2014	1.257	Supernate
41	< 6.60E+00	1.07E+04	1.01E+07	SRNL-L3100-2014-00193	10/1/2014	1.170	Supernate
43	4.45E+00	9.74E+03	2.31E+07	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00008	12/2/2014	1.170	Supernate
38	4.62E+00	1.96E+04	3.41E+07	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00008	12/2/2014	1.300	Supernate
38	6.13E+00	1.41E+04	3.50E+07	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00008	12/2/2014	1.330	Supernate
43	6.17E+00	1.33E+04	2.25E+07	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00008	12/2/2014	1.180	Supernate
13	< 1.06E+01	4.92E+04	1.71E+08	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00064	12/16/2014	1.080	Supernate
13	< 2.30E+01	5.72E+04	1.78E+08	SRNL-L3100-2015-00032, Rev. 1 and SRNL-STI-2015-00064	12/16/2014	1.070	Supernate
35	2.47E+01	1.47E+05	4.53E+08	SRNL-STI-2015-00224	3/9/2015	1.370	Supernate
35	5.77E+01	4.03E+04	1.36E+08	SRNL-STI-2015-00224	3/9/2015	1.220	Supernate
35	1.64E+02	1.26E+05	4.44E+08	SRNL-STI-2015-00224	3/9/2015	1.340	Supernate
39	2.49E+01	2.18E+04	5.60E+07	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.204	Supernate
39	3.00E+01	2.46E+04	5.66E+07	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.209	Supernate

Table 3-1: Sampled Concentrations of I-129, Tc-99, and Cs-137 (Continued)

Tank	I-129 pCi/mL at Closure	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
37	< 4.42E+02	1.01E+05	3.18E+08	SRNL-L3100-2016-00221	6/1/2015	N/A	Supernate
37	< 5.23E+02	1.09E+05	3.09E+08	SRNL-L3100-2016-00221	6/1/2015	N/A	Supernate
30	1.67E+02	2.48E+05	6.59E+08	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.371	Supernate
32	2.86E+02	4.26E+05	9.59E+08	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.495	Supernate
30	2.78E+02	3.68E+05	1.04E+09	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.477	Supernate
32	2.87E+02	2.97E+05	8.80E+08	SRNL-L3100-2016-00221 and SRNL-L3100-2017-00007	6/1/2015	1.439	Supernate
12	5.82E+03	5.27E+03	7.49E+06	SRR-CWDA-2015-00075, Rev.1	6/1/2015	1.280	Residual
23	1.42E+01	2.66E+04	4.94E+07	SRNL-STI-2015-00369	6/8/2015	1.270	Supernate
23	4.00E+01	4.16E+04	1.00E+08	SRNL-STI-2015-00369	6/8/2015	1.160	Supernate
23	4.09E+01	4.19E+04	1.07E+08	SRNL-STI-2015-00369	6/8/2015	1.170	Supernate
4	< 1.09E+01	3.74E+04	9.81E+07	SRNL-STI-2015-00456	8/19/2015	1.110	Supernate
4	1.26E+01	3.56E+04	1.01E+08	SRNL-STI-2015-00456	8/19/2015	1.100	Supernate
21	4.97E+01	6.28E+04	1.65E+08	SRNL-STI-2015-00622	9/1/2015	1.250	Supernate
38	< 7.07E+00	1.80E+04	3.78E+07	SRNL-STI-2015-00662	10/12/2015	1.050	Supernate
43	< 4.64E+00	2.25E+04	3.38E+07	SRNL-STI-2015-00662	10/12/2015	1.220	Supernate
43	< 6.71E+00	2.02E+04	3.44E+07	SRNL-STI-2015-00662	10/12/2015	1.220	Supernate
51	1.19E+03	7.24E+04	1.73E+08	SRNL-STI-2016-00026, Rev. 1	10/20/2015	1.150	Sludge
50	1.11E+01	1.54E+04	3.48E+05	SRNL-L3100-2015-00227	10/30/2015	1.238	Supernate
50	1.44E+01	1.96E+04	8.58E+05	SRNL-L3100-2016-00069	1/14/2016	1.234	Supernate
50	2.35E+01	3.24E+04	4.44E+05	SRNL-L3100-2016-00124	4/6/2016	1.237	Supernate
22	< 4.28E+01	1.13E+04	3.00E+07	SRNL-L3100-2016-00221	6/1/2016	N/A	Supernate
41	< 6.76E+01	2.22E+04	2.51E+07	SRNL-L3100-2016-00221	6/1/2016	N/A	Supernate
38	< 2.45E+02	2.40E+04	4.52E+07	SRNL-L3100-2016-00221	6/1/2016	N/A	Supernate
21	2.57E+01	3.87E+04	8.61E+07	SRNL-STI-2017-00055	11/21/2016	1.254	Supernate
50	3.49E+01	4.35E+04	3.67E+05	SRNL-L3100-2016-00229	10/4/2016	1.235	Supernate
50	3.53E+01	4.04E+04	1.87E+05	SRNL-L3100-2016-00173	7/14/2016	1.242	Supernate
21	2.88E+01	4.17E+04	1.09E+08	SRNL-STI-2017-00698	7/31/2017	1.269	Supernate
50	4.04E+01	4.70E+04	1.85E+05	SRNL-L3100-2017-00033	1/16/2017	1.238	Supernate
40	< 1.20E+02	2.10E+04	3.29E+07	SRNL-L3100-2017-00029	4/12/2017	N/A	Sludge
50	3.60E+01	4.80E+04	6.64E+05	SRNL-L3100-2017-00076	4/19/2017	1.236	Supernate
50	3.23E+01	4.39E+04	6.28E+05	SRNL-L3100-2017-00116	7/17/2017	1.240	Supernate
24	5.14E+02	3.95E+05	1.43E+09	SRNL-L3100-2017-00108	7/1/2017	1.488	Supernate
25	4.82E+01	1.57E+05	4.10E+08	SRNL-L3100-2017-00141	7/21/2017	1.380	Supernate
34	1.22E+02	2.11E+05	7.53E+08	SRNL-L3100-2017-00141	7/21/2017	1.430	Supernate
36	4.34E+02	4.28E+05	2.53E+09	SRNL-L3100-2017-00141	8/21/2017	1.480	Supernate
42	2.18E+02	3.26E+05	1.16E+09	SRNL-L3100-2017-00141	8/14/2017	1.460	Supernate

Note: All Tc-99 and Cs-137 concentrations have been decayed to October 1, 2032.
NA = Not Available

Table 3-2: Concentrations of Cs-137 for Samples without Associated I-129 Concentrations

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
19	1.38E+07	DPST-81-00329	5/1/1981	N/A	Supernate
19	9.68E+06	DPST-81-00329	5/1/1981	N/A	Supernate
20	3.22E+06	HLW-HLE-94-0328	11/1/1985	1.170	N/A
20	2.61E+07	HLW-HLE-94-0328	11/15/1985	1.370	N/A
22	1.03E+07	CBU-PIT-2005-00127	5/21/1986	N/A	Supernate
22	1.02E+07	HLW-HLE-94-0328	5/21/1986	1.260	N/A
21	7.30E+05	HLW-HLE-94-0328	6/4/1986	1.040	N/A
20	2.03E+07	HLW-HLE-94-0328	7/14/1986	1.340	N/A
20	9.70E+04	HLW-HLE-94-0328	8/2/1986	1.220	N/A
20	9.35E+06	HLW-HLE-94-0328	9/3/1986	1.210	N/A
21	8.33E+06	CBU-PIT-2005-00127	9/10/1986	N/A	Supernate
21	6.60E+07	CBU-PIT-2005-00127	9/22/1986	N/A	Supernate
21	6.57E+07	HLW-HLE-94-0328	9/22/1986	1.170	N/A
21	3.82E+07	CBU-PIT-2005-00127	9/24/1986	N/A	Supernate
21	3.75E+07	HLW-HLE-94-0328	9/24/1986	1.210	N/A
21	8.46E+06	HLW-HLE-94-0328	10/9/1986	1.060	N/A
20	9.44E+06	CBU-PIT-2005-00127	1/5/1987	N/A	Supernate
50	5.73E+02	HLW-HLE-94-0328	6/28/1990	N/A	N/A
50	6.05E+02	HLW-HLE-94-0328	6/28/1990	N/A	N/A
50	6.78E+02	HLW-HLE-94-0328	2/28/1992	N/A	N/A
50	6.49E+02	HLW-HLE-94-0328	2/28/1992	N/A	N/A
50	7.57E+02	HLW-HLE-94-0328	3/30/1992	N/A	N/A
50	6.65E+02	HLW-HLE-94-0328	3/30/1992	N/A	N/A
30	9.95E+08	HLW-HLE-94-0328	4/10/1992	1.336	N/A
33	1.96E+08	HLW-HLE-94-0328	4/29/1992	1.245	N/A
34	1.98E+08	CBU-PIT-2005-00127	4/30/1992	N/A	Supernate
34	1.96E+08	HLW-HLE-94-0328	4/30/1992	1.218	N/A
50	7.89E+02	HLW-HLE-94-0328	5/4/1992	N/A	N/A
50	7.89E+02	HLW-HLE-94-0328	5/4/1992	N/A	N/A
50	1.43E+03	HLW-HLE-94-0328	6/4/1992	N/A	N/A
50	9.28E+02	HLW-HLE-94-0328	6/4/1992	N/A	N/A
27	3.93E+08	CBU-PIT-2005-00127	7/21/1992	N/A	Supernate
27	3.94E+08	WSRC-RP-93-1009	7/21/1992	1.453	Supernate
27	3.93E+08	HLW-HLE-94-0328	7/21/1992	1.453	N/A
28	4.77E+08	CBU-PIT-2005-00127	7/21/1992	N/A	Supernate
28	4.65E+08	WSRC-RP-93-1009	7/21/1992	1.474	Supernate
28	4.65E+08	HLW-HLE-94-0328	7/21/1992	1.474	N/A
25	4.47E+08	WSRC-RP-93-1009	7/24/1992	1.482	Supernate
50	9.40E+02	HLW-HLE-94-0328	7/28/1992	N/A	N/A
50	9.95E+02	HLW-HLE-94-0328	7/28/1992	N/A	N/A
26	5.73E+08	WSRC-RP-93-1009	7/29/1992	1.546	Supernate
26	5.57E+08	CBU-PIT-2005-00127	8/14/1992	N/A	Supernate

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
26	5.74E+08	HLW-HLE-94-0328	8/14/1992	1.546	N/A
50	9.77E+02	HLW-HLE-94-0328	8/31/1992	N/A	N/A
50	9.77E+02	HLW-HLE-94-0328	8/31/1992	N/A	N/A
30	9.97E+08	CBU-PIT-2005-00127	10/4/1992	N/A	Supernate
50	9.92E+02	HLW-HLE-94-0328	11/4/1992	N/A	N/A
50	8.92E+02	HLW-HLE-94-0328	11/4/1992	N/A	N/A
29	1.17E+09	WSRC-RP-93-1009	11/23/1992	1.430	Supernate
30	8.66E+08	WSRC-RP-93-1009	11/23/1992	1.280	Supernate
32	3.97E+08	WSRC-RP-93-1009	11/23/1992	1.240	Supernate
38	3.97E+08	WSRC-RP-93-1009	11/23/1992	1.470	Supernate
43	2.70E+08	WSRC-RP-93-1009	11/23/1992	1.430	Supernate
38	3.96E+08	CBU-PIT-2005-00127	11/24/1992	N/A	Supernate
38	3.97E+08	HLW-HLE-94-0328	11/24/1992	1.470	N/A
43	2.72E+08	CBU-PIT-2005-00127	11/24/1992	N/A	Supernate
43	2.71E+08	HLW-HLE-94-0328	11/24/1992	1.430	N/A
29	1.16E+09	CBU-PIT-2005-00127	11/28/1992	N/A	Supernate
29	1.17E+09	HLW-HLE-94-0328	11/28/1992	1.430	N/A
30	8.81E+08	CBU-PIT-2005-00127	11/29/1992	N/A	Supernate
30	8.65E+08	HLW-HLE-94-0328	11/29/1992	1.280	N/A
32	3.96E+08	CBU-PIT-2005-00127	11/29/1992	N/A	Supernate
32	3.97E+08	HLW-HLE-94-0328	11/29/1992	1.240	N/A
50	5.31E+02	HLW-HLE-94-0328	12/9/1992	N/A	N/A
50	5.66E+02	HLW-HLE-94-0328	12/9/1992	N/A	N/A
50	1.38E+03	HLW-HLE-94-0328	1/31/1993	N/A	N/A
50	1.37E+03	HLW-HLE-94-0328	1/31/1993	N/A	N/A
50	1.20E+03	HLW-HLE-94-0328	2/20/1993	N/A	N/A
50	1.14E+03	HLW-HLE-94-0328	2/20/1993	N/A	N/A
50	9.50E+02	HLW-HLE-94-0328	3/18/1993	N/A	N/A
50	1.00E+03	HLW-HLE-94-0328	3/18/1993	N/A	N/A
50	1.05E+03	HLW-HLE-94-0328	6/24/1993	N/A	N/A
50	1.11E+03	HLW-HLE-94-0328	6/24/1993	N/A	N/A
50	1.01E+03	HLW-HLE-94-0328	8/2/1993	N/A	N/A
50	1.02E+03	HLW-HLE-94-0328	8/2/1993	N/A	N/A
50	1.01E+03	HLW-HLE-94-0328	8/19/1993	N/A	N/A
50	1.01E+03	HLW-HLE-94-0328	8/19/1993	N/A	N/A
50	9.10E+02	HLW-HLE-94-0328	9/16/1993	N/A	N/A
50	9.10E+02	HLW-HLE-94-0328	9/16/1993	N/A	N/A
50	9.63E+02	HLW-HLE-94-0328	10/12/1993	N/A	N/A
50	9.63E+02	HLW-HLE-94-0328	10/12/1993	N/A	N/A
50	9.65E+02	HLW-HLE-94-0328	11/25/1993	N/A	N/A
50	9.65E+02	HLW-HLE-94-0328	11/25/1993	N/A	N/A
44	5.86E+08	WSRC-TR-2004-00375, Rev. 1	5/12/1999	N/A	Supernate
35	3.50E+08	WSRC-TR-2004-00375, Rev. 1	6/25/2000	N/A	Supernate
33	9.17E+06	WSRC-TR-2004-00375, Rev. 1	6/27/2000	N/A	Supernate

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
23	4.10E+04	WSRC-TR-2004-00375, Rev. 1	11/1/2002	N/A	Supernate
23	1.58E+04	WSRC-TR-2004-00375, Rev. 1	11/1/2002	N/A	Supernate
45	5.69E+08	WSRC-TR-2004-00375, Rev. 1	6/9/2003	N/A	Supernate
45	6.37E+08	X-ESR-G-00004	6/9/2003	N/A	Supernate
46	7.64E+08	WSRC-TR-2004-00375, Rev. 1	6/23/2003	N/A	Supernate
41	5.09E+07	WSRC-TR-2004-00375, Rev. 1	7/10/2003	N/A	Supernate
41	5.09E+07	SRT-LWP-2003-00061	7/10/2003	1.400	Supernate
3	2.00E+08	WSRC-TR-2004-00131	8/5/2003	2.070	Salt
3	4.74E+08	WSRC-TR-2004-00131	8/5/2003	2.070	Salt
3	8.28E+08	WSRC-TR-2004-00131	8/5/2003	1.470	Supernate
3	8.90E+08	WSRC-TR-2004-00131	8/5/2003	1.500	Supernate
3	9.57E+08	WSRC-TR-2004-00131	8/5/2003	1.520	Supernate
3	9.61E+08	WSRC-TR-2004-00131	8/5/2003	1.490	Supernate
29	6.99E+08	WSRC-TR-2004-00130	8/26/2003	2.130	Salt
29	3.55E+08	WSRC-TR-2004-00130	9/11/2003	1.260	Supernate
2	1.02E+08	WSRC-TR-2004-00131	9/12/2003	2.040	Salt
38	3.70E+07	WSRC-TR-2004-00129	9/1/2003	1.940	Salt
2	8.39E+08	WSRC-TR-2004-00131	9/10/2003	1.500	Supernate
38	8.85E+07	WSRC-TR-2004-00129	9/11/2003	1.450	Supernate
38	3.70E+07	WSRC-TR-2004-00129	9/11/2003	1.940	Salt
41	7.39E+07	WSRC-TR-2004-00375, Rev. 1	9/12/2003	N/A	Supernate
41	7.90E+07	WSRC-TR-2004-00375, Rev. 1	9/12/2003	N/A	Supernate
48	6.38E+06	WSRC-TR-2003-00720	9/17/2003	1.148	Supernate
41	8.97E+07	WSRC-TR-2004-00375, Rev. 1	9/18/2003	N/A	Supernate
41	8.77E+07	WSRC-TR-2004-00375, Rev. 1	9/18/2003	N/A	Supernate
10	1.27E+08	WSRC-TR-2004-00164	10/23/2003	2.170	Salt
10	8.51E+07	WSRC-TR-2004-00164	10/23/2003	1.980	Salt
10	4.52E+08	WSRC-TR-2004-00164	10/23/2003	1.435	Supernate
10	5.03E+08	WSRC-TR-2004-00164	10/23/2003	1.438	Supernate
28	1.47E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	1.45E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	5.89E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	1.53E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	3.01E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	6.43E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	4.49E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	6.47E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
28	3.00E+08	WSRC-STI-2006-00151	2/14/2006	1.900	Salt
25	3.88E+08	WSRC-STI-2007-00123	6/7/2006	1.440	Supernate
39	9.55E+07	WSRC-TR-2007-00199, Rev. 1	4/2/2007	1.230	Supernate
51	1.23E+07	WSRC-STI-2007-00697	5/31/2007	1.060	Supernate
49	1.50E+08	WSRC-STI-2008-00117	1/18/2008	1.258	Supernate
5	4.39E+06	SRNL-L3100-2008-00020	6/24/2008	1.022	Residual
6	1.42E+07	SRNL-L3100-2008-00021	7/15/2008	1.100	Residual

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
5	1.63E+08	SRNL-L3100-2008-00020	9/24/2008	1.040	Residual
6	4.15E+06	SRNL-L3100-2008-00021	9/25/2008	1.035	Residual
48	7.21E+06	SRNL-STI-2012-00420	2/28/2012	1.198	Supernate
22	1.63E+06	SRR-LWE-2012-00198, Rev. 1	8/23/2012	N/A	Supernate
7	4.16E+07	SRR-LWE-2012-00198, Rev. 1	8/29/2012	N/A	Supernate
8	4.35E+07	SRR-LWE-2012-00198, Rev. 1	8/29/2012	N/A	Supernate
4	3.60E+07	SRR-LWE-2012-00198, Rev. 1	9/6/2012	N/A	Supernate
21	2.46E+07	SRR-LWE-2012-00198, Rev. 1	10/3/2012	N/A	Supernate
11	3.31E+07	SRNL-L3100-2013-00094	5/10/2013	1.217	Supernate
35	4.70E+08	SRNL-STI-2013-00730	8/28/2013	N/A	Supernate
35	3.20E+08	SRNL-L3100-2013-00212	11/14/2013	N/A	Supernate
35	2.91E+08	SRNL-L3100-2013-00212	11/14/2013	N/A	Supernate
35	4.72E+08	SRNL-L3100-2013-00212	11/14/2013	N/A	Supernate
38	2.31E+07	SRNL-STI-2014-00081	1/15/2014	1.215	Supernate
38	2.39E+07	SRNL-STI-2014-00081	1/15/2014	1.240	Supernate
43	1.52E+07	SRNL-STI-2014-00081	1/15/2014	1.150	Supernate
43	1.60E+07	SRNL-STI-2014-00081	1/15/2014	1.160	Supernate
38	3.16E+07	SRNL-TR-2014-00141	6/2/2014	1.287	Supernate
38	2.84E+07	SRNL-TR-2014-00141	6/2/2014	1.288	Supernate
43	2.02E+07	SRNL-TR-2014-00141	6/2/2014	1.197	Supernate
43	1.90E+07	SRNL-TR-2014-00141	6/2/2014	1.188	Supernate
50	1.71E+06	SRNL-L3100-2014-00221	9/30/2014	1.239	Supernate
50	8.65E+05	SRNL-L3100-2014-00279	1/7/2015	1.241	Supernate
50	5.66E+05	SRNL-L3100-2015-00065	4/16/2015	1.235	Supernate
50	4.39E+05	SRNL-L3100-2015-00107	7/6/2015	1.236	Supernate
50	3.69E+05	SRNL-L3100-2015-00178	7/9/2015	1.236	Supernate
51	1.66E+08	SRNL-STI-2017-00486	5/1/2017	1.100	Supernate
16	3.16E+08	HLW-HLE-94-0328	5/25/1960	1.370	N/A
16	9.27E+08	HLW-HLE-94-0328	5/25/1960	N/A	N/A
11	4.30E+05	DPSPU 78-11-12	6/1/1962	N/A	Supernate
1	9.12E+05	DPSPU 78-11-8	4/1/1963	1.284	Supernate
3	2.29E+08	DPSPU 83-11-9	5/9/1963	1.295	Supernate
9	5.73E+07	DPSPU 79-11-1	4/1/1965	1.264	Supernate
14	3.24E+08	DPSPU 77-11-19	12/1/1963	1.300	Supernate
14	3.53E+08	DPSPU 77-11-19	4/1/1965	1.318	Supernate
15	1.45E+08	DPSPU 77-11-26	9/21/1966	1.340	Supernate
11	3.05E+05	DPSPU 78-11-12	12/1/1969	N/A	Sludge
3	8.88E+07	DPSPU 83-11-9	3/1/1970	2.120	Salt
4	1.24E+09	DPSPU 80-11-9	6/1/1972	N/A	Supernate
4	1.24E+09	HLW-HLE-94-0328	6/23/1972	N/A	N/A
18	1.25E+09	HLW-HLE-94-0328	9/7/1972	N/A	N/A
13	1.14E+08	DPSPU-78-11-2	12/19/1972	1.200	Supernate
13	1.14E+08	HLW-HLE-94-0328	12/19/1972	1.200	N/A
15	5.70E+08	HLW-HLE-94-0328	12/19/1972	1.290	N/A

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
14	2.28E+08	HLW-HLE-94-0328	1/3/1973	1.380	N/A
10	9.11E+08	HLW-HLE-94-0328	1/5/1973	1.390	N/A
9	4.57E+08	HLW-HLE-94-0328	1/11/1973	1.390	N/A
2	9.13E+08	HLW-HLE-94-0328	2/20/1973	1.410	N/A
1	1.61E+09	HLW-HLE-94-0328	2/21/1973	1.410	N/A
5	2.63E+09	HLW-HLE-94-0328	3/1/1973	1.400	N/A
6	4.58E+08	HLW-HLE-94-0328	3/1/1973	1.220	N/A
8	2.98E+07	HLW-HLE-94-0328	3/8/1973	1.200	N/A
18	3.47E+07	HLW-HLE-94-0328	8/22/1973	N/A	N/A
1	1.18E+09	HLW-HLE-94-0328	8/5/1974	N/A	N/A
2	1.54E+09	HLW-HLE-94-0328	8/24/1974	N/A	N/A
10	5.33E+08	HLW-HLE-94-0328	8/27/1974	N/A	N/A
24	8.27E+07	HLW-HLE-94-0328	8/27/1974	N/A	N/A
1	1.80E+09	HLW-HLE-94-0328	3/12/1975	N/A	N/A
11	3.63E+08	HLW-HLE-94-0328	7/17/1975	N/A	N/A
11	3.63E+08	HLW-HLE-94-0328	8/8/1975	N/A	N/A
15	2.43E+08	HLW-HLE-94-0328	10/9/1975	N/A	N/A
18	1.08E+08	HLW-HLE-94-0328	10/14/1975	1.364	N/A
19	8.99E+07	HLW-HLE-94-0328	10/14/1975	1.430	N/A
20	1.58E+08	HLW-HLE-94-0328	10/14/1975	1.446	N/A
17	2.92E+05	HLW-HLE-94-0328	10/20/1975	1.164	N/A
22	1.95E+06	HLW-HLE-94-0328	10/24/1975	1.202	N/A
23	3.65E+03	HLW-HLE-94-0328	10/24/1975	1.005	N/A
24	4.87E+07	HLW-HLE-94-0328	10/24/1975	1.113	N/A
15	2.44E+08	HLW-HLE-94-0328	12/18/1975	N/A	N/A
34	9.76E+08	HLW-HLE-94-0328	1/12/1976	N/A	N/A
31	1.15E+09	HLW-HLE-94-0328	6/11/1976	N/A	N/A
32	4.08E+08	HLW-HLE-94-0328	6/11/1976	N/A	N/A
13	6.43E+08	HLW-HLE-94-0328	6/15/1976	N/A	N/A
10	6.68E+08	HLW-HLE-94-0328	6/18/1976	N/A	N/A
22	4.45E+07	HLW-HLE-94-0328	6/23/1976	N/A	N/A
8	3.71E+08	HLW-HLE-94-0328	7/1/1976	N/A	N/A
29	6.32E+08	HLW-HLE-94-0328	7/14/1976	N/A	N/A
17	1.00E+06	HLW-HLE-94-0328	7/20/1976	N/A	N/A
18	1.23E+05	HLW-HLE-94-0328	7/20/1976	N/A	N/A
21	4.98E+07	HLW-HLE-94-0328	10/12/1976	N/A	N/A
18	3.77E+07	HLW-HLE-94-0328	4/5/1977	N/A	N/A
23	1.50E+03	HLW-HLE-94-0328	4/6/1977	N/A	N/A
11	7.19E+07	HLW-HLE-94-0328	11/6/1978	N/A	N/A
12	3.22E+08	HLW-HLE-94-0328	12/18/1978	N/A	N/A
10	5.96E+07	HLW-HLE-94-0328	6/22/1979	1.380	N/A
16	1.95E+07	HLW-HLE-94-0328	11/19/1979	N/A	N/A
13	5.92E+07	HLW-HLE-94-0328	2/25/1981	1.440	N/A
31	9.93E+07	HLW-HLE-94-0328	2/25/1981	1.500	N/A

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
26	5.51E+08	HLW-HLE-94-0328	12/3/1981	1.520	N/A
28	3.34E+08	HLW-HLE-94-0328	12/3/1981	N/A	N/A
24	9.50E+07	HLW-HLE-94-0328	9/3/1983	1.060	N/A
23	4.86E+06	HLW-HLE-94-0328	1/11/1985	N/A	N/A
29	6.04E+07	HLW-HLE-94-0328	1/11/1985	N/A	N/A
20	5.56E+06	HLW-HLE-94-0328	1/22/1985	N/A	N/A
22	1.15E+05	HLW-HLE-94-0328	1/22/1985	N/A	N/A
43	2.76E+07	HLW-HLE-94-0328	1/22/1985	N/A	N/A
44	6.37E+07	HLW-HLE-94-0328	1/22/1985	N/A	N/A
10	1.67E+07	HLW-HLE-94-0328	2/28/1985	N/A	N/A
12	8.18E+07	HLW-HLE-94-0328	2/28/1985	N/A	N/A
15	1.52E+07	HLW-HLE-94-0328	2/28/1985	N/A	N/A
35	1.22E+08	HLW-HLE-94-0328	2/28/1985	N/A	N/A
38	9.91E+05	HLW-HLE-94-0328	2/28/1985	N/A	N/A
25	6.58E+07	HLW-HLE-94-0328	4/9/1985	N/A	N/A
28	9.41E+07	HLW-HLE-94-0328	4/9/1985	N/A	N/A
34	4.31E+07	HLW-HLE-94-0328	4/9/1985	N/A	N/A
47	1.63E+07	HLW-HLE-94-0328	4/9/1985	N/A	N/A
25	7.79E+07	HLW-HLE-94-0328	8/19/1985	1.640	N/A
28	7.03E+07	HLW-HLE-94-0328	8/19/1985	1.410	N/A
34	2.44E+07	HLW-HLE-94-0328	8/19/1985	1.226	N/A
15	1.22E+08	HLW-HLE-94-0328	9/6/1985	1.170	N/A
7	4.44E+07	HLW-HLE-94-0328	11/26/1985	1.285	N/A
8	9.09E+07	HLW-HLE-94-0328	11/26/1985	1.247	N/A
7	4.45E+07	HLW-HLE-94-0328	12/20/1985	N/A	N/A
10	1.22E+07	HLW-HLE-94-0328	12/20/1985	N/A	N/A
34	2.63E+07	HLW-HLE-94-0328	12/20/1985	N/A	N/A
8	1.27E+07	HLW-HLE-94-0328	12/31/1985	N/A	N/A
20	1.77E+07	HLW-HLE-94-0328	2/20/1986	1.354	N/A
22	5.89E+05	HLW-HLE-94-0328	2/20/1986	1.075	N/A
10	1.04E+06	HLW-HLE-94-0328	2/24/1986	1.060	N/A
38	1.25E+06	HLW-HLE-94-0328	2/24/1986	1.221	N/A
50	7.84E+07	HLW-HLE-94-0328	2/24/1986	1.247	N/A
20	2.17E+07	HLW-HLE-94-0328	3/14/1986	1.370	N/A
39	1.29E+08	HLW-HLE-94-0328	3/14/1986	1.302	N/A
43	4.28E+07	HLW-HLE-94-0328	3/14/1986	1.360	N/A
7	6.64E+07	HLW-HLE-94-0328	4/4/1986	1.350	N/A
34	3.59E+07	HLW-HLE-94-0328	4/4/1986	1.250	N/A
45	1.32E+08	HLW-HLE-94-0328	4/4/1986	1.470	N/A
47	7.09E+07	HLW-HLE-94-0328	4/4/1986	1.473	N/A
13	2.24E+08	HLW-HLE-94-0328	4/21/1986	1.448	N/A
36	2.28E+08	HLW-HLE-94-0328	4/21/1986	1.514	N/A
38	1.53E+06	HLW-HLE-94-0328	4/21/1986	1.272	N/A
10	4.77E+06	HLW-HLE-94-0328	4/25/1986	1.176	N/A

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
20	2.02E+07	HLW-HLE-94-0328	4/26/1986	1.327	N/A
20	2.49E+07	HLW-HLE-94-0328	5/22/1986	1.370	N/A
20	1.87E+07	HLW-HLE-94-0328	6/3/1986	1.357	N/A
22	2.01E+07	HLW-HLE-94-0328	6/11/1986	1.370	N/A
30	7.59E+07	HLW-HLE-94-0328	6/11/1986	1.313	N/A
31	2.41E+08	HLW-HLE-94-0328	6/11/1986	1.511	N/A
32	2.93E+08	HLW-HLE-94-0328	6/11/1986	1.295	N/A
37	3.90E+08	HLW-HLE-94-0328	6/11/1986	1.484	N/A
50	2.44E+06	HLW-HLE-94-0328	6/11/1986	1.281	N/A
11	1.11E+07	HLW-HLE-94-0328	6/19/1986	1.233	N/A
39	4.31E+07	HLW-HLE-94-0328	7/17/1986	N/A	N/A
20	3.03E+06	HLW-HLE-94-0328	8/8/1986	N/A	N/A
20	3.72E+06	HLW-HLE-94-0328	8/8/1986	N/A	N/A
20	1.20E+07	HLW-HLE-94-0328	8/8/1986	1.230	N/A
21	4.68E+07	HLW-HLE-94-0328	8/13/1986	1.150	N/A
26	5.85E+07	HLW-HLE-94-0328	8/18/1986	1.402	N/A
33	4.59E+07	HLW-HLE-94-0328	8/18/1986	1.263	N/A
21	6.25E+07	HLW-HLE-94-0328	9/2/1986	1.170	N/A
38	3.17E+06	HLW-HLE-94-0328	9/9/1986	0.988	N/A
39	1.26E+08	HLW-HLE-94-0328	9/9/1986	1.157	N/A
41	3.64E+07	HLW-HLE-94-0328	9/9/1986	1.079	N/A
48	1.09E+07	HLW-HLE-94-0328	9/9/1986	0.991	N/A
22	1.67E+07	HLW-HLE-94-0328	9/22/1986	1.270	N/A
30	8.57E+07	HLW-HLE-94-0328	10/15/1986	N/A	N/A
7	5.09E+07	HLW-HLE-94-0328	11/25/1986	1.154	N/A
27	6.46E+07	HLW-HLE-94-0328	11/25/1986	1.298	N/A
44	4.74E+07	HLW-HLE-94-0328	11/25/1986	1.220	N/A
45	1.05E+08	HLW-HLE-94-0328	11/25/1986	1.332	N/A
47	1.00E+08	HLW-HLE-94-0328	11/25/1986	1.394	N/A
19	9.08E+05	HLW-HLE-94-0328	11/26/1986	1.020	N/A
28	3.75E+07	HLW-HLE-94-0328	11/26/1986	1.185	N/A
38	1.68E+04	HLW-HLE-94-0328	1/1/1987	1.172	N/A
26	5.88E+07	HLW-HLE-94-0328	1/20/1987	N/A	N/A
33	3.44E+07	HLW-HLE-94-0328	1/20/1987	N/A	N/A
42	4.07E+06	HLW-HLE-94-0328	1/20/1987	N/A	N/A
13	2.22E+08	HLW-HLE-94-0328	1/21/1987	N/A	N/A
40	1.15E+06	HLW-HLE-94-0328	1/27/1987	0.950	N/A
43	2.33E+07	HLW-HLE-94-0328	2/24/1987	1.226	N/A
21	4.04E+05	HLW-HLE-94-0328	4/1/1987	N/A	N/A
37	3.04E+08	HLW-HLE-94-0328	4/1/1987	N/A	N/A
39	1.00E+08	HLW-HLE-94-0328	4/1/1987	N/A	N/A
41	4.40E+07	HLW-HLE-94-0328	4/1/1987	N/A	N/A
23	1.09E+07	HLW-HLE-94-0328	4/2/1987	N/A	N/A
36	3.19E+08	HLW-HLE-94-0328	4/2/1987	N/A	N/A

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
27	7.10E+07	HLW-HLE-94-0328	4/3/1987	1.323	N/A
44	2.67E+07	HLW-HLE-94-0328	4/3/1987	1.120	N/A
45	7.27E+07	HLW-HLE-94-0328	4/3/1987	1.333	N/A
10	1.10E+06	HLW-HLE-94-0328	4/7/1987	1.036	N/A
10	6.07E+06	HLW-HLE-94-0328	4/9/1987	1.228	N/A
7	2.23E+07	HLW-HLE-94-0328	4/14/1987	1.052	N/A
1	1.45E+08	HLW-HLE-94-0328	4/30/1987	1.265	N/A
2	3.62E+05	HLW-HLE-94-0328	4/30/1987	1.269	N/A
19	1.57E+06	HLW-HLE-94-0328	5/1/1987	N/A	N/A
20	3.74E+05	HLW-HLE-94-0328	5/1/1987	1.020	N/A
10	6.79E+06	HLW-HLE-94-0328	5/4/1987	1.228	N/A
10	1.88E+07	HLW-HLE-94-0328	6/12/1987	N/A	N/A
23	1.11E+07	HLW-HLE-94-0328	6/12/1987	N/A	N/A
42	2.73E+06	HLW-HLE-94-0328	6/12/1987	N/A	N/A
49	1.69E+05	HLW-HLE-94-0328	6/12/1987	N/A	N/A
50	1.78E+05	HLW-HLE-94-0328	6/12/1987	N/A	N/A
29	1.32E+08	HLW-HLE-94-0328	7/17/1987	1.135	N/A
13	2.63E+08	HLW-HLE-94-0328	9/28/1987	1.300	N/A
22	3.39E+05	HLW-HLE-94-0328	9/28/1987	0.905	N/A
24	5.99E+05	HLW-HLE-94-0328	9/28/1987	0.897	N/A
35	1.09E+08	HLW-HLE-94-0328	9/28/1987	1.179	N/A
36	2.63E+08	HLW-HLE-94-0328	9/28/1987	1.390	N/A
37	2.39E+08	HLW-HLE-94-0328	9/28/1987	1.292	N/A
38	1.63E+07	HLW-HLE-94-0328	9/28/1987	1.184	N/A
43	1.19E+07	HLW-HLE-94-0328	9/28/1987	1.110	N/A
4	5.43E+06	HLW-HLE-94-0328	10/7/1987	1.133	N/A
25	6.78E+07	HLW-HLE-94-0328	10/7/1987	1.322	N/A
27	6.09E+07	HLW-HLE-94-0328	10/7/1987	1.302	N/A
28	6.60E+07	HLW-HLE-94-0328	10/7/1987	1.316	N/A
34	3.22E+07	HLW-HLE-94-0328	10/7/1987	1.162	N/A
45	5.96E+07	HLW-HLE-94-0328	10/7/1987	1.331	N/A
50	3.01E+05	HLW-HLE-94-0328	12/1/1987	1.0400	N/A
15	3.94E+07	HLW-HLE-94-0328	12/1/1987	1.230	N/A
21	1.36E+06	HLW-HLE-94-0328	12/1/1987	1.033	N/A
23	4.28E+05	HLW-HLE-94-0328	12/1/1987	0.990	N/A
39	9.43E+07	HLW-HLE-94-0328	12/1/1987	1.298	N/A
23	6.71E+03	HLW-HLE-94-0328	12/8/1987	1.028	N/A
11	9.49E+06	HLW-HLE-94-0328	3/7/1988	1.280	N/A
15	2.75E+06	HLW-HLE-94-0328	3/7/1988	1.266	N/A
43	2.54E+07	HLW-HLE-94-0328	3/7/1988	1.154	N/A
13	2.59E+08	HLW-HLE-94-0328	3/21/1988	1.379	N/A
22	1.04E+06	HLW-HLE-94-0328	3/21/1988	1.017	N/A
36	2.28E+08	HLW-HLE-94-0328	3/21/1988	1.297	N/A
37	3.05E+08	HLW-HLE-94-0328	3/21/1988	1.530	N/A

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
38	3.61E+07	HLW-HLE-94-0328	3/21/1988	1.399	N/A
23	7.09E+04	HLW-HLE-94-0328	3/22/1988	1.003	N/A
43	1.58E+07	HLW-HLE-94-0328	4/5/1988	1.189	N/A
25	8.95E+07	HLW-HLE-94-0328	4/21/1988	1.450	N/A
26	7.25E+07	HLW-HLE-94-0328	4/21/1988	1.532	N/A
28	7.34E+07	HLW-HLE-94-0328	4/21/1988	1.575	N/A
47	6.70E+07	HLW-HLE-94-0328	4/21/1988	1.489	N/A
27	2.99E+05	HLW-HLE-94-0328	5/18/1988	N/A	N/A
34	2.40E+07	HLW-HLE-94-0328	5/18/1988	N/A	N/A
44	9.25E+07	HLW-HLE-94-0328	5/18/1988	N/A	N/A
45	3.04E+07	HLW-HLE-94-0328	5/18/1988	N/A	N/A
32	5.77E+08	HLW-HLE-94-0328	12/11/1988	1.236	N/A
21	4.76E+05	HLW-HLE-94-0328	12/21/1988	1.021	N/A
23	6.50E+04	HLW-HLE-94-0328	12/21/1988	1.025	N/A
21	4.23E+05	HLW-HLE-94-0328	8/23/1989	1.003	N/A
21	1.51E+07	HLW-HLE-94-0328	9/15/1989	1.027	N/A
23	7.33E+05	HLW-HLE-94-0328	9/27/1989	1.038	N/A
21	1.30E+06	HLW-HLE-94-0328	11/30/1989	1.000	N/A
32	7.68E+08	HLW-HLE-94-0328	12/15/1989	1.271	N/A
21	8.62E+05	HLW-HLE-94-0328	3/1/1990	0.999	N/A
23	5.55E+04	HLW-HLE-94-0328	3/8/1990	0.991	N/A
21	1.82E+05	WSRC-TR-90-151	3/28/1990	N/A	Supernate
22	3.58E+04	WSRC-TR-90-151	3/28/1990	N/A	Supernate
23	7.94E+03	WSRC-TR-90-151	3/28/1990	N/A	Supernate
43	9.00E+07	WSRC-TR-90-151	3/28/1990	N/A	Supernate
38	3.19E+07	HLW-HLE-94-0328	2/25/1991	1.277	N/A
39	6.22E+07	HLW-HLE-94-0328	3/2/1991	1.293	N/A
43	4.25E+07	HLW-HLE-94-0328	3/8/1991	1.085	N/A
13	1.90E+09	HLW-HLE-94-0328	5/29/1991	1.435	N/A
23	1.02E+04	HLW-HLE-94-0328	5/29/1991	1.015	N/A
24	1.73E+06	HLW-HLE-94-0328	5/29/1991	1.050	N/A
38	4.10E+08	HLW-HLE-94-0328	5/29/1991	1.459	N/A
43	1.05E+08	HLW-HLE-94-0328	6/17/1991	1.240	N/A
26	3.52E+08	HLW-HLE-94-0328	7/1/1991	1.376	N/A
41	9.42E+07	HLW-HLE-94-0328	8/24/1991	1.414	N/A
48	2.36E+07	HLW-HLE-94-0328	8/24/1991	1.095	N/A
38	1.58E+08	HLW-HLE-94-0328	8/28/1991	1.550	N/A
43	5.96E+07	HLW-HLE-94-0328	8/28/1991	1.114	N/A
42	3.05E+07	HLW-HLE-94-0328	8/30/1991	1.043	N/A
30	1.08E+09	HLW-HLE-94-0328	9/4/1991	1.353	N/A
31	1.39E+09	HLW-HLE-94-0328	9/4/1991	1.462	N/A
37	5.87E+08	HLW-HLE-94-0328	9/4/1991	1.299	N/A
39	5.53E+08	HLW-HLE-94-0328	9/4/1991	1.298	N/A
17	5.33E+05	HLW-HLE-94-0328	9/15/1991	1.040	N/A

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
20	1.44E+06	HLW-HLE-94-0328	9/15/1991	1.169	N/A
21	9.75E+05	HLW-HLE-94-0328	9/15/1991	1.020	N/A
22	8.46E+05	HLW-HLE-94-0328	9/15/1991	1.033	N/A
23	5.93E+05	HLW-HLE-94-0328	9/15/1991	1.017	N/A
26	5.17E+08	HLW-HLE-94-0328	9/15/1991	1.426	N/A
45	7.26E+08	HLW-HLE-94-0328	9/15/1991	1.487	N/A
38	1.42E+08	HLW-HLE-94-0328	9/30/1991	1.345	N/A
38	3.32E+08	HLW-HLE-94-0328	10/1/1991	1.450	N/A
43	2.27E+08	HLW-HLE-94-0328	10/1/1991	1.308	N/A
38	1.39E+08	HLW-HLE-94-0328	10/25/1991	1.269	N/A
43	2.11E+08	HLW-HLE-94-0328	10/25/1991	1.245	N/A
24	2.37E+06	HLW-HLE-94-0328	10/29/1991	1.048	N/A
19	2.71E+06	HLW-HLE-94-0328	10/30/1991	1.237	N/A
26	1.77E+08	HLW-HLE-94-0328	10/30/1991	1.260	N/A
44	5.49E+08	HLW-HLE-94-0328	10/30/1991	1.430	N/A
45	6.06E+08	HLW-HLE-94-0328	10/30/1991	1.487	N/A
50	5.37E+05	HLW-HLE-94-0328	11/4/1991	1.238	N/A
26	4.60E+08	HLW-HLE-94-0328	11/13/1991	1.379	N/A
45	6.95E+08	HLW-HLE-94-0328	11/13/1991	1.500	N/A
47	4.07E+08	HLW-HLE-94-0328	11/13/1991	1.364	N/A
40	1.57E+07	HLW-HLE-94-0328	11/19/1991	1.150	N/A
48	3.67E+06	HLW-HLE-94-0328	11/19/1991	1.060	N/A
43	1.20E+08	HLW-HLE-94-0328	11/23/1991	1.223	N/A
35	8.77E+08	HLW-HLE-94-0328	11/26/1991	1.307	N/A
38	3.50E+08	HLW-HLE-94-0328	11/26/1991	1.465	N/A
21	8.03E+04	HLW-HLE-94-0328	12/2/1991	1.018	N/A
17	1.13E+06	HLW-HLE-94-0328	12/11/1991	1.041	N/A
20	8.91E+05	HLW-HLE-94-0328	12/11/1991	1.169	N/A
38	2.47E+08	HLW-HLE-94-0328	12/20/1991	1.444	N/A
43	1.28E+08	HLW-HLE-94-0328	12/20/1991	1.264	N/A
22	6.61E+04	HLW-HLE-94-0328	12/26/1991	1.018	N/A
23	1.02E+06	HLW-HLE-94-0328	12/26/1991	1.040	N/A
29	1.29E+09	HLW-HLE-94-0328	12/26/1991	1.453	N/A
32	9.69E+08	HLW-HLE-94-0328	12/26/1991	1.289	N/A
38	3.74E+08	HLW-HLE-94-0328	12/26/1991	1.464	N/A
43	1.60E+08	HLW-HLE-94-0328	12/26/1991	1.323	N/A
39	4.94E+08	HLW-HLE-94-0328	1/14/1992	1.308	N/A
26	5.57E+08	HLW-HLE-94-0328	1/15/1992	1.448	N/A
34	3.09E+08	HLW-HLE-94-0328	1/15/1992	1.280	N/A
19	2.93E+06	HLW-HLE-94-0328	1/16/1992	1.241	N/A
45	7.78E+08	HLW-HLE-94-0328	1/17/1992	1.521	N/A
11	1.15E+08	HLW-HLE-94-0328	2/17/1992	1.291	N/A
40	2.02E+07	HLW-HLE-94-0328	2/17/1992	1.151	N/A
41	3.29E+08	HLW-HLE-94-0328	2/17/1992	1.419	N/A

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
42	3.77E+06	HLW-HLE-94-0328	2/17/1992	1.045	N/A
51	9.00E+06	HLW-HLE-94-0328	2/17/1992	1.167	N/A
17	7.18E+04	HLW-HLE-94-0328	2/24/1992	1.037	N/A
26	5.58E+08	HLW-HLE-94-0328	2/26/1992	1.432	N/A
26	6.03E+08	HLW-HLE-94-0328	2/26/1992	1.426	N/A
33	2.87E+08	HLW-HLE-94-0328	2/26/1992	1.253	N/A
45	4.43E+08	HLW-HLE-94-0328	2/26/1992	1.456	N/A
45	6.64E+08	HLW-HLE-94-0328	2/26/1992	1.471	N/A
48	6.67E+06	HLW-HLE-94-0328	3/13/1992	1.064	N/A
49	5.31E+05	HLW-HLE-94-0328	3/13/1992	1.132	N/A
38	4.26E+08	HLW-HLE-94-0328	3/15/1992	1.453	N/A
43	9.23E+08	HLW-HLE-94-0328	3/15/1992	1.332	N/A
38	4.26E+08	HLW-HLE-94-0328	3/16/1992	1.461	N/A
39	6.90E+08	HLW-HLE-94-0328	3/16/1992	1.286	N/A
43	3.67E+08	HLW-HLE-94-0328	3/16/1992	1.341	N/A
21	2.57E+05	HLW-HLE-94-0328	3/18/1992	1.019	N/A
22	4.66E+05	HLW-HLE-94-0328	3/18/1992	1.037	N/A
23	1.61E+05	HLW-HLE-94-0328	3/18/1992	1.016	N/A
30	1.43E+09	HLW-HLE-94-0328	3/18/1992	1.365	N/A
31	1.44E+09	HLW-HLE-94-0328	3/18/1992	1.433	N/A
37	7.67E+08	HLW-HLE-94-0328	3/18/1992	1.324	N/A
19	3.35E+06	HLW-HLE-94-0328	4/6/1992	1.239	N/A
44	7.71E+08	HLW-HLE-94-0328	4/6/1992	1.499	N/A
24	2.62E+06	HLW-HLE-94-0328	4/10/1992	1.051	N/A
35	9.42E+08	HLW-HLE-94-0328	5/16/1992	1.260	N/A
43	2.25E+08	HLW-HLE-94-0328	5/16/1992	1.369	N/A
17	8.42E+04	HLW-HLE-94-0328	5/19/1992	1.039	N/A
20	1.22E+06	HLW-HLE-94-0328	5/19/1992	1.201	N/A
26	4.81E+08	HLW-HLE-94-0328	5/19/1992	1.487	N/A
26	7.27E+08	HLW-HLE-94-0328	5/19/1992	1.506	N/A
45	6.11E+08	HLW-HLE-94-0328	5/19/1992	1.547	N/A
45	1.32E+09	HLW-HLE-94-0328	5/19/1992	1.522	N/A
13	3.21E+09	HLW-HLE-94-0328	5/29/1992	1.431	N/A
13	2.18E+09	HLW-HLE-94-0328	6/1/1992	1.512	N/A
38	3.93E+08	HLW-HLE-94-0328	6/20/1992	1.479	N/A
43	2.15E+08	HLW-HLE-94-0328	6/20/1992	1.377	N/A
21	3.36E+05	HLW-HLE-94-0328	6/25/1992	1.025	N/A
22	4.11E+05	HLW-HLE-94-0328	6/25/1992	1.035	N/A
23	2.23E+05	HLW-HLE-94-0328	6/25/1992	1.012	N/A
38	2.63E+08	HLW-HLE-94-0328	6/25/1992	1.413	N/A
43	2.63E+08	HLW-HLE-94-0328	6/25/1992	1.371	N/A
24	3.00E+06	HLW-HLE-94-0328	7/11/1992	1.035	N/A
27	5.65E+08	HLW-HLE-94-0328	7/21/1992	1.508	N/A
28	6.39E+08	HLW-HLE-94-0328	7/21/1992	1.463	N/A

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
21	5.74E+05	HLW-HLE-94-0328	7/28/1992	1.117	N/A
19	2.54E+06	HLW-HLE-94-0328	7/30/1992	1.240	N/A
25	4.47E+08	HLW-HLE-94-0328	7/30/1992	1.451	N/A
34	2.81E+08	HLW-HLE-94-0328	7/30/1992	1.254	N/A
1	1.75E+09	HLW-HLE-94-0328	7/31/1992	1.517	N/A
4	1.12E+09	HLW-HLE-94-0328	7/31/1992	1.311	N/A
7	2.70E+08	HLW-HLE-94-0328	7/31/1992	1.275	N/A
26	6.41E+08	HLW-HLE-94-0328	8/14/1992	1.518	N/A
45	6.54E+08	HLW-HLE-94-0328	8/14/1992	1.548	N/A
33	2.04E+08	HLW-HLE-94-0328	8/28/1992	1.254	N/A
40	2.11E+07	HLW-HLE-94-0328	8/28/1992	1.212	N/A
48	6.00E+06	HLW-HLE-94-0328	8/28/1992	1.073	N/A
49	8.30E+05	HLW-HLE-94-0328	8/28/1992	1.137	N/A
51	8.09E+06	HLW-HLE-94-0328	8/28/1992	1.170	N/A
38	3.38E+08	HLW-HLE-94-0328	9/14/1992	1.429	N/A
43	2.37E+08	HLW-HLE-94-0328	9/14/1992	1.389	N/A
20	1.01E+06	HLW-HLE-94-0328	9/15/1992	1.214	N/A
22	3.75E+05	HLW-HLE-94-0328	9/16/1992	1.037	N/A
23	2.53E+05	HLW-HLE-94-0328	9/16/1992	1.020	N/A
2	9.16E+08	HLW-HLE-94-0328	10/22/1992	1.554	N/A
19	2.63E+06	HLW-HLE-94-0328	10/23/1992	1.241	N/A
21	6.13E+05	HLW-HLE-94-0328	10/27/1992	1.059	N/A
24	2.91E+06	HLW-HLE-94-0328	10/27/1992	1.051	N/A
41	3.01E+08	HLW-HLE-94-0328	10/27/1992	1.359	N/A
26	6.90E+08	HLW-HLE-94-0328	11/13/1992	1.545	N/A
20	1.29E+07	HLW-HLE-94-0328	12/14/1992	1.176	N/A
21	7.63E+06	HLW-HLE-94-0328	12/14/1992	1.049	N/A
22	3.03E+05	HLW-HLE-94-0328	12/14/1992	1.037	N/A
23	3.61E+05	HLW-HLE-94-0328	12/14/1992	1.016	N/A
48	3.32E+07	HLW-HLE-94-0328	12/16/1992	1.091	N/A
19	2.93E+06	HLW-HLE-94-0328	1/18/1993	1.239	N/A
34	2.62E+08	HLW-HLE-94-0328	1/18/1993	1.244	N/A
24	2.30E+06	HLW-HLE-94-0328	1/30/1993	1.043	N/A
26	6.54E+08	HLW-HLE-94-0328	2/24/1993	1.390	N/A
33	2.37E+08	HLW-HLE-94-0328	2/24/1993	1.260	N/A
45	3.84E+08	HLW-HLE-94-0328	2/24/1993	1.522	N/A
40	1.79E+07	HLW-HLE-94-0328	3/1/1993	1.186	N/A
51	1.15E+07	HLW-HLE-94-0328	3/1/1993	1.204	N/A
11	1.05E+08	HLW-HLE-94-0328	3/3/1993	1.322	N/A
38	2.18E+08	HLW-HLE-94-0328	3/3/1993	1.364	N/A
17	8.62E+04	HLW-HLE-94-0328	3/8/1993	1.039	N/A
20	1.09E+06	HLW-HLE-94-0328	3/8/1993	1.206	N/A
43	2.86E+08	HLW-HLE-94-0328	3/12/1993	1.445	N/A
36	1.62E+08	HLW-HLE-94-0328	3/28/1993	1.500	N/A

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
36	4.41E+08	HLW-HLE-94-0328	3/28/1993	1.391	N/A
23	1.28E+04	HLW-HLE-94-0328	3/29/1993	1.018	N/A
37	1.93E+08	HLW-HLE-94-0328	3/29/1993	1.347	N/A
37	2.94E+08	HLW-HLE-94-0328	3/29/1993	1.400	N/A
21	8.04E+05	HLW-HLE-94-0328	4/7/1993	1.057	N/A
22	2.31E+06	HLW-HLE-94-0328	4/7/1993	1.037	N/A
31	1.39E+09	HLW-HLE-94-0328	4/7/1993	1.429	N/A
19	3.74E+06	HLW-HLE-94-0328	4/12/1993	1.248	N/A
44	6.04E+07	HLW-HLE-94-0328	4/12/1993	1.420	N/A
49	1.06E+05	HLW-HLE-94-0328	4/12/1993	1.135	N/A
50	5.96E+04	HLW-HLE-94-0328	4/12/1993	N/A	N/A
48	7.77E+05	HLW-HLE-94-0328	4/18/1993	1.060	N/A
13	1.88E+09	HLW-HLE-94-0328	4/30/1993	1.451	N/A
24	2.89E+06	HLW-HLE-94-0328	4/30/1993	1.040	N/A
30	1.35E+09	HLW-HLE-94-0328	4/30/1993	1.424	N/A
17	1.33E+04	HLW-HLE-94-0328	5/11/1993	1.039	N/A
35	7.86E+08	HLW-HLE-94-0328	5/27/1993	1.287	N/A
42	2.75E+07	HLW-HLE-94-0328	5/27/1993	1.047	N/A
20	1.21E+06	HLW-HLE-94-0328	6/14/1993	1.210	N/A
23	7.83E+04	HLW-HLE-94-0328	7/13/1993	1.001	N/A
38	2.94E+08	HLW-HLE-94-0328	7/13/1993	1.456	N/A
43	1.97E+08	HLW-HLE-94-0328	7/13/1993	1.351	N/A
1	1.98E+09	HLW-HLE-94-0328	7/22/1993	1.623	N/A
4	1.17E+09	HLW-HLE-94-0328	7/22/1993	1.302	N/A
7	3.19E+08	HLW-HLE-94-0328	7/22/1993	1.284	N/A
51	3.78E+06	HLW-HLE-94-0328	7/22/1993	1.110	N/A
19	2.86E+06	HLW-HLE-94-0328	7/23/1993	1.244	N/A
28	4.19E+08	HLW-HLE-94-0328	7/23/1993	1.376	N/A
34	2.52E+08	HLW-HLE-94-0328	7/23/1993	1.221	N/A
25	5.06E+08	HLW-HLE-94-0328	8/5/1993	1.459	N/A
27	5.04E+08	HLW-HLE-94-0328	8/5/1993	1.456	N/A
17	6.74E+04	HLW-HLE-94-0328	8/12/1993	1.039	N/A
33	2.14E+08	HLW-HLE-94-0328	8/12/1993	1.246	N/A
48	7.28E+04	HLW-HLE-94-0328	8/25/1993	1.039	N/A
49	6.32E+04	HLW-HLE-94-0328	8/25/1993	1.133	N/A
13	1.80E+09	HLW-HLE-94-0328	9/5/1993	1.437	N/A
21	1.57E+06	HLW-HLE-94-0328	9/5/1993	1.086	N/A
22	3.33E+05	HLW-HLE-94-0328	9/5/1993	1.040	N/A
24	2.94E+06	HLW-HLE-94-0328	9/5/1993	1.050	N/A
30	1.37E+09	HLW-HLE-94-0328	9/5/1993	1.398	N/A
48	8.76E+04	HLW-HLE-94-0328	9/24/1993	1.045	N/A
38	1.83E+08	HLW-HLE-94-0328	10/4/1993	1.354	N/A
43	1.61E+08	HLW-HLE-94-0328	10/4/1993	1.318	N/A
23	6.34E+04	HLW-HLE-94-0328	10/5/1993	1.001	N/A

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
20	1.28E+06	HLW-HLE-94-0328	10/13/1993	1.227	N/A
29	1.23E+09	HLW-HLE-94-0328	11/21/1993	1.451	N/A
32	5.60E+08	HLW-HLE-94-0328	11/21/1993	1.253	N/A
35	8.89E+08	HLW-HLE-94-0328	11/21/1993	1.295	N/A
39	4.98E+08	HLW-HLE-94-0328	11/21/1993	1.294	N/A
2	6.16E+08	HLW-HLE-94-0328	11/24/1993	1.463	N/A
17	1.44E+04	HLW-HLE-94-0328	11/24/1993	1.039	N/A
19	2.33E+06	HLW-HLE-94-0328	11/24/1993	1.245	N/A
20	1.05E+06	HLW-HLE-94-0328	12/1/1993	1.235	N/A
21	1.13E+06	HLW-HLE-94-0328	1/5/1994	1.066	N/A
22	1.20E+08	HLW-HLE-94-0328	1/5/1994	1.039	N/A
24	2.81E+06	HLW-HLE-94-0328	1/6/1994	1.050	N/A
51	3.34E+06	WSRC-RP-95-1003	10/16/1995	1.175	Sludge
8	2.36E+08	ESH-HPT-98-0406	7/10/1998	N/A	Sludge
12	5.49E+08	ESH-HPT-98-0406	7/10/1998	N/A	Sludge
48	3.32E+06	SRTC-LWP-99-00114	1/4/1999	1.120	Supernate
48	3.75E+06	SRTC-LWP-99-00114	2/18/1999	1.120	Supernate
48	4.06E+06	SRTC-LWP-99-00114	4/2/1999	1.170	Supernate
48	4.60E+06	SRTC-LWP-99-00114	7/28/1999	1.140	Supernate
43	6.87E+07	WSRC-TR-2000-00208	2/2/2000	1.190	Supernate
43	4.15E+07	WSRC-TR-2000-00208	2/2/2000	1.310	Supernate
43	1.64E+08	WSRC-TR-2000-00208	2/2/2000	1.390	Supernate
30	1.35E+09	WSRC-TR-2000-00112	4/3/2000	1.370	Supernate
30	1.24E+09	WSRC-TR-2000-00112	4/3/2000	1.380	Supernate
30	1.36E+09	WSRC-TR-2000-00112	4/3/2000	1.340	Supernate
32	7.43E+08	WSRC-TR-2000-00112	4/3/2000	1.280	Supernate
32	7.41E+08	WSRC-TR-2000-00112	4/3/2000	1.280	Supernate
32	7.79E+08	WSRC-TR-2000-00112	4/3/2000	1.280	Supernate
32	1.24E+09	WSRC-TR-2000-00112	4/3/2000	1.370	Supernate
30	1.17E+09	WSRC-TR-2001-00514	3/27/2001	1.390	Supernate
30	1.21E+09	WSRC-TR-2001-00514	3/27/2001	1.400	Supernate
30	2.53E+09	WSRC-TR-2001-00514	3/27/2001	1.940	Supernate
30	1.75E+09	WSRC-TR-2001-00514	3/27/2001	1.500	Supernate
32	1.63E+09	WSRC-TR-2001-00514	3/27/2001	1.430	Supernate
32	1.62E+09	WSRC-TR-2001-00514	3/27/2001	1.430	Supernate
26	6.56E+08	SRT-LWP-2000-00039	8/10/2001	1.320	Supernate
26	9.52E+08	SRT-LWP-2000-00039	8/10/2001	1.430	Supernate
46	1.17E+09	SRT-LWP-2000-00039	8/10/2001	1.440	Supernate
46	8.44E+08	SRT-LWP-2000-00039	8/10/2001	1.330	Supernate
21	9.14E+05	SRT-LWP-2002-00029	2/22/2002	1.020	Supernate
42	1.20E+08	SRT-LWP-2002-00032	3/21/2002	1.300	Supernate
26	7.47E+08	SRT-LWP-2002-00033	3/25/2002	1.400	Supernate
23	2.35E+04	SRT-LWP-2002-00038	6/13/2002	1.010	Supernate
6	3.71E+07	SRT-LWP-2002-00064	7/10/2002	1.100	Supernate

Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
8	3.16E+07	SRT-LWP-2002-00064	7/10/2002	1.100	Supernate
31	3.80E+08	WSRC-TR-2002-00388	8/6/2002	1.960	Salt
31	3.63E+08	WSRC-TR-2002-00388	8/6/2002	1.278	Supernate
46	9.49E+08	SRT-LWP-2002-00081	9/12/2002	1.470	Supernate
24	2.57E+05	SRT-LWP-2002-00098	9/13/2002	1.050	Supernate
34	3.61E+08	SRT-LWP-2002-00098	9/13/2002	1.380	Supernate
41	3.35E+07	CBU-SPT-2004-00118	4/3/2003	1.910	Salt
41	8.12E+07	CBU-SPT-2004-00118	4/3/2003	N/A	Supernate
45	1.77E+08	WSRC-TR-2004-00386, R1	6/9/2003	1.530	Supernate
3	3.38E+08	CBU-SPT-2004-00118	8/1/2003	2.070	Salt
3	9.60E+08	CBU-SPT-2004-00118	8/1/2003	1.490	Supernate
3	3.24E+07	CBU-SPT-2004-00118	8/1/2003	N/A	Salt
3	2.00E+08	SRT-LWP-2003-00080	8/5/2003	2.070	Salt
3	4.74E+08	SRT-LWP-2003-00080	8/5/2003	2.070	Salt
29	7.04E+08	CBU-SPT-2004-00118	8/26/2003	2.130	Salt
29	3.52E+08	CBU-SPT-2004-00118	8/26/2003	1.260	Supernate
29	1.29E+09	CBU-SPT-2004-00118	8/26/2003	N/A	Supernate
29	6.99E+08	SRT-LWP-2003-00084	8/26/2003	2.130	Salt
2	9.75E+07	CBU-SPT-2004-00118	9/1/2003	2.040	Salt
2	8.40E+08	CBU-SPT-2004-00118	9/1/2003	1.500	Supernate
38	4.06E+07	CBU-SPT-2004-00118	9/1/2003	1.940	Salt
38	9.89E+07	CBU-SPT-2004-00118	9/1/2003	1.430	Supernate
38	8.80E+07	CBU-SPT-2004-00118	9/1/2003	1.450	Supernate
2	8.40E+08	SRT-LWP-2003-00092	9/10/2003	1.500	Supernate
29	3.52E+08	SRT-LWP-2003-00092	9/10/2003	1.260	Supernate
38	8.81E+07	SRT-LWP-2003-00092	9/10/2003	1.450	Supernate
41	8.81E+07	SRT-LWP-2003-00096	9/18/2003	1.408	Supernate
2	1.02E+08	SRT-LWP-2003-00090	9/12/2003	2.040	Salt
48	2.33E+08	WSRC-TR-2003-00720	9/17/2003	1.144	Supernate
41	7.59E+07	SRT-LWP-2003-00096	9/12/2003	1.400	Supernate
38	4.07E+07	SRT-LWP-2003-00095	9/21/2003	2.000	Salt
38	9.90E+07	SRT-LWP-2003-00095	9/21/2003	1.430	Supernate
10	8.55E+07	CBU-SPT-2004-00118	10/1/2003	2.060	Salt
10	1.28E+08	CBU-SPT-2004-00118	10/1/2003	2.060	Salt
10	4.48E+08	CBU-SPT-2004-00118	10/1/2003	1.430	Supernate
10	1.90E+07	CBU-SPT-2004-00118	10/1/2003	N/A	Salt
41	1.91E+07	WSRC-TR-2004-00165	12/10/2003	2.070	Salt
41	1.06E+08	WSRC-TR-2004-00165	12/10/2003	1.430	Supernate
41	2.32E+07	WSRC-TR-2004-00165	12/10/2003	2.040	Salt
48	6.07E+06	WSRC-TR-2004-00514	8/23/2004	1.164	Supernate
48	2.14E+08	WSRC-TR-2004-00514	8/23/2004	1.162	Sludge
37	7.40E+08	WSRC-TR-2005-00277	5/20/2005	1.910	Salt
51	4.42E+07	SRNL-ITS-2005-00203	8/19/2005	1.150	Supernate
51	3.79E+07	WSRC-STI-2006-00036	1/24/2006	1.190	Sludge

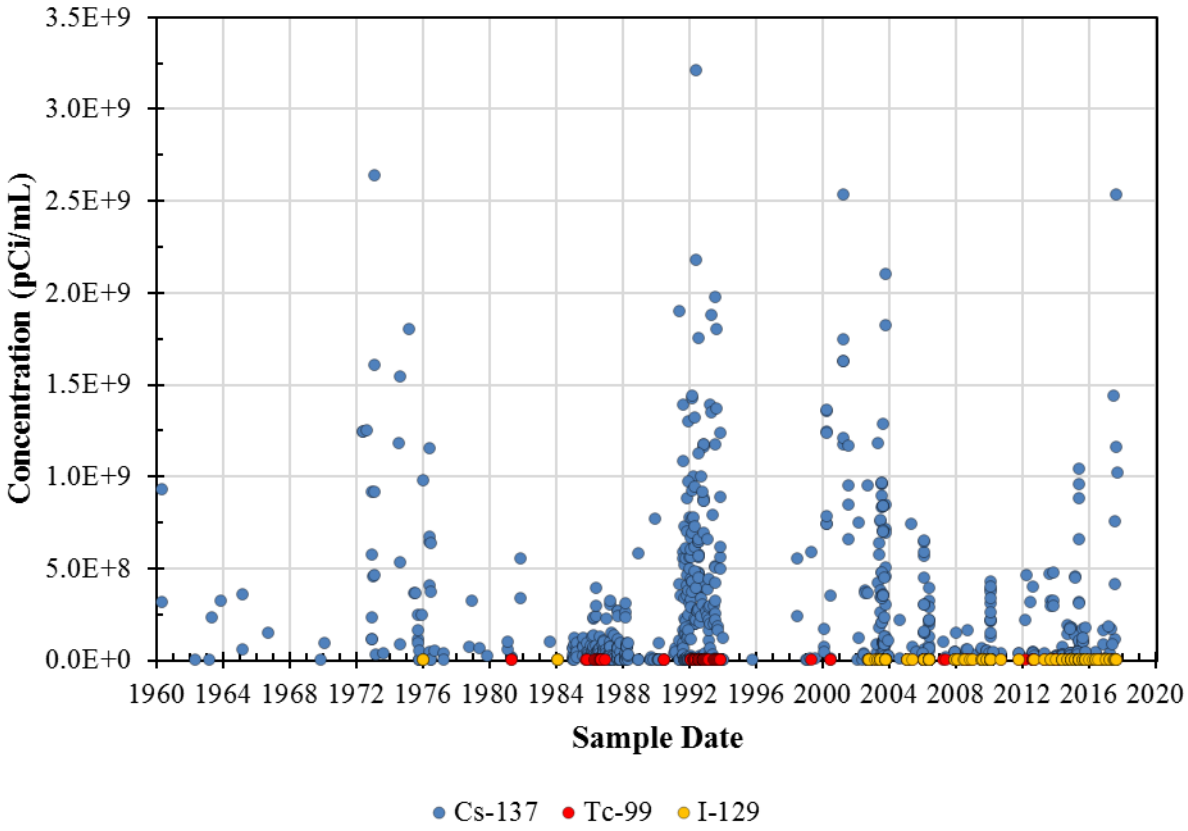
Table 3-2: Concentrations of Cs-137 Samples without Associated I-129 Concentrations (Continued)

Tank	Cs-137 pCi/mL at Closure	Reference	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
41	5.50E+07	SRNL-STI-2008-00446, rev 1	8/28/2008	1.412	Supernate
22	1.41E+05	SRNL-CST-2008-00061	9/19/2008	1.024	Supernate
41	5.50E+07	SRNL-L3100-2008-00026	9/22/2008	1.412	Supernate
21	3.79E+07	SRNL-STI-2010-00136	1/19/2010	1.263	Supernate
49	4.22E+07	SRNL-STI-2010-00234	3/25/2010	1.265	Supernate
49	3.42E+07	SRNL-STI-2012-00024	10/10/2011	1.271	Supernate
48	2.19E+08	SRNL-STI-2012-00420	2/28/2012	1.219	Sludge
13	4.62E+08	SRNL-L3100-2012-00070	4/16/2012	1.360	Sludge
13	3.15E+08	SRNL-L3100-2012-00088	6/18/2012	1.260	Sludge
13	4.01E+08	SRNL-L3100-2012-00122	8/13/2012	1.270	Supernate
22	1.91E+08	SRNL-STI-2014-00380	10/1/2014	1.120	Supernate
38	3.50E+07	SRNL-STI-2015-00008	11/25/2014	1.330	Supernate
38	3.41E+07	SRNL-STI-2015-00008	11/25/2014	1.300	Supernate
43	2.25E+07	SRNL-STI-2015-00008	11/25/2014	1.180	Supernate
43	2.31E+07	SRNL-STI-2015-00008	11/25/2014	1.170	Supernate
13	1.77E+08	SRNL-STI-2015-00064	12/1/2014	1.070	Supernate
13	1.71E+08	SRNL-STI-2015-00064	12/1/2014	1.080	Supernate
48	6.40E+06	SRNL-L3100-2014-00280	12/4/2014	1.225	Sludge
38	4.32E+07	SRNL-STI-2015-00336	5/1/2015	1.295	Supernate
43	2.59E+07	SRNL-STI-2015-00336	5/1/2015	1.180	Supernate
38	3.96E+07	SRNL-STI-2015-00662	10/22/2015	1.240	Supernate
7	1.21E+08	SRNL-STI-2015-00486	8/24/2015	1.120	Supernate
15	1.62E+08	SRNL-L3100-2016-00214	11/4/2016	1.250	Sludge
15	1.82E+08	SRNL-STI-2017-00247	3/16/2017	1.190	Sludge
15	8.22E+07	SRNL-L3100-2017-00070	5/30/2017	1.230	Sludge
22	8.09E+06	SRNL-L3100-2017-00015	12/22/2016	1.030	Supernate
32	1.02E+09	SRNL-L3100-2017-00125	9/21/2017	1.440	Supernate

Note: All Cs-137 concentrations have been decayed to October 1, 2032.
NA = Not Available

Note that there is significantly more data for the Cs-137 concentrations than there are for the I-129 concentrations. Figure 3-1 provides a graphical depiction of the data from Tables 3-1 and 3-2. 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 (1.54E+02 pCi/mL for I-129, 1.06E+05 pCi/mL for Tc-99, and 2.64E+08 pCi/mL for Cs-137).

Figure 3-1: Sampled Concentrations of I-129, Tc-99, and Cs-137 (Linear Representation)



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 3-2) and to determine the average values using the logarithmic means. The logarithmic means of the sampled values are 3.59E+01 pCi/mL for I-129, 2.72E+04 pCi/mL for Tc-99, and 2.61E+07 pCi/mL for Cs-137, which are much closer to the respective median values of 3.31E+01 pCi/mL, 3.87E+04 pCi/mL and 6.83E+07 pCi/mL, indicating that the logarithmic means are more representative values than the linear means.

Figure 3-2: Sampled Concentrations of I-129, Tc-99, and Cs-137 (Logarithmic Representation)

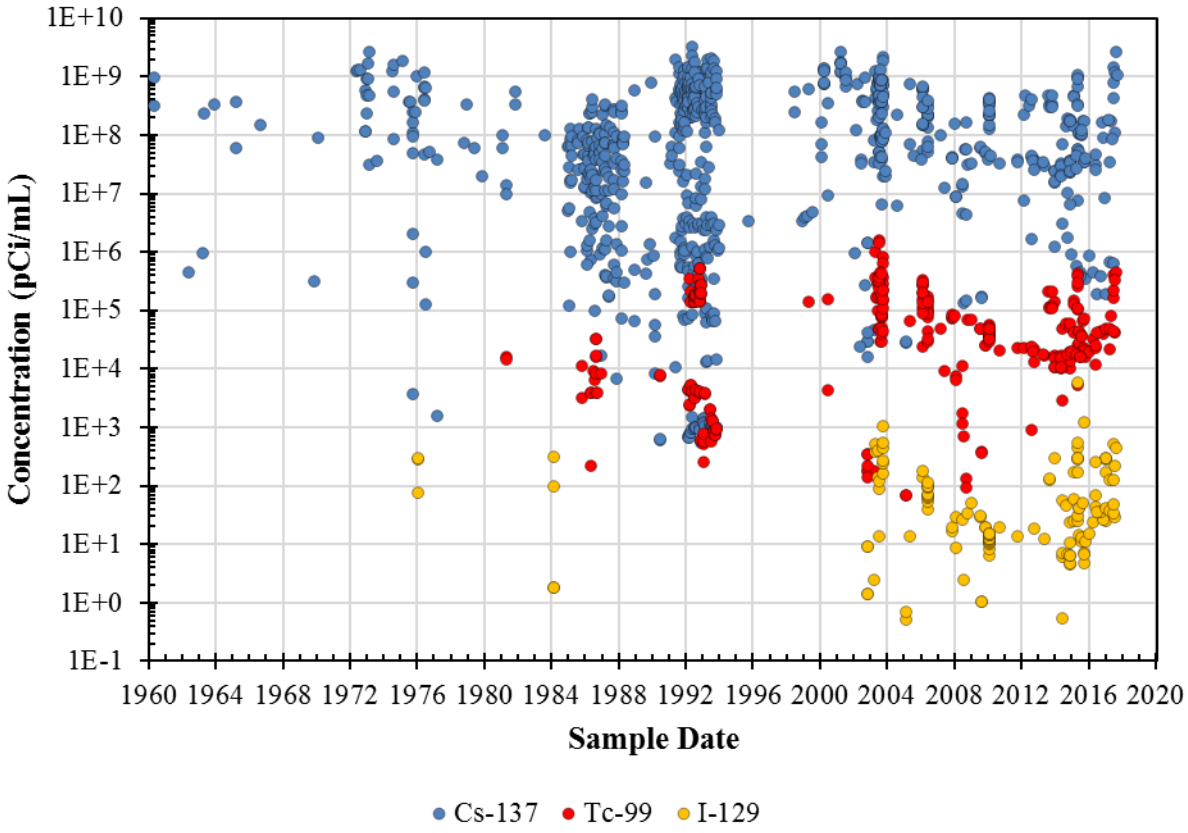
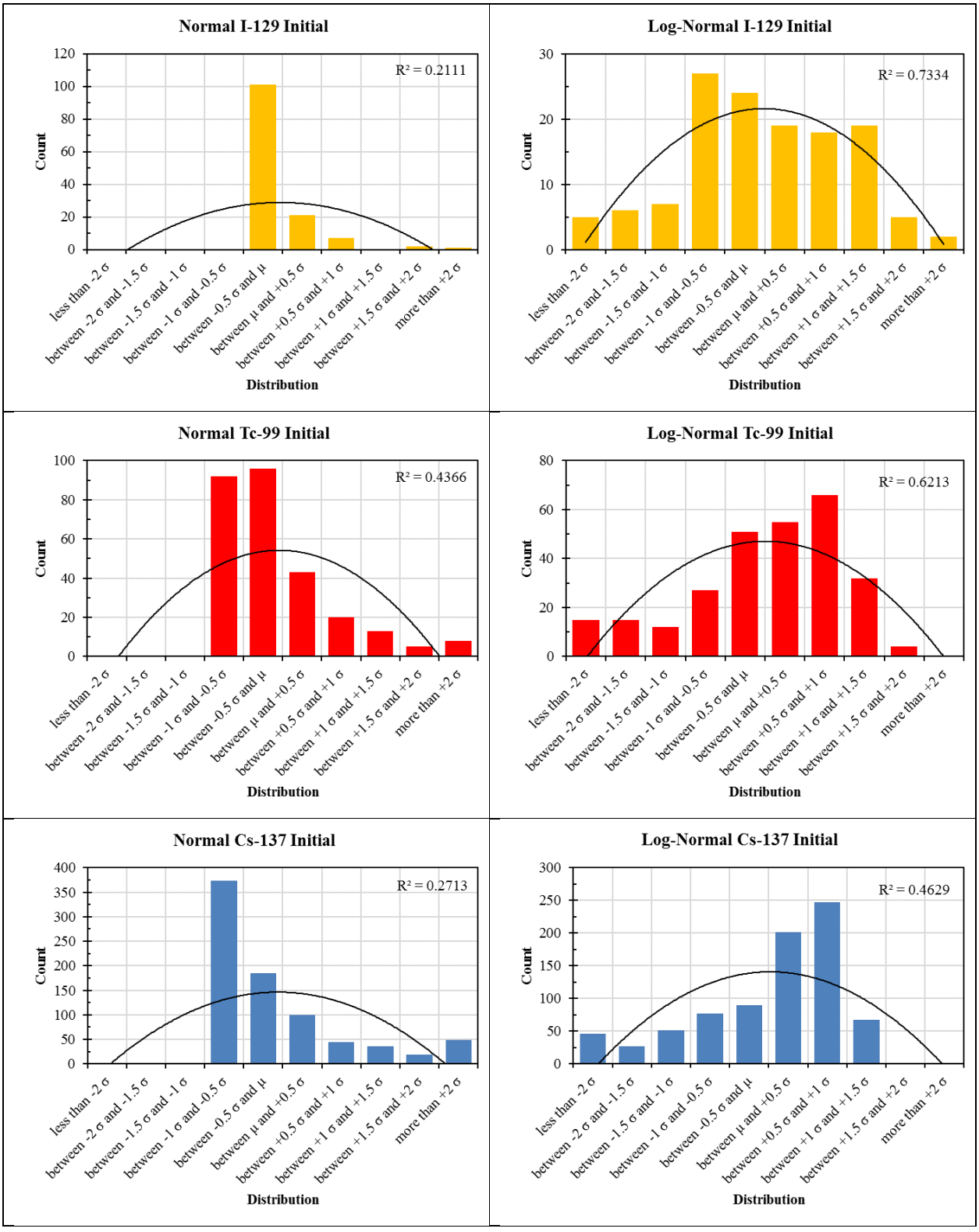


Figure 3-3 provides an alternative illustration of this distinctive behavior by presenting the number of sampled data points falling within increments of 0.5 standard deviations (σ) from the mean (μ) along both normal and log-normal distributions. The log-normal distribution provides a more "bell-shaped"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

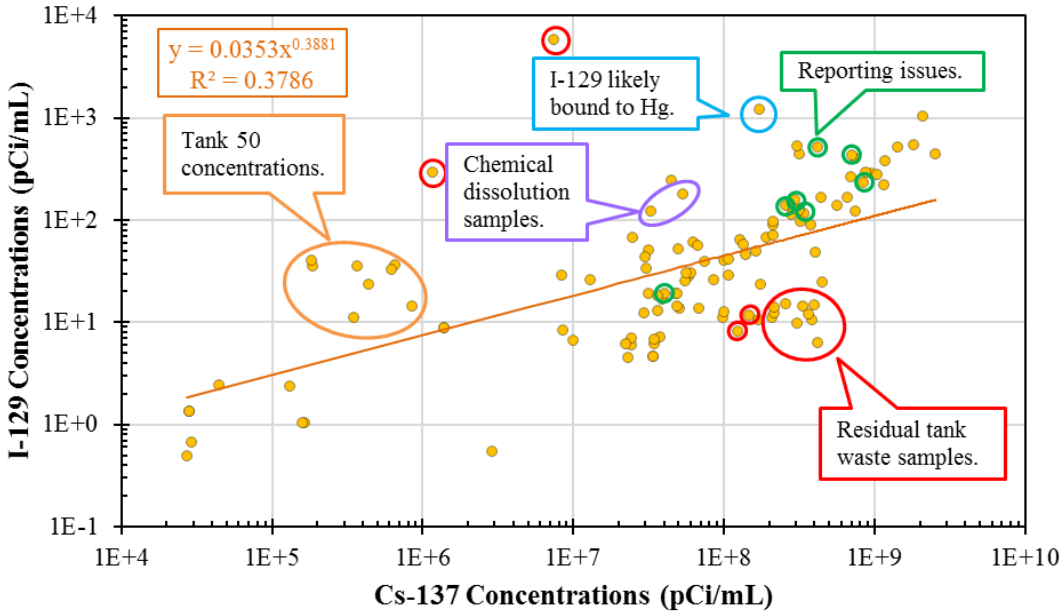
Figure 3-3: Distribution Behavior of Sampled Concentrations of I-129, Tc-99, and Cs-137



3.2 Initial Relationship Between I-129 Concentrations and Cs-137 Concentrations

Observation of Figure 3-2 shows that the distribution of the data points for I-129 concentrations appear to have a very similar distribution to the respective Cs-137 data points. This relationship between I-129 and Cs-137 is similar to the relationship between Tc-99 and Cs-137, as defined in the *Evaluation of Tc-99 Concentration Data to Improve Liquid Waste Inventory Projections*. [SRR-CWDA-2015-00123] Both I-129 and Cs-137 are fission products from a number of nuclear fission reactions. [WSRC-TR-94-0562] Figure 3-4 provides a more direct comparison, plotting the I-129 concentrations as a function of the Cs-137 concentrations.

Figure 3-4: Relationship Between Concentrations of I-129 and Cs-137 from the Initial Data Set



This figure shows the relationship between I-129 and Cs-137 along a power curve:

$$y = 3.53E\text{-}02x^{0.3881} \quad \text{(Eq.3-1)}$$

where y is the I-129 concentration (pCi/mL) and x is the Cs-137 concentration (pCi/mL) decayed to October 1, 2032.

The distribution has an R-squared of 0.3786. This R-squared value is relatively low. However, as shown in Figure 3-4, a number of the Cs-137 concentrations do not reflect the general behavior of the rest of the available data. These are discussed in Section 3.3.

3.3 Remove Outliers from the I-129 Concentration Data

Four types of outliers were identified in the initial data set. The first is the Tank 50 samples, followed by residual tank waste samples, then samples deemed chemical outliers (i.e., dissolution samples and one sludge sample with I-129 likely bound to Hg), and lastly samples with apparent reporting issues (e.g., sample concentrations not corrected for dilution).

For the Tank 50 samples, the decontamination of the salt solution (i.e., the removal of Cs-137) significantly alters the relationship between the Cs-137 and the I-129 concentrations such that using these samples for comparison purposes is counterproductive. Accordingly, all Tank 50 samples were removed from the initial data set. Removing only the Tank 50 samples improves the R-squared of the relationship between the I-129 concentrations and the Cs-137 concentrations from 0.3786 to 0.4630.

Similarly, 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 of the residual tank waste samples were selected for removal as well. Removing only the residual tank waste samples improves the R-squared of the relationship between the I-129 concentrations and the Cs-137 concentrations from 0.4630 to 0.7148.

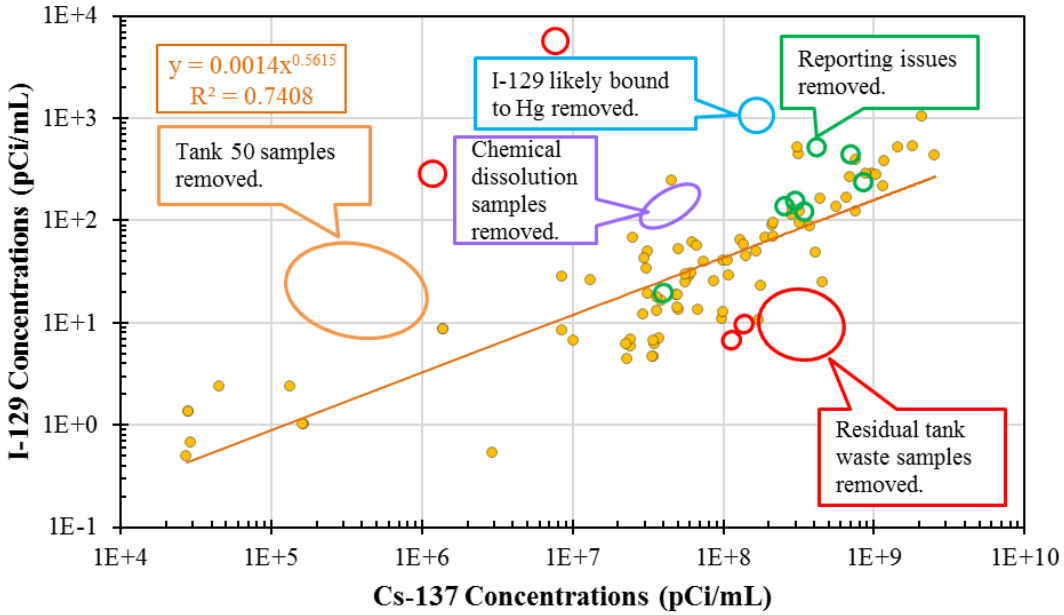
It was determined that some of the samples in the initial data underwent chemical processing (e.g., chemical dissolution in extractant solutions) prior to concentration measurements, such that the samples were chemically altered; while another sample "was likely retained as a nonvolatile mercury species". [SRNL-STI-2016-00026] Additionally, a handful of samples used in the initial data set were found to have reporting issues (i.e., the values reported were not corrected for dilution, and in one instance the values reported in a reference were not consistent with the cited work). Removing these samples (i.e., chemical outliers and data points identified as having reporting issues) improves the R-squared of the relationship between the I-129 concentrations and the Cs-137 concentrations from 0.7148 to 0.7408.

Figure 3-4 circled the outlier data points according to these criteria. Figure 3-5 shows the resulting data set after removing the outliers. Collectively, removing all of these outliers (i.e., the Tank 50 samples, the residual waste tank samples, the chemically-altered outliers, and samples found to have reporting issues), improves the R-squared of the relationship between the I-129 concentrations and the Cs-137 concentrations from 0.3786 to 0.7408 (Figure 3-5). The revised relationship is defined by Equation 3-2:

$$y = 1.40E\text{-}03x^{0.5615} \quad \text{(Eq. 3-2)}$$

where y is the I-129 concentration (pCi/mL) and x is the Cs-137 concentration (pCi/mL) decayed to October 1, 2032.

Figure 3-5: Relationship Between Concentrations of I-129 and Cs-137 (Less Outliers)



3.4 Remove Very Low Concentration Samples

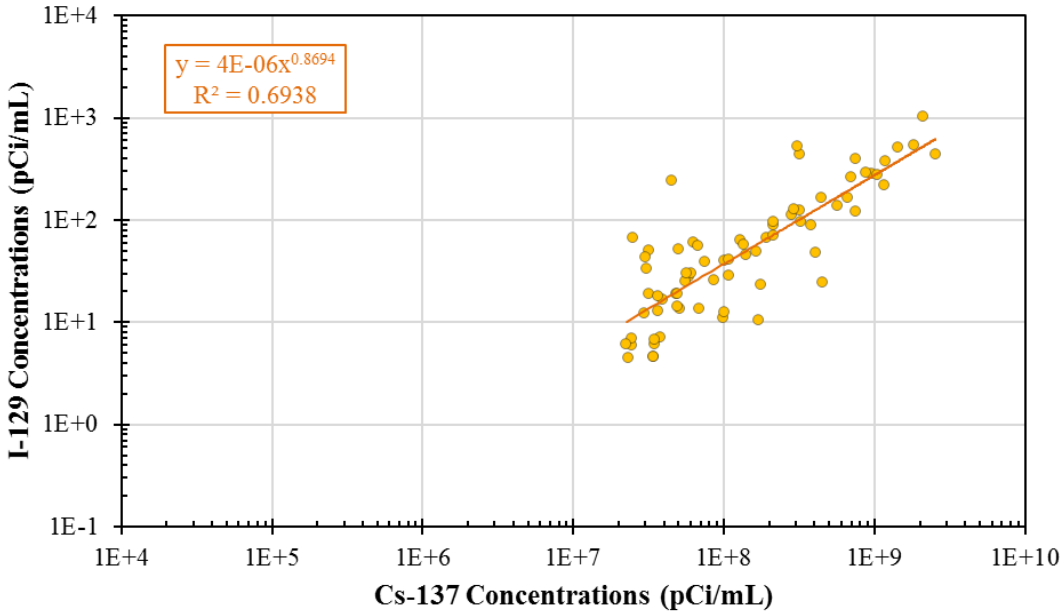
At this point, when concentrations of Cs-137 are greater than approximately 1.0E+08 pCi/mL, most of the data points are above the quantitative trendline (see Figure 3-5). This indicates that Equation 3-2 has a slope that tends to underrepresent these higher concentration values; this is caused by the influence of the lower-concentration samples. 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 improve the slope of this trendline (i.e., to better represent the higher concentration samples), the lower-concentration values were removed. Specifically, all samples with Cs-137 concentration less than 2.0E+07 pCi/mL were ignored (deleted) as shown in Figure 3-6.

The resulting R-squared value for the relationship between I-129 concentrations and Cs-137 concentrations decreased from 0.7408 to 0.6938 (Figure 3-5 and Figure 3-6, respectively), however the trendline is positioned such that the higher concentration samples are better represented. The revised relationship is defined by Equation 3-3:

$$y = 4.12E\text{-}06x^{0.8694} \quad \text{(Eq. 3-3)}$$

where y is the I-129 concentration (pCi/mL) and x is the Cs-137 concentration (pCi/mL) decayed to October 1, 2032. This relationship can be used to assume I-129 concentrations for samples that only include Cs-137 data.

Figure 3-6: Relationship Between Concentrations of I-129 and Cs-137 (Less Outliers and Low-Concentration Samples)



3.5 Remove Detection Limit Samples

Concentrations of I-129 within SRS tank waste are very low relative to more prevalent radionuclides. As shown in Figure 3-2, I-129 concentrations are typically three to four orders of magnitude lower than Tc-99 concentrations and seven to eight orders of magnitude lower than Cs-137 concentrations. Accordingly, it can sometimes be difficult to take an accurate measurement of the I-129 data. Of the I-129 data presented in Table 3-1, more than a third were below detection limits (as identified by a "less than" sign (<)).

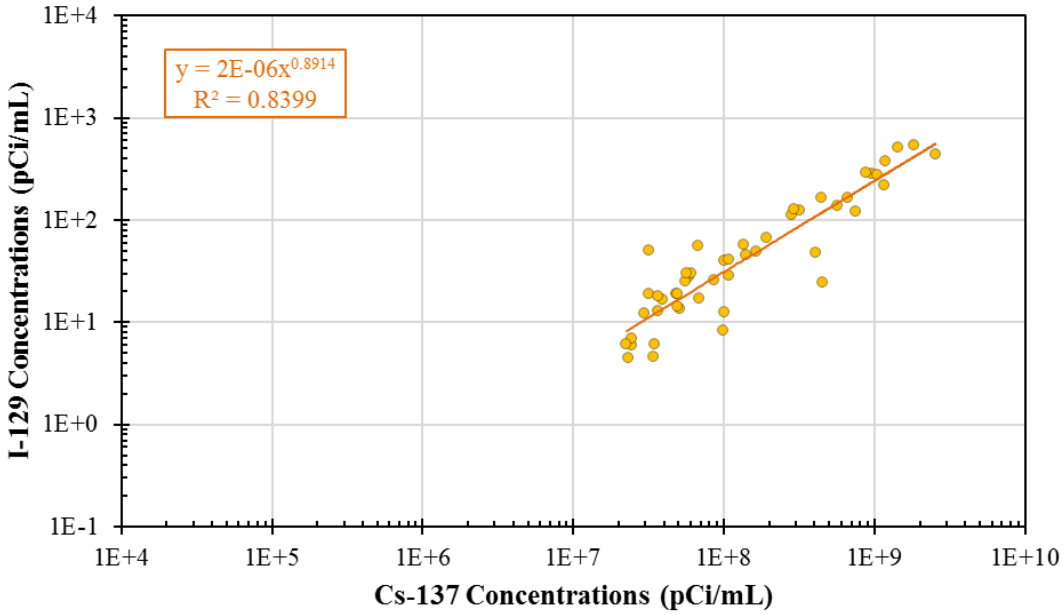
The I-129 samples that are below the detection limits do not represent real data, but instead indicate a conservative upper bound based on sample size and detection methods. For the next step in data normalization, all of the remaining detection limit sample were removed, leaving only real measured sampled data as shown in Figure 3-7.

The resulting R-squared value for the relationship between I-129 concentrations and Cs-137 concentrations increased from 0.6938 to 0.8399 (Figure 3-6 and Figure 3-7, respectively). Further, the trendline is positioned such that the higher concentration samples are better represented. The revised relationship is defined by Equation 3-4:

$$y = 2.30E\text{-}06x^{0.8914} \quad \text{(Eq. 3-4)}$$

where y is the I-129 concentration (pCi/mL) and x is the Cs-137 concentration (pCi/mL) decayed to October 1, 2032. This relationship can be used to assume I-129 concentrations for samples that only include Cs-137 data.

Figure 3-7: Relationship Between Concentrations of I-129 and Cs-137 (Less Outliers, Low-Concentration Samples, and Samples Below Detection)



3.6 Consolidate Like Values for I-129 Samples

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 (or near) the same date. To prevent double-counting of I-129 samples, all of the remaining I-129 samples with like values were averaged together, using the linear mean. For example, two samples from Tank 30 were collected in January of 2017. [SRNL-L3100-2017-00007] Rather than using each of these values for further analysis, the two samples were averaged together (see the last row in Table 3-3).

Table 3-3: Example of Data for Consolidation

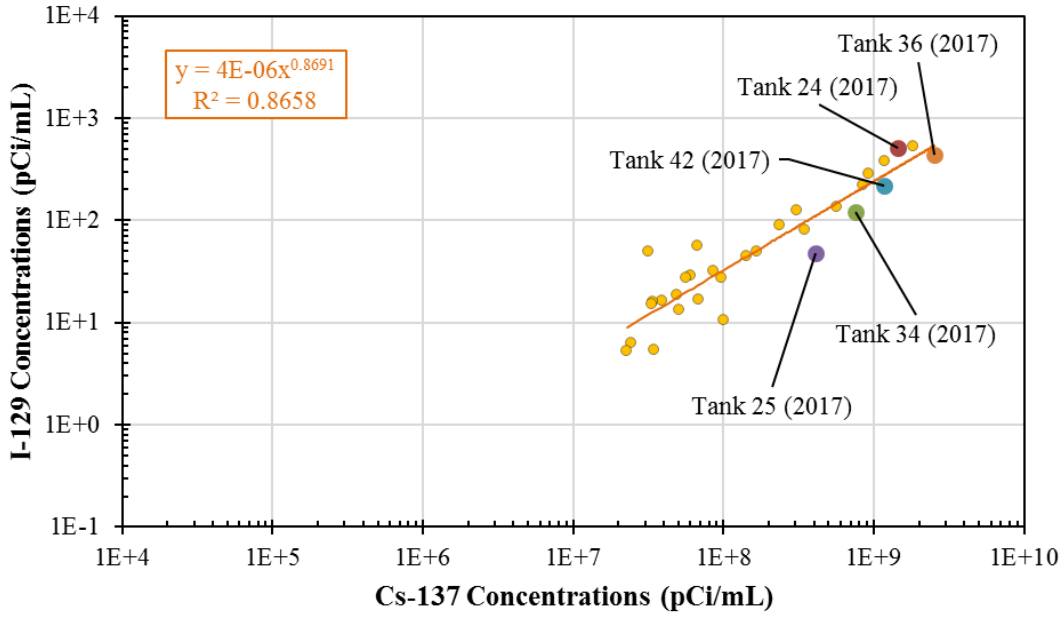
Tank	I-129 Concentration (pCi/mL)	Sample Description
30	1.67E+02	Analysis to support I-129 Evaluations, HTF-30-15-69 (Surface)
30	2.78E+02	Analysis to support I-129 Evaluations, HTF-30-15-70 (Depth)
30	**2.22E+02**	**Consolidated Average**

By consolidating these "like" values (and similar sets of like values), the R-squared value for the relationship between I-129 concentrations and Cs-137 concentrations improved slightly from 0.8399 to 0.8658 (Figure 3-8). The revised relationship is defined by Equation 3-5:

$$y = 3.64E\text{-}06x^{0.8691} \quad \text{(Eq. 3-5)}$$

where y is the I-129 concentration (pCi/mL) and x is the Cs-137 concentration (pCi/mL) decayed to October 1, 2032. This relationship can be used to assume I-129 concentrations for samples that only include Cs-137 data.

Figure 3-8: Relationship Between Concentrations of I-129 and Cs-137 (After Data Reduction and Consolidating Like Values)



Note: This figure identifies recent (2017) sample data to provide additional context.

This formula can be validated by applying it to Cs-137 concentrations from samples that also include I-129 concentrations, then comparing the estimated value (i.e., the value based on the Cs-137 concentration) against the actual measured I-129 concentrations. Figure 3-9 provides this graphical comparison. The solid black line running diagonally through this figure is provided to indicate where the points would lie if there were a perfect 1-to-1 relationship between the estimated values and the measured values.

At first glance, there appears to be significant variation; however, this comparison includes all of the I-129 and Cs-137 pairs from Table 3-1, including a number of outliers that are not appropriate representations of typical tank waste. Figure 3-10 removes these outliers (e.g., samples from Tank 50). By removing the outlier samples, nearly all of the estimated surrogate values are within an order of magnitude of the measured values (i.e., the points are between the black dashed lines). This indicates a very good agreement between the estimated I-129 concentrations (based on Cs-137) and the actual measured I-129 concentrations. Next, the samples wherein the measured I-129 concentration were below the detection limits (i.e., the "less than" samples) were removed, as these values do not represent actual I-129 concentrations. The result (Figure 3-11) shows that the estimated value is almost always close to actual value except when concentrations are very low.

Figure 3-9: Comparison of Estimated Concentrations to Measured Concentrations

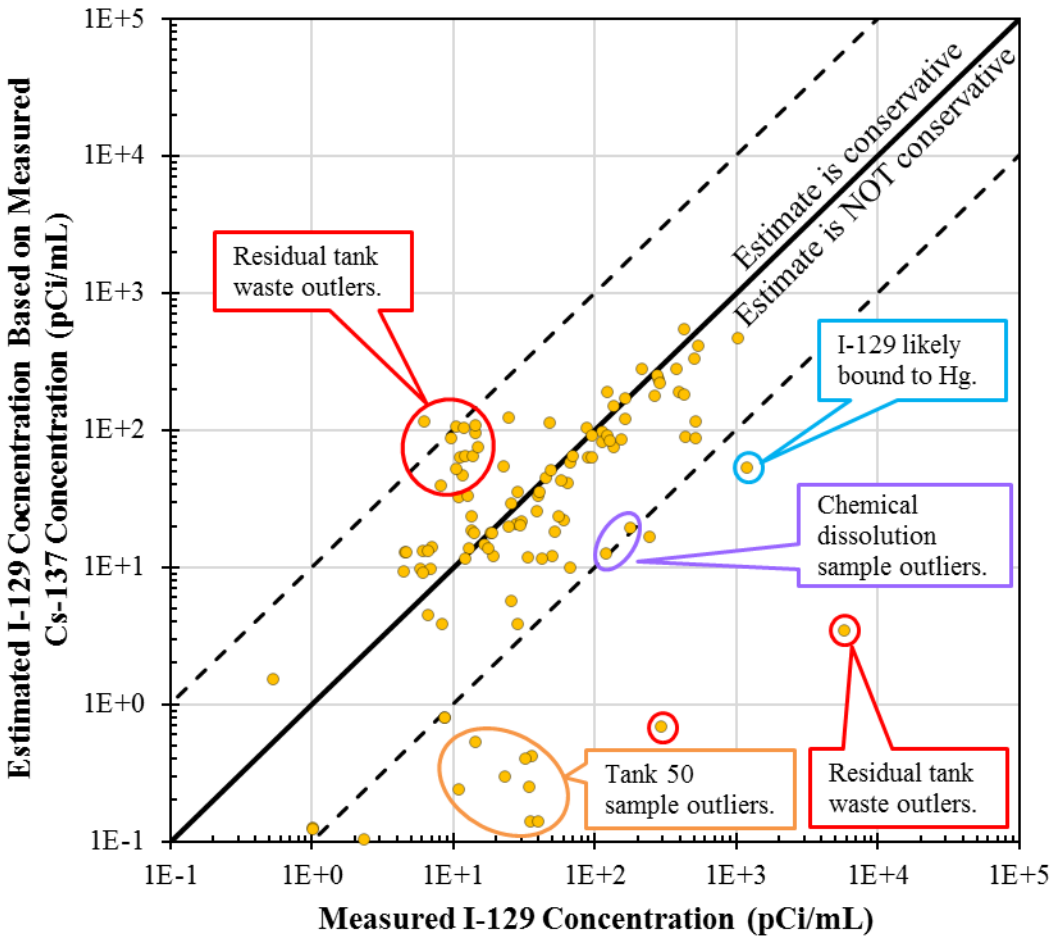


Figure 3-10: Comparison of Estimated Concentrations to Measured Concentrations, Excluding Outlier Samples

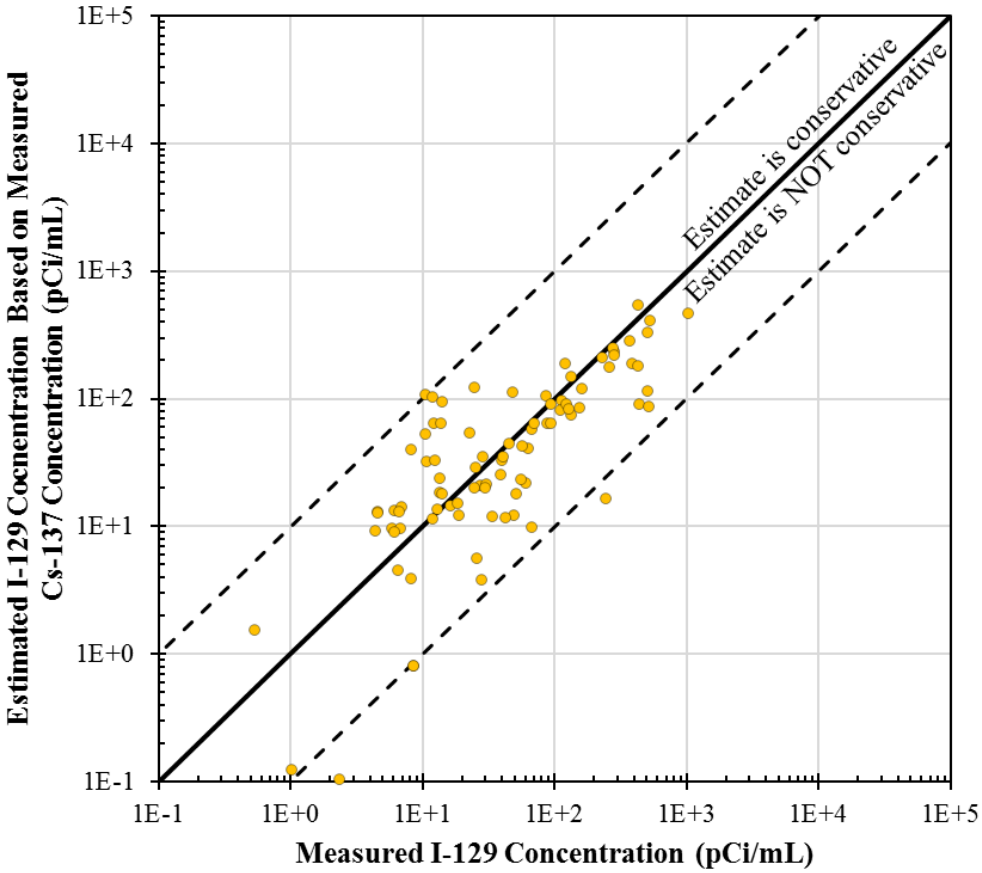
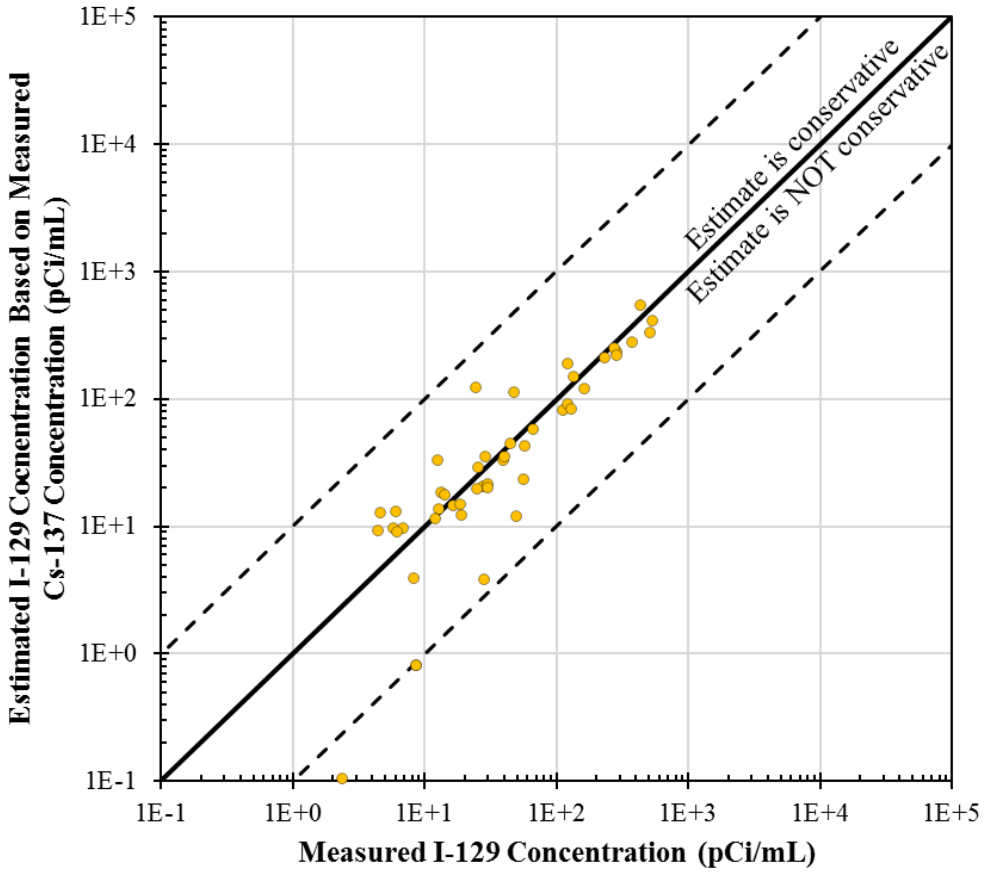


Figure 3-11: Comparison of Estimated Concentrations to Measured Concentrations, Excluding Outlier Samples and Less-Than Detected Samples

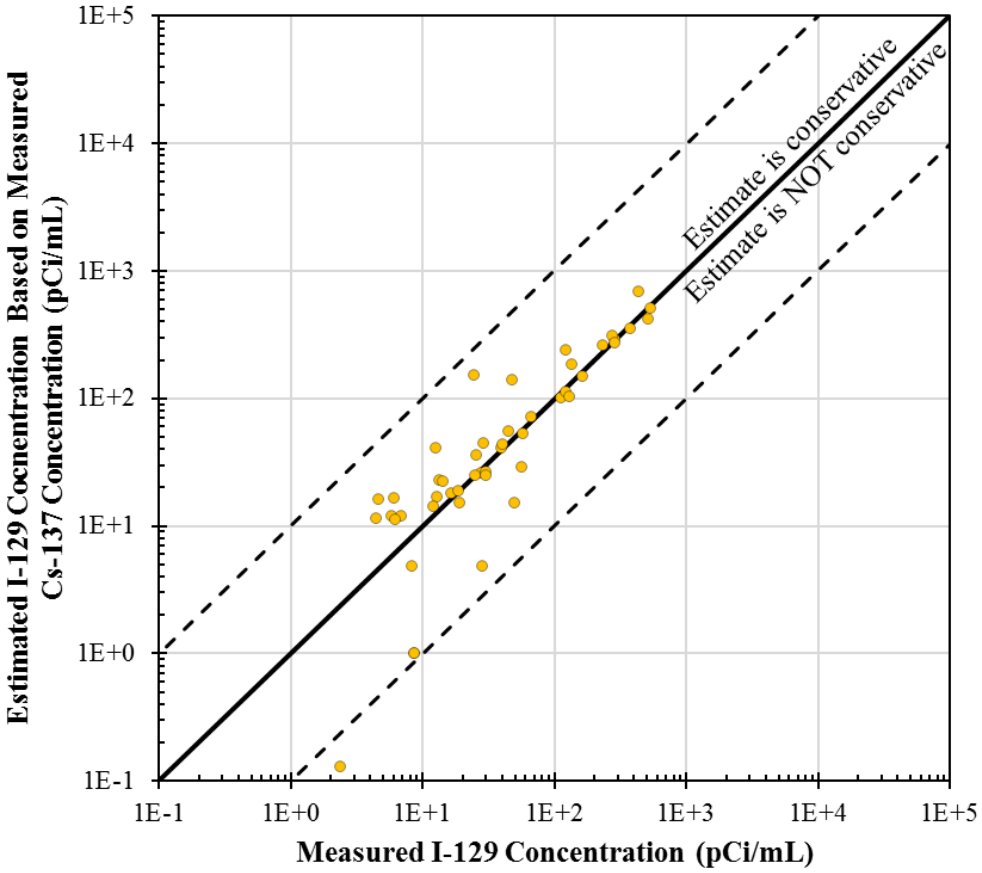


It is noted, however, that the comparison in Figure 3-11 is slightly non-conservative (on average, the measured values were 10% higher than the estimated values). To account for this, and to account for uncertainty, it is recommended that all estimates be scaled up by 25% as defined by Equation 3-6:

$$y = 1.25 \times (3.64E\text{-}06x^{0.8691}) \quad \text{(Eq. 3-6)}$$

This adjustment results in estimates that are, on average, approximately 13% higher than the measured values (Figure 3-12). Given this comparison, Equation 3-6 is a valid tool for estimating I-129 concentrations in the Savannah River Site tank farms when only the Cs-137 concentrations are available.

Figure 3-12: Comparison of Final Estimated Concentrations to Measured Concentrations



3.7 Remove Outliers and Low Concentration Values for All Samples

Sections 3.3 (*Remove Outliers from the I-129 Concentration Data*) and 3.4 (*Remove Very Low Concentration Samples*) focused only on those samples from Table 3-1 that included measurements of I-129 concentrations. However, Table 3-2 shows that much more data is available when all of the Cs-137 samples are included. These Cs-137 values shall be used to predict the I-129 concentrations based on Equation 3-6. Prior to predicting I-129 concentrations for each of these Cs-137 samples, the steps described in Sections 3.3, 3.4, and 3.6 were repeated, using all available data (i.e., Tables 3-1 and 3-2 combined). Note that the Detection Limit samples are included in this data set.

3.8 Normalization Summary

Table 3-4 and Figure 3-13 provide the results from the data normalizing activities described in Section 3.7, wherein records with Cs-137 concentrations but no I-129 concentrations used the relationship (i.e., Equation 3-6) to estimate the respective I-129 concentrations. The resulting data were used for the analyses in Section 4. Also, for samples without Tc-99 data, the relationship from the *Evaluation of Tc-99 Concentration Data to Improve Liquid Waste Inventory Projections* was assumed ($y = 0.0353x^{0.7753}$). [SRR-CWDA-2015-00123]

Table 3-4: Sampled Concentrations of I-129, Tc-99, and Cs-137 After Data Normalization

Tank	I-129 pCi/mL at Closure	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
1	4.56E+02	4.84E+05	1.61E+09	2/21/1973	1.410	N/A
1	3.49E+02	3.81E+05	1.18E+09	8/5/1974	N/A	N/A
1	5.04E+02	5.29E+05	1.80E+09	3/12/1975	N/A	N/A
1	5.64E+01	7.51E+04	1.45E+08	4/30/1987	1.265	N/A
1	4.92E+02	5.18E+05	1.75E+09	7/31/1992	1.517	N/A
1	5.46E+02	5.68E+05	1.98E+09	7/22/1993	1.623	N/A
2	2.79E+02	3.13E+05	9.13E+08	2/20/1973	1.410	N/A
2	4.40E+02	4.69E+05	1.54E+09	8/24/1974	N/A	N/A
2	2.80E+02	3.13E+05	9.16E+08	10/22/1992	1.554	N/A
2	1.98E+02	2.30E+05	6.16E+08	11/24/1993	1.463	N/A
2	4.09E+01	8.36E+04	1.00E+08	9/8/2003	2.040	Salt
2	2.59E+02	4.06E+05	8.39E+08	9/7/2003	1.500	Supernate
3	3.68E+01	5.13E+04	8.88E+07	3/1/1970	2.120	Salt
3	1.17E+02	2.02E+05	3.37E+08	8/4/2003	2.070	Salt
3	8.38E+01	1.07E+05	2.29E+08	5/9/1963	1.295	Supernate
3	2.81E+02	3.39E+05	9.19E+08	8/4/2003	1.494	Supernate
4	3.64E+02	3.97E+05	1.24E+09	6/12/1972	N/A	Supernate
4	3.34E+02	3.67E+05	1.12E+09	7/31/1992	1.311	N/A
4	3.46E+02	3.79E+05	1.17E+09	7/22/1993	1.302	N/A
4	1.93E+01	1.90E+04	4.23E+07	9/6/2012	N/A	Supernate
4	1.05E+01	3.65E+04	9.93E+07	8/19/2015	1.105	Supernate
5	7.01E+02	7.11E+05	2.63E+09	3/1/1973	1.400	N/A
6	1.53E+02	1.83E+05	4.58E+08	3/1/1973	1.220	N/A
6	1.72E+01	2.61E+04	3.71E+07	7/10/2002	1.100	Supernate
7	2.02E+01	3.00E+04	4.44E+07	12/8/1985	1.285	N/A
7	2.86E+01	4.09E+04	6.64E+07	4/4/1986	1.350	N/A
7	2.27E+01	3.33E+04	5.09E+07	11/25/1986	1.154	N/A
7	1.11E+01	1.76E+04	2.23E+07	4/14/1987	1.052	N/A
7	9.67E+01	1.21E+05	2.70E+08	7/31/1992	1.275	N/A
7	1.12E+02	1.38E+05	3.19E+08	7/22/1993	1.284	N/A
7	2.19E+01	2.20E+04	4.90E+07	8/29/2012	N/A	Supernate
7	4.83E+01	6.54E+04	1.21E+08	8/24/2015	1.120	Supernate
8	1.42E+01	2.20E+04	2.98E+07	3/8/1973	1.200	N/A
8	1.27E+02	1.55E+05	3.71E+08	7/1/1976	N/A	N/A
8	3.76E+01	5.23E+04	9.09E+07	11/26/1985	1.247	N/A
8	8.60E+01	1.09E+05	2.36E+08	7/10/1998	N/A	Sludge
8	1.50E+01	2.30E+04	3.16E+07	7/10/2002	1.100	Supernate
8	2.28E+01	2.30E+04	5.12E+07	8/29/2012	N/A	Supernate
8	5.60E+01	4.80E+04	6.70E+07	6/12/2014	N/A	Supernate
9	2.52E+01	3.65E+04	5.73E+07	4/1/1965	1.264	Supernate
9	1.53E+02	1.83E+05	4.57E+08	1/11/1973	1.390	N/A
10	2.78E+02	3.12E+05	9.11E+08	1/5/1973	1.390	N/A
10	1.75E+02	2.06E+05	5.33E+08	8/27/1974	N/A	N/A
10	2.13E+02	2.45E+05	6.68E+08	6/18/1976	N/A	N/A

Table 3-4: Sampled Concentrations of I-129, Tc-99, and Cs-137 After Data Normalization (Continued)

Tank	I-129 pCi/mL at Closure	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
10	2.60E+01	3.77E+04	5.96E+07	6/22/1979	1.380	N/A
10	4.31E+01	7.47E+04	1.06E+08	10/12/2003	2.068	Salt
10	1.56E+02	1.81E+05	4.68E+08	10/15/2003	1.434	Supernate
11	7.60E+01	1.53E+05	3.63E+08	9/25/1975	N/A	N/A
11	3.06E+01	4.36E+04	7.19E+07	11/6/1978	N/A	N/A
11	4.62E+01	6.28E+04	1.15E+08	2/17/1992	1.291	N/A
11	4.27E+01	5.85E+04	1.05E+08	3/3/1993	1.322	N/A
11	1.80E+01	1.75E+04	3.89E+07	5/10/2013	1.217	Supernate
12	2.80E+02	3.83E+05	1.19E+09	1/21/1976	N/A	Supernate
12	1.13E+02	1.39E+05	3.22E+08	12/18/1978	N/A	N/A
12	3.43E+01	4.81E+04	8.18E+07	2/28/1985	N/A	N/A
12	1.79E+02	2.11E+05	5.49E+08	7/10/1998	N/A	Sludge
13	4.57E+01	6.22E+04	1.14E+08	12/19/1972	1.200	Supernate
13	2.06E+02	2.38E+05	6.43E+08	6/15/1976	N/A	N/A
13	2.59E+01	3.75E+04	5.92E+07	2/25/1981	1.440	N/A
13	8.21E+01	1.05E+05	2.24E+08	4/21/1986	1.448	N/A
13	8.99E+01	1.14E+05	2.48E+08	9/3/1987	1.339	N/A
13	5.28E+02	5.52E+05	1.90E+09	5/29/1991	1.435	N/A
13	7.14E+02	7.23E+05	2.69E+09	5/30/1992	1.472	N/A
13	5.13E+02	5.38E+05	1.84E+09	7/3/1993	1.444	N/A
13	5.36E+02	6.30E+05	1.82E+09	10/20/2003	N/A	Supernate
13	1.54E+02	1.84E+05	4.62E+08	4/16/2012	1.360	Sludge
13	1.11E+02	1.37E+05	3.15E+08	6/18/2012	1.260	Sludge
13	1.36E+02	1.65E+05	4.01E+08	8/13/2012	1.270	Supernate
13	1.68E+01	5.32E+04	1.74E+08	12/8/2014	1.075	Supernate
14	1.13E+02	1.40E+05	3.24E+08	12/1/1963	1.300	Supernate
14	1.22E+02	1.50E+05	3.53E+08	4/1/1965	1.318	Supernate
14	8.36E+01	1.07E+05	2.28E+08	1/3/1973	1.380	N/A
15	5.62E+01	7.49E+04	1.45E+08	9/21/1966	1.340	Supernate
15	1.85E+02	2.17E+05	5.70E+08	12/19/1972	1.290	N/A
15	2.90E+02	1.12E+05	2.44E+08	12/6/1975	N/A	N/A
15	4.85E+01	6.56E+04	1.22E+08	9/6/1985	1.170	N/A
15	1.82E+01	2.73E+04	3.94E+07	12/1/1987	1.230	N/A
15	6.20E+01	8.16E+04	1.62E+08	11/4/2016	1.250	Sludge
15	6.87E+01	8.95E+04	1.82E+08	3/16/2017	1.190	Sludge
15	3.44E+01	4.83E+04	8.22E+07	5/30/2017	1.230	Sludge
16	2.00E+02	2.32E+05	6.22E+08	5/25/1960	1.370	N/A
18	3.66E+02	3.99E+05	1.25E+09	9/7/1972	N/A	N/A
18	1.63E+01	2.48E+04	3.47E+07	8/22/1973	N/A	N/A
18	4.38E+01	5.99E+04	1.08E+08	10/14/1975	1.364	N/A
18	1.75E+01	2.64E+04	3.77E+07	4/5/1977	N/A	N/A
19	3.72E+01	5.18E+04	8.99E+07	10/14/1975	1.430	N/A
20	6.09E+01	8.04E+04	1.58E+08	10/14/1975	1.446	N/A
20	1.27E+01	1.08E+04	2.61E+07	11/15/1985	1.370	N/A
20	1.05E+01	1.67E+04	2.09E+07	4/4/1986	1.349	N/A

Table 3-4: Sampled Concentrations of I-129, Tc-99, and Cs-137 After Data Normalization (Continued)

Tank	I-129 pCi/mL at Closure	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
20	1.12E+01	9.01E+03	2.26E+07	6/17/1986	1.355	N/A
21	2.23E+01	3.28E+04	4.98E+07	10/12/1976	N/A	N/A
21	2.32E+01	2.40E+04	5.21E+07	9/23/1986	N/A	Supernate
21	2.36E+01	2.44E+04	5.31E+07	9/7/1986	1.175	N/A
21	1.76E+01	2.65E+04	3.79E+07	1/19/2010	1.263	Supernate
21	1.67E+01	1.95E+04	3.34E+07	1/2/2012	1.296	Supernate
21	1.21E+01	1.67E+04	2.95E+07	5/16/2013	1.272	Supernate
21	4.53E+01	5.76E+04	1.41E+08	9/18/2014	1.257	Supernate
21	4.97E+01	6.28E+04	1.65E+08	9/1/2015	1.250	Supernate
21	2.57E+01	3.87E+04	8.61E+07	11/21/2016	1.254	Supernate
21	2.88E+01	4.17E+04	1.09E+08	7/31/2017	1.269	Supernate
22	2.02E+01	3.00E+04	4.45E+07	6/23/1976	N/A	N/A
22	1.01E+01	1.62E+04	2.01E+07	6/11/1986	1.370	N/A
22	4.80E+01	6.50E+04	1.20E+08	1/5/1994	1.039	N/A
22	7.15E+01	9.28E+04	1.91E+08	10/1/2014	1.120	Supernate
22	4.28E+01	1.13E+04	3.00E+07	6/1/2016	N/A	Supernate
23	1.88E+01	2.44E+04	4.90E+07	11/16/2009	N/A	Supernate
23	1.42E+01	2.66E+04	4.94E+07	6/8/2015	1.270	Supernate
23	4.05E+01	4.18E+04	1.04E+08	6/8/2015	1.165	Supernate
24	3.46E+01	4.86E+04	8.27E+07	8/27/1974	N/A	N/A
24	2.18E+01	3.22E+04	4.87E+07	10/24/1975	1.113	N/A
24	3.90E+01	5.40E+04	9.50E+07	9/3/1983	1.060	N/A
24	2.92E+01	4.76E+04	5.99E+07	7/28/2009	N/A	Supernate
24	5.14E+02	3.95E+05	1.43E+09	7/1/2017	1.490	Supernate
25	3.06E+01	4.35E+04	7.19E+07	6/14/1985	1.640	N/A
25	3.31E+01	4.67E+04	7.86E+07	1/13/1988	1.386	N/A
25	1.50E+02	1.67E+05	4.47E+08	7/27/1992	1.466	Supernate
25	1.67E+02	1.98E+05	5.06E+08	8/5/1993	1.459	N/A
25	7.47E+01	8.85E+04	1.76E+08	6/7/2006	1.920	Salt
25	1.33E+02	1.36E+05	3.88E+08	6/7/2006	1.440	Supernate
25	4.82E+01	1.57E+05	4.10E+08	7/21/2017	1.380	Supernate
26	1.80E+02	2.11E+05	5.51E+08	12/3/1981	1.520	N/A
26	2.74E+01	3.94E+04	6.33E+07	4/30/1987	1.467	N/A
26	1.46E+02	1.76E+05	4.35E+08	8/8/1991	1.401	N/A
26	1.12E+02	1.38E+05	3.18E+08	11/6/1991	1.319	N/A
26	1.86E+02	2.18E+05	5.73E+08	2/12/1992	1.435	N/A
26	1.95E+02	2.27E+05	6.04E+08	5/19/1992	1.497	N/A
26	1.90E+02	1.80E+05	5.86E+08	8/10/1992	1.537	Supernate
26	2.19E+02	2.52E+05	6.90E+08	11/13/1992	1.545	N/A
26	2.09E+02	2.41E+05	6.54E+08	2/24/1993	1.390	N/A
26	2.45E+02	2.78E+05	7.85E+08	10/24/2001	1.383	Supernate
27	2.82E+01	4.05E+04	6.55E+07	4/22/1987	1.308	N/A
27	1.47E+02	1.40E+05	4.36E+08	7/21/1992	1.471	Supernate
27	1.66E+02	1.97E+05	5.04E+08	8/5/1993	1.456	N/A
28	1.16E+02	1.43E+05	3.34E+08	12/3/1981	N/A	N/A

Table 3-4: Sampled Concentrations of I-129, Tc-99, and Cs-137 After Data Normalization (Continued)

Tank	I-129 pCi/mL at Closure	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
28	3.44E+01	4.83E+04	8.22E+07	6/14/1985	1.410	N/A
28	1.74E+01	2.63E+04	3.75E+07	11/26/1986	1.185	N/A
28	2.84E+01	4.08E+04	6.60E+07	10/7/1987	1.316	N/A
28	3.12E+01	4.42E+04	7.34E+07	4/21/1988	1.575	N/A
28	1.69E+02	1.80E+05	5.11E+08	7/21/1992	1.470	Supernate
28	1.42E+02	1.71E+05	4.19E+08	7/23/1993	1.376	N/A
28	1.29E+02	2.00E+05	3.75E+08	2/14/2006	1.900	Salt
28	1.36E+02	1.99E+05	5.64E+08	2/15/2006	1.458	Supernate
29	2.03E+02	2.35E+05	6.32E+08	7/14/1976	N/A	N/A
29	2.63E+01	3.80E+04	6.04E+07	1/11/1985	N/A	N/A
29	5.19E+01	6.97E+04	1.32E+08	7/17/1987	1.135	N/A
29	3.56E+02	5.19E+05	1.21E+09	12/1/1992	1.441	N/A
29	2.22E+02	4.28E+05	7.00E+08	8/26/2003	2.130	Salt
29	1.90E+02	1.76E+05	5.86E+08	9/2/2003	1.260	Supernate
30	3.00E+02	4.07E+05	1.28E+09	2/29/1984	1.650	Supernate
30	3.39E+01	4.77E+04	8.08E+07	8/13/1986	1.313	N/A
30	3.23E+02	3.56E+05	1.08E+09	9/4/1991	1.353	N/A
30	3.57E+02	3.43E+05	1.21E+09	3/29/1992	1.350	N/A
30	2.76E+02	2.81E+05	9.02E+08	11/13/1992	1.280	Supernate
30	3.94E+02	4.25E+05	1.36E+09	7/3/1993	1.411	N/A
30	3.84E+02	4.15E+05	1.32E+09	4/3/2000	1.363	Supernate
30	3.98E+02	4.29E+05	1.38E+09	3/27/2001	1.430	Supernate
30	6.77E+02	6.89E+05	2.53E+09	3/27/2001	1.940	Supernate
30	3.78E+02	9.83E+05	1.18E+09	5/12/2003	N/A	Supernate
30	2.22E+02	3.08E+05	8.49E+08	6/1/2015	1.424	Supernate
30	2.22E+02	3.11E+05	9.08E+08	1/11/2017	1.424	Supernate
31	3.41E+02	3.74E+05	1.15E+09	6/11/1976	N/A	N/A
31	4.06E+01	5.60E+04	9.93E+07	2/25/1981	1.500	N/A
31	8.76E+01	1.11E+05	2.41E+08	6/11/1986	1.511	N/A
31	4.05E+02	4.36E+05	1.40E+09	5/20/1992	1.442	N/A
31	1.30E+02	1.58E+05	3.80E+08	8/6/2002	1.960	Salt
31	1.25E+02	1.53E+05	3.63E+08	8/6/2002	1.278	Supernate
32	1.39E+02	1.67E+05	4.08E+08	6/11/1976	N/A	N/A
32	9.60E+01	1.47E+05	3.46E+08	2/29/1984	1.270	Supernate
32	1.04E+02	1.29E+05	2.93E+08	6/11/1986	1.295	N/A
32	1.87E+02	2.19E+05	5.77E+08	12/11/1988	1.236	N/A
32	2.67E+02	3.01E+05	8.69E+08	12/20/1990	1.280	N/A
32	1.35E+02	1.92E+05	3.97E+08	11/27/1992	1.240	Supernate
32	1.83E+02	2.14E+05	5.60E+08	11/21/1993	1.253	N/A
32	2.69E+02	3.02E+05	8.75E+08	4/3/2000	1.303	Supernate
32	4.61E+02	4.89E+05	1.63E+09	3/27/2001	1.430	Supernate
32	2.86E+02	3.62E+05	9.20E+08	6/1/2015	1.467	Supernate
32	2.86E+02	3.90E+05	1.22E+09	1/11/2017	1.467	Supernate
32	3.07E+02	3.40E+05	1.02E+09	9/21/2017	1.440	Supernate
33	2.07E+01	3.07E+04	4.59E+07	8/18/1986	1.263	N/A

Table 3-4: Sampled Concentrations of I-129, Tc-99, and Cs-137 After Data Normalization (Continued)

Tank	I-129 pCi/mL at Closure	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
33	1.61E+01	2.46E+04	3.44E+07	1/20/1987	N/A	N/A
33	8.39E+01	2.07E+05	2.29E+08	5/18/1992	1.251	N/A
33	8.28E+01	1.06E+05	2.26E+08	5/19/1993	1.253	N/A
34	2.96E+02	3.29E+05	9.76E+08	1/12/1976	N/A	N/A
34	1.49E+01	2.29E+04	3.13E+07	8/16/1985	1.226	N/A
34	1.68E+01	2.55E+04	3.59E+07	4/4/1986	1.250	N/A
34	1.36E+01	2.10E+04	2.81E+07	1/27/1988	1.162	N/A
34	8.92E+01	1.40E+05	2.46E+08	4/26/1992	1.251	N/A
34	9.28E+01	1.17E+05	2.57E+08	4/21/1993	1.232	N/A
34	1.25E+02	1.52E+05	3.61E+08	9/13/2002	1.380	Supernate
34	1.22E+02	2.11E+05	7.53E+08	7/21/2017	1.430	Supernate
35	4.86E+01	6.57E+04	1.22E+08	2/28/1985	N/A	N/A
35	4.40E+01	6.01E+04	1.09E+08	9/28/1987	1.179	N/A
35	2.69E+02	3.02E+05	8.74E+08	11/21/1992	1.287	N/A
35	1.21E+02	1.49E+05	3.50E+08	6/25/2000	N/A	Supernate
35	1.26E+02	1.41E+05	3.60E+08	9/15/2013	1.265	Supernate
35	1.25E+02	1.41E+05	3.61E+08	11/14/2013	N/A	Supernate
35	8.20E+01	1.04E+05	3.44E+08	3/9/2015	1.310	Supernate
36	8.36E+01	1.07E+05	2.28E+08	4/21/1986	1.514	N/A
36	1.03E+02	1.29E+05	2.91E+08	6/30/1987	1.390	N/A
36	8.35E+01	1.07E+05	2.28E+08	3/21/1988	1.297	N/A
36	1.07E+02	1.32E+05	3.02E+08	3/28/1993	1.446	N/A
36	4.34E+02	4.28E+05	2.53E+09	8/21/2017	1.480	Supernate
37	1.33E+02	1.62E+05	3.90E+08	6/11/1986	1.484	N/A
37	9.71E+01	1.22E+05	2.71E+08	6/30/1987	1.292	N/A
37	1.08E+02	1.33E+05	3.05E+08	3/21/1988	1.530	N/A
37	2.15E+02	2.48E+05	6.77E+08	12/11/1991	1.311	N/A
37	8.85E+01	1.12E+05	2.44E+08	3/29/1993	1.373	N/A
37	1.03E+03	8.11E+05	2.10E+09	10/10/2003	N/A	Supernate
37	2.33E+02	2.66E+05	7.40E+08	5/20/2005	1.910	Salt
37	4.82E+02	1.05E+05	3.13E+08	6/1/2015	N/A	Supernate
38	1.68E+01	2.55E+04	3.61E+07	3/21/1988	1.399	N/A
38	1.51E+01	2.32E+04	3.19E+07	2/25/1991	1.277	N/A
38	1.39E+02	1.68E+05	4.10E+08	5/29/1991	1.459	N/A
38	6.08E+01	8.03E+04	1.58E+08	8/28/1991	1.550	N/A
38	5.54E+01	7.39E+04	1.42E+08	9/30/1991	1.345	N/A
38	1.16E+02	1.43E+05	3.32E+08	10/1/1991	1.450	N/A
38	5.44E+01	7.27E+04	1.39E+08	10/25/1991	1.269	N/A
38	1.13E+02	1.40E+05	3.24E+08	12/14/1991	1.458	N/A
38	1.30E+02	1.99E+05	3.79E+08	8/5/1992	1.454	N/A
38	8.48E+01	1.08E+05	2.32E+08	6/26/1993	1.391	N/A
38	1.79E+01	2.91E+04	3.88E+07	9/8/2003	1.955	Salt
38	3.81E+01	4.99E+04	9.25E+07	9/8/2003	1.442	Supernate
38	1.16E+01	1.57E+04	2.35E+07	1/15/2014	1.228	Supernate
38	6.38E+00	1.51E+04	2.72E+07	6/7/2014	1.288	Supernate

Table 3-4: Sampled Concentrations of I-129, Tc-99, and Cs-137 After Data Normalization (Continued)

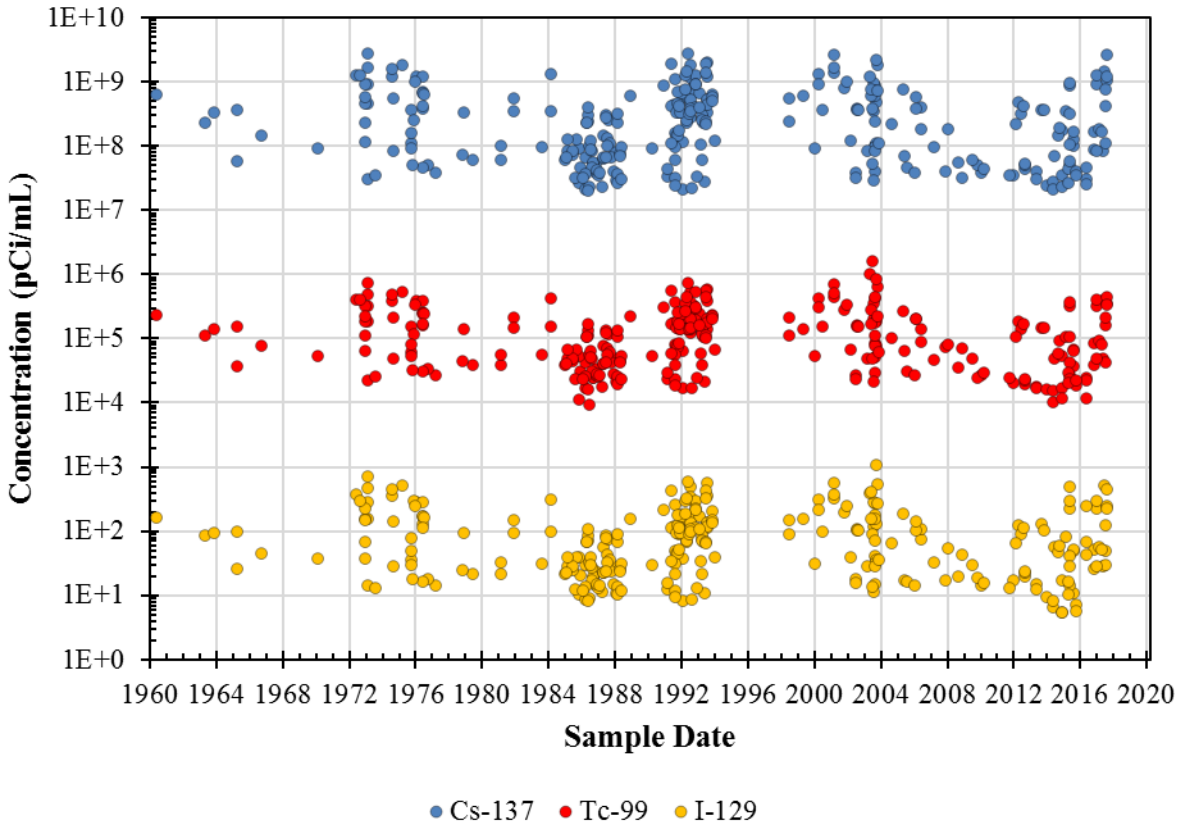
Tank	I-129 pCi/mL at Closure	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
38	5.38E+00	1.68E+04	3.45E+07	11/28/2014	1.315	Supernate
38	1.97E+01	2.93E+04	4.32E+07	5/1/2015	1.295	Supernate
38	7.07E+00	1.80E+04	3.87E+07	10/17/2015	1.145	Supernate
38	2.45E+02	2.40E+04	4.52E+07	6/1/2016	N/A	Supernate
39	4.05E+01	5.59E+04	9.92E+07	6/23/1986	1.230	N/A
39	3.99E+01	5.51E+04	9.73E+07	8/1/1987	1.298	N/A
39	1.51E+02	1.81E+05	4.50E+08	10/9/1991	1.296	N/A
39	1.65E+02	1.95E+05	4.98E+08	11/21/1993	1.294	N/A
39	8.78E+01	1.56E+06	3.78E+08	7/10/2003	N/A	Supernate
39	3.92E+01	4.64E+04	9.55E+07	4/2/2007	1.230	Supernate
39	2.74E+01	2.32E+04	5.63E+07	6/1/2015	1.207	Supernate
39	2.74E+01	4.82E+04	8.19E+07	1/11/2017	1.207	Supernate
40	1.01E+01	1.63E+04	2.02E+07	2/17/1992	1.151	N/A
40	1.06E+01	1.69E+04	2.11E+07	8/28/1992	1.212	N/A
41	1.85E+01	2.78E+04	4.02E+07	12/20/1986	1.079	N/A
41	3.88E+01	5.37E+04	9.42E+07	8/24/1991	1.414	N/A
41	1.11E+02	1.37E+05	3.15E+08	6/22/1992	1.389	N/A
41	1.36E+01	2.12E+04	2.84E+07	8/6/2003	1.975	Salt
41	3.40E+01	4.78E+04	8.12E+07	4/3/2003	N/A	Supernate
41	1.35E+01	4.70E+04	5.09E+07	7/10/2003	1.401	Supernate
41	3.45E+01	7.72E+04	8.24E+07	9/15/2003	1.404	Supernate
41	4.30E+01	5.90E+04	1.06E+08	12/10/2003	1.430	Supernate
41	2.43E+01	3.54E+04	5.50E+07	9/9/2008	1.412	Supernate
41	6.76E+01	2.22E+04	2.51E+07	6/1/2016	N/A	Supernate
42	1.46E+01	2.24E+04	3.05E+07	8/30/1991	1.043	N/A
42	1.33E+01	2.07E+04	2.75E+07	5/27/1993	1.047	N/A
42	4.78E+01	6.47E+04	1.20E+08	3/21/2002	1.300	Supernate
42	2.18E+02	3.26E+05	1.16E+09	8/14/2017	1.460	Supernate
43	1.48E+01	2.28E+04	3.12E+07	2/19/1986	1.293	N/A
43	1.24E+01	1.95E+04	2.54E+07	3/7/1988	1.154	N/A
43	3.72E+01	5.18E+04	9.00E+07	3/28/1990	N/A	Supernate
43	1.94E+01	2.90E+04	4.25E+07	3/8/1991	1.085	N/A
43	4.27E+01	5.86E+04	1.05E+08	6/17/1991	1.240	N/A
43	2.60E+01	3.77E+04	5.96E+07	8/28/1991	1.114	N/A
43	6.45E+01	8.46E+04	1.69E+08	11/18/1991	1.273	N/A
43	1.18E+02	1.43E+05	3.38E+08	7/27/1992	1.380	N/A
43	7.93E+01	1.02E+05	2.15E+08	6/29/1993	1.371	N/A
43	3.78E+01	5.25E+04	9.15E+07	2/2/2000	1.297	Supernate
43	1.01E+01	1.00E+04	2.02E+07	6/2/2014	1.197	Supernate
43	5.31E+00	1.15E+04	2.28E+07	11/28/2014	1.175	Supernate
43	1.26E+01	1.97E+04	2.59E+07	5/1/2015	1.180	Supernate
43	5.67E+00	2.14E+04	3.41E+07	10/12/2015	1.220	Supernate
44	1.90E+02	1.40E+05	5.86E+08	5/12/1999	N/A	Supernate
44	2.76E+01	3.96E+04	6.37E+07	1/22/1985	N/A	N/A
44	1.72E+01	2.61E+04	3.71E+07	1/28/1987	1.170	N/A

Table 3-4: Sampled Concentrations of I-129, Tc-99, and Cs-137 After Data Normalization (Continued)

Tank	I-129 pCi/mL at Closure	Tc-99 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference	Specific Gravity or Density	Waste Phase
44	3.81E+01	5.29E+04	9.25E+07	5/18/1988	N/A	N/A
44	2.10E+02	2.43E+05	6.60E+08	1/17/1992	1.465	N/A
44	2.63E+01	3.80E+04	6.04E+07	4/12/1993	1.420	N/A
45	4.72E+01	6.41E+04	1.18E+08	7/30/1986	1.401	N/A
45	2.85E+01	4.08E+04	6.62E+07	7/5/1987	1.332	N/A
45	1.45E+01	2.24E+04	3.04E+07	5/18/1988	N/A	N/A
45	2.15E+02	2.47E+05	6.76E+08	10/19/1991	1.491	N/A
45	2.34E+02	2.67E+05	7.44E+08	4/15/1992	1.511	N/A
45	1.31E+02	1.60E+05	3.84E+08	2/24/1993	1.522	N/A
45	1.95E+02	1.66E+05	6.03E+08	6/9/2003	N/A	Supernate
46	2.98E+02	3.32E+05	9.87E+08	12/20/2001	1.413	Supernate
46	3.94E+02	2.77E+05	7.57E+08	6/23/2003	N/A	Supernate
47	3.57E+01	4.99E+04	8.57E+07	7/30/1986	1.434	N/A
47	2.88E+01	4.12E+04	6.70E+07	4/21/1988	1.489	N/A
47	1.38E+02	1.67E+05	4.07E+08	11/13/1991	1.364	N/A
48	1.16E+01	1.84E+04	2.36E+07	8/24/1991	1.095	N/A
48	1.57E+01	2.40E+04	3.32E+07	12/16/1992	1.091	N/A
48	8.53E+01	1.09E+05	2.33E+08	9/17/2003	1.144	Supernate
48	7.90E+01	1.01E+05	2.14E+08	8/23/2004	1.162	Sludge
48	8.07E+01	1.03E+05	2.19E+08	2/28/2012	1.219	Sludge
49	2.65E+02	2.18E+05	6.94E+08	10/20/2003	N/A	Supernate
49	1.70E+01	6.28E+04	6.83E+07	6/1/2005	1.370	Supernate
49	1.66E+01	7.16E+04	3.91E+07	12/7/2007	1.251	Supernate
49	6.69E+01	7.93E+04	1.76E+08	1/18/2008	1.258	Supernate
49	4.19E+01	6.89E+04	3.12E+07	12/5/2008	1.273	Supernate
49	1.93E+01	2.88E+04	4.22E+07	3/25/2010	1.265	Supernate
49	1.61E+01	2.45E+04	3.42E+07	10/10/2011	1.271	Supernate
51	2.01E+01	2.99E+04	4.42E+07	8/19/2005	1.150	Supernate
51	1.76E+01	2.65E+04	3.79E+07	1/24/2006	1.190	Sludge
51	6.33E+01	7.95E+04	1.66E+08	5/1/2017	1.100	Sludge

Note: All Cs-137 and Tc-99 concentrations have been decayed to October 1, 2032.
NA = Not Available

Figure 3-13: Concentrations of I-129, Tc-99, and Cs-137 After Data Normalization

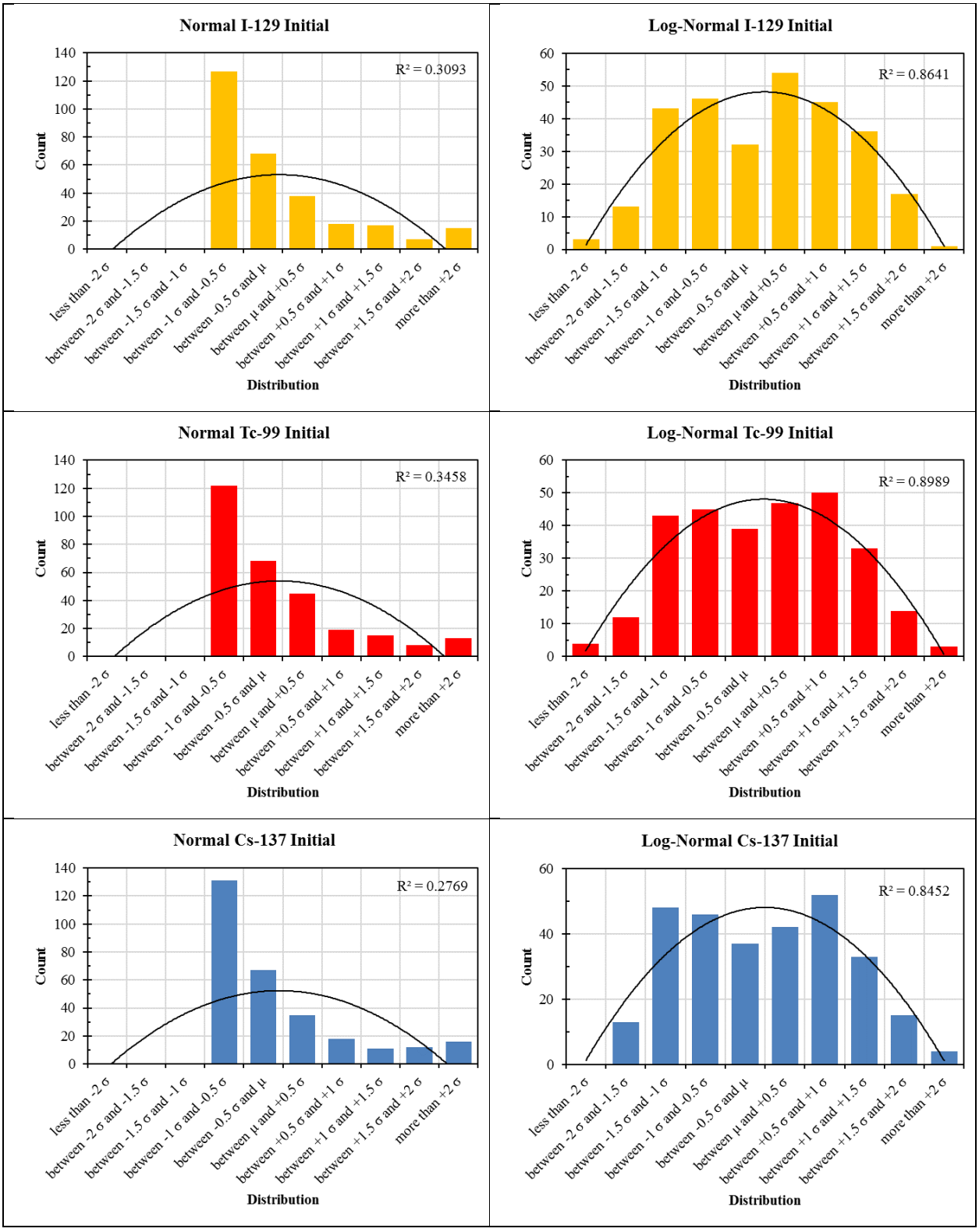


Note: All Cs-137 and Tc-99 concentrations have been decayed to October 1, 2032.

Figure 3-14 provides an alternative illustration of this logarithmic data 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 3-3.

The final logarithmic mean concentrations for I-129, Tc-99, and Cs-137 were 6.01E+01 pCi/mL, 9.24E+04 pCi/mL and 1.92E+08 pCi/mL, respectively. Similarly, the median concentrations for I-129, Tc-99, and Cs-137 were 6.58E+01 pCi/mL, 1.02E+05 pCi/mL and 2.14E+08 pCi/mL, respectively.

Figure 3-14: Distribution Behavior of Sampled Concentrations of I-129, Tc-99, and Cs-137 After Data Normalization



4.0 I-129 INVENTORY ESTIMATE

Section 4.1 provides a description of the approach used to estimate the I-129 concentrations for waste in the tank farms. In Section 4.2 these concentrations are multiplied by the current tank farm volumes (see Table A-2 in Appendix A) to provide an estimated inventory of I-129 based on Cs-137 data. Finally, Section 4.3 examines the set of available I-129 samples and replaces the estimated concentration values with recent sample concentrations, where applicable. Section 4.4 provides a brief summary of the recommended inventory.

4.1 Estimate of I-129 Concentrations of Tank Farm Waste

Data from a recent *Curie and Volume Inventory Report* (SRR-LWP-2017-00033[1]) was used to estimate what the current Cs-137 concentrations would be if decayed to October 1, 2032 (see Table A-6 in Appendix A). Using these Cs-137 concentrations with Equation 3-6 (Section 3.6), the data was converted into estimated concentrations for I-129. These estimated concentrations are provided in Table 4-1.

4.2 Preliminary Estimate of I-129 Inventories

The aqueous concentrations were multiplied by the sum of the supernate volume and interstitial liquid volumes (Table A-2) to provide an estimated I-129 supernate inventory. The sludge concentrations were multiplied by the insoluble sludge volumes (Table A-2) to provide an estimated I-129 sludge inventory. The salt concentrations were multiplied by the solid salt volumes (Table A-2) to provide an estimated I-129 salt inventory. These values are provided in Table 4-2.

[1] Note that a more recent *Curie and Volume Inventory Report* is available (SRR-LWP-2017-00057); however, this report did not include the Cs-137-specific data.

Table 4-1: Estimated Concentrations for I-129 Based on Cs-137

Tank	Concentration (pCi/mL)		
	Aqueous Waste [a]	Insoluble Sludge	Insoluble Salt
1	6.04E+02	6.58E+02	2.60E+00
2	2.51E+02	1.89E+02	2.60E+00
3	2.53E+02	1.69E+02	2.60E+00
4	3.98E+01	3.09E+02	2.60E+00
5 & 6	Not Applicable. Tank(s) closed.		
7	4.73E+01	2.50E+02	2.60E+00
8	3.01E+01	2.33E+03	2.60E+00
9	1.53E+02	2.88E+02	2.60E+00
10	4.12E+01	4.03E+01	2.60E+00
11	1.01E+01	2.89E+02	2.60E+00
12	Not Applicable. Tank(s) closed.		
13	7.65E+01	8.53E+02	2.60E+00
14	8.03E+02	7.45E+01	2.60E+00
15	6.86E+01	1.38E+02	2.60E+00
16 through 20	Not Applicable. Tank(s) closed.		
21	3.60E+01	1.92E+02	2.60E+00
22	4.59E+00	5.25E+01	2.60E+00
23	3.76E+01	1.40E+01	2.60E+00
24	3.17E+02	0.00E+00	2.60E+00
25	1.37E+02	0.00E+00	2.60E+00
26	9.60E+01	1.08E+01	2.60E+00
27	2.10E+02	0.00E+00	2.60E+00
28	2.17E+02	0.00E+00	2.60E+00
29	5.97E+01	0.00E+00	2.60E+00
30	4.12E+02	3.98E+02	2.60E+00
31	4.27E+02	0.00E+00	2.60E+00
32	2.43E+02	6.36E+02	2.60E+00
33	1.44E+02	8.84E+02	2.60E+00
34	2.26E+02	3.87E+03	2.60E+00
35	1.42E+02	7.96E+02	2.60E+00
36	6.54E+02	2.18E+02	2.60E+00
37	1.47E+02	0.00E+00	2.60E+00
38	2.33E+01	7.08E+02	2.60E+00
39	2.51E+01	4.76E+02	2.60E+00
40	1.77E+01	2.58E+02	2.60E+00
41	9.50E+00	5.69E+01	2.60E+00
42	3.36E+02	2.38E+02	2.60E+00
43	3.47E+01	7.46E+01	2.60E+00
44	1.42E+02	0.00E+00	2.60E+00
45	2.01E+02	0.00E+00	2.60E+00
46	2.59E+02	0.00E+00	2.60E+00
47	2.36E+02	8.68E+00	2.60E+00
48	5.19E+00	0.00E+00	2.60E+00
49	5.11E+01	0.00E+00	2.60E+00
50 [b]	3.23E+01	Not applicable.	
51	2.18E+01	4.21E+02	2.60E+00

Notes: (a) Aqueous waste concentrations apply to supernate and interstitial liquid in sludge and salt.
(b) Due to the variable decontamination factor (DF) applied to Cs-137 in Tank 50, the Tank 50 concentration of I-129 is not based on Cs-137 data. Instead, a recent measured value is applied from SRNL-L3100-2017-00116.
(c) For simplicity, the concentration of 2.60E+00 pCi/mL is applied to all salt inventories.

Table 4-2: Preliminary Estimate of Inventories for I-129 Based on Cs-137 Concentrations

Tank	Inventory (Ci)		
	Supernate	Sludge	Salt
1	3.40E-01	5.27E-03	3.30E-03
2	1.55E-01	8.75E-04	3.69E-03
3	1.57E-01	7.79E-04	3.69E-03
4	1.79E-02	2.81E-03	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.		
7	5.10E-02	3.86E-03	0.00E+00
8	4.04E-02	1.07E-02	0.00E+00
9	9.64E-02	8.86E-04	3.78E-03
10	1.51E-02	1.24E-04	1.32E-03
11	4.34E-03	6.34E-03	0.00E+00
12	Not Applicable. Tank(s) closed.		
13	1.21E-01	3.73E-02	0.00E+00
14	1.78E-01	2.37E-03	8.91E-04
15	1.11E-01	2.93E-02	0.00E+00
16 through 20	Not Applicable. Tank(s) closed.		
21	1.03E-01	1.28E-02	0.00E+00
22	1.29E-02	4.34E-03	0.00E+00
23	6.73E-02	1.22E-03	0.00E+00
24	1.42E+00	0.00E+00	0.00E+00
25	3.98E-01	0.00E+00	3.45E-03
26	3.44E-01	3.12E-03	1.93E-04
27	3.37E-01	0.00E+00	7.97E-03
28	4.08E-01	0.00E+00	7.09E-03
29	8.51E-02	0.00E+00	7.04E-03
30	1.45E+00	3.18E-04	2.19E-03
31	6.12E-01	0.00E+00	8.53E-03
32	6.30E-01	7.51E-02	1.81E-03
33	5.49E-01	8.04E-02	2.02E-03
34	8.68E-01	5.54E-02	1.32E-03
35	5.11E-01	6.47E-02	0.00E+00
36	1.14E+00	8.71E-05	7.89E-03
37	3.58E-01	0.00E+00	5.97E-03
38	4.91E-02	3.30E-02	5.27E-03
39	7.92E-02	1.11E-01	0.00E+00
40	2.49E-02	1.56E-01	0.00E+00
41	2.37E-02	4.22E-04	2.37E-03
42	1.57E+00	4.75E-03	0.00E+00
43	9.18E-02	2.02E-02	0.00E+00
44	2.81E-01	0.00E+00	6.94E-03
45	2.83E-01	0.00E+00	8.51E-03
46	3.72E-01	0.00E+00	8.61E-03
47	5.75E-01	2.44E-03	5.32E-03
48	4.76E-03	0.00E+00	0.00E+00
49	2.07E-01	0.00E+00	4.83E-05
50	8.29E-02	Not Applicable	
51	2.44E-03	7.03E-03	0.00E+00

This preliminary estimate results in 14.2 Ci of I-129 in supernate, 0.7 Ci in sludge, and 0.1 Ci in salt, for a total of 15.1 Ci of I-129 in the tank farms.

4.3 Replacement of Recent Concentrations of I-129

Table 4-1 provided a summary of the I-129 waste concentrations for each tank based on the Cs-137 data from a recent *Curie and Volume Inventory Report* and on the analysis of available sample data in Section 3. The intent of these estimated values was to provide an informed estimate of I-129 concentrations and inventories when tank-specific sample data is not available. However, for tanks with recent sample data, the best value to use is the actual 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 still be applicable and appropriate to use.

Table 4-3 identifies the most recent Cs-137 and I-129 sample values. This data comes from Table 3-1 (or Table 3-2 for those tanks with no associated I-129 values). For a number of waste tanks, no valid I-129 samples were identified (i.e., Tanks 1, 2, 3, 7, 9, 10, 14, 15, 26, 27, 29, 31, 33, 44, 45, 47, 48, and 51). For these tanks, a surrogate value is assumed using the most recent Cs-137 concentration measured and Equation 3-6.

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 June of 2015 or newer was assumed to still be valid, regardless of any transfer activity occurring since that time.
- 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 sample data was then selected by cross-referencing the applicability dates from Table B-2 against the sample dates in Table 4-3. Where applicable, the analysis-estimated concentrations in Table 4-1 were then replaced with the concentrations from Table 4-3 to provide final concentration recommendations (Table 4-4). The aqueous waste concentrations were assumed to be applicable as both supernate concentrations and as interstitial liquid concentrations.

In Table 4-4, for Tanks 15 and 51, recent sludge concentrations are applied to the sludge waste. With the exception of the sludge in Tanks 15 and 51, no other changes were made to the sludge or salt concentrations (i.e., for the solid wastes, the concentrations from Table 4-1 were assumed).

Table 4-3: Most Recent Aqueous Sample Concentrations for Each Waste Tank

Tank	I-129 pCi/mL at Closure	Cs-137 pCi/mL at Closure	Date of Sample or Reference
1 [a]	5.46E+02	1.98E+09	7/22/1993
2 [a]	2.60E+02	8.40E+08	9/10/2003
3 [a]	2.92E+02	9.61E+08	8/5/2003
4	1.26E+01	1.01E+08	8/19/2015
5 & 6	Not Applicable. Tank(s) closed.		
7 [a]	4.83E+01	1.21E+08	8/24/2015
8	5.60E+01	6.70E+07	6/12/2014
9 [a]	1.53E+02	4.57E+08	1/11/1973
10 [a]	1.66E+02	5.03E+08	10/23/2003
11	2.84E+01	8.46E+06	2/15/2008
12	Not Applicable. Tank(s) closed.		
13 [b]	2.30E+01	1.78E+08	12/16/2014
14 [a]	8.36E+01	2.28E+08	1/3/1973
15 [c]	1.80E+00	2.75E+06	3/7/1988
16 to 20	Not Applicable. Tank(s) closed.		
21	2.88E+01	1.09E+08	7/31/2017
22 [b]	4.28E+01	3.00E+07	6/1/2016
23	4.09E+01	1.07E+08	6/8/2015
24	5.14E+02	1.43E+09	7/1/2017
25	4.82E+01	4.10E+08	7/21/2017
26 [a]	2.34E+02	7.47E+08	3/25/2002
27 [a]	1.66E+02	5.04E+08	8/5/1993
28	1.36E+02	5.64E+08	2/15/2006
29 [a]	1.23E+02	3.55E+08	9/11/2003
30	2.78E+02	1.04E+09	6/1/2015
31 [a]	1.30E+02	3.80E+08	8/6/2002
32	2.87E+02	8.80E+08	6/1/2015
33 [a]	5.11E+00	9.17E+06	6/27/2000
34	1.22E+02	7.53E+08	7/21/2017
35	1.64E+02	4.44E+08	3/9/2015
36	4.34E+02	2.53E+09	8/21/2017
37 [b]	5.23E+02	3.09E+08	6/1/2015
38 [b]	2.45E+02	4.52E+07	6/1/2016
39	3.00E+01	5.66E+07	6/1/2015
40 [b]	1.20E+02	3.29E+07	4/12/2017
41 [b]	6.76E+01	2.51E+07	6/1/2016
42	2.18E+02	1.16E+09	8/14/2017
43 [b]	6.71E+00	3.44E+07	10/12/2015
44 [a]	1.90E+02	5.86E+08	5/12/1999
45 [a]	2.04E+02	6.37E+08	6/9/2003
46 [b]	3.94E+02	7.50E+08	6/23/2003
47 [a]	1.38E+02	4.07E+08	11/13/1991
48 [a]	3.74E+00	6.40E+06	12/4/2014
49	4.82E+01	1.62E+08	8/11/2016
50	3.23E+01	6.28E+05	7/17/2017
51	6.33E+01	1.66E+08	5/1/2017

Notes: (a) I-129 concentration is assumed based on the Cs-137 concentration.
(b) I-129 value is a "less than detection limit" value.
(c) A more recent Cs-137 sludge value from 5/30/2017 is used for estimating I-129 sludge concentration

4.4 I-129 Inventory Estimate Summary

Table 4-4 and Figure 4-1 provide a best estimate for current I-129 inventories in the SRS waste tanks based upon an analysis of available sample data. This final estimate results in 14.89 Ci of I-129 in supernate, 0.72 Ci in sludge, and 0.11 Ci in salt. The sum of these values is 15.7 Ci of I-129 in the tank farms. The recent *Curie and Volume Inventory Report* (SRR-LWP-2017-00033) estimated a value that is more than 30% higher than this value (20.8 Ci). It should also be noted that only the soluble waste inventory (i.e., supernate, interstitial liquid, and salt) is destined for disposal at SDF (i.e., sludge is expected to be sent to the Defense Waste Processing Facility (DWPF) for vitrification). The total soluble inventory from Table 4-4 is 15 Ci compared to 20.5 Ci estimated in the *Curie and Volume Inventory Report.* [SRR-LWP-2017-00033] As indicated in Section 3.6, the comparison of analysis-based concentrations versus recently measured sample values were similar, providing evidence that the analysis-based estimates for I-129 in tank farm wastes are reasonable.

As described in Section 2, a reliable projection of I-129 inventories was expected to be between 10 Ci and 20 Ci. With a total of 15.7 Ci, the estimate provided herein is within the expected range.

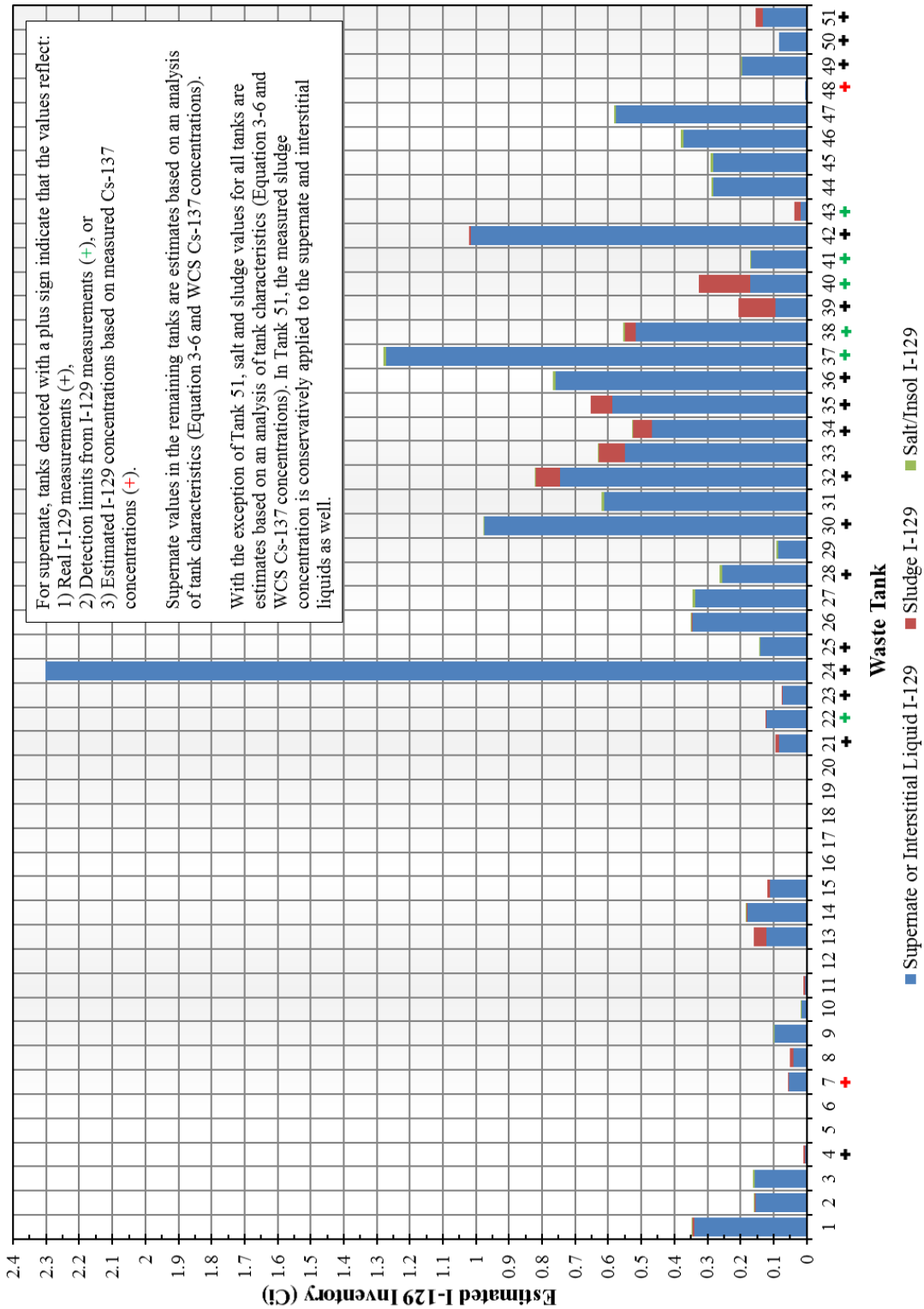
Table 4-4: Final Tank-Specific I-129 Concentrations and Inventory Estimate

	Concentration (pCi/mL)			Inventory (Ci)		
Tank	**Supernate and Interstitial Liquid**	**Sludge**	**Salt [a]**	**Supernate**	**Sludge**	**Salt**
1	6.04E+02	6.58E+02	2.60E+00	3.40E-01	5.27E-03	3.30E-03
2	2.51E+02	1.89E+02	2.60E+00	1.55E-01	8.75E-04	3.69E-03
3	2.53E+02	1.69E+02	2.60E+00	1.57E-01	7.79E-04	3.69E-03
4	1.26E+01	3.09E+02	2.60E+00	5.66E-03	2.81E-03	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.					
7	4.83E+01	2.50E+02	2.60E+00	5.20E-02	3.86E-03	0.00E+00
8	3.01E+01	2.33E+03	2.60E+00	4.04E-02	1.07E-02	0.00E+00
9	1.53E+02	2.88E+02	2.60E+00	9.64E-02	8.86E-04	3.78E-03
10	4.12E+01	4.03E+01	2.60E+00	1.51E-02	1.24E-04	1.31E-03
11	1.01E+01	2.89E+02	2.60E+00	4.34E-03	6.34E-03	0.00E+00
12	Not Applicable. Tank(s) closed.					
13	7.65E+01	8.53E+02	2.60E+00	1.21E-01	3.73E-02	0.00E+00
14	8.03E+02	7.45E+01	2.60E+00	1.78E-01	2.37E-03	8.94E-04
15 [c]	6.86E+01	3.44E+01	2.60E+00	1.11E-01	7.31E-03	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.					
21	2.88E+01	1.92E+02	2.60E+00	8.27E-02	1.28E-02	0.00E+00
22	4.28E+01	5.25E+01	2.60E+00	1.20E-01	4.34E-03	0.00E+00
23	4.09E+01	1.40E+01	2.60E+00	7.32E-02	1.22E-03	0.00E+00
24	5.14E+02	0.00E+00	2.60E+00	2.30E+00	0.00E+00	0.00E+00
25	4.82E+01	0.00E+00	2.60E+00	1.40E-01	0.00E+00	3.45E-03
26	9.60E+01	1.08E+01	2.60E+00	3.44E-01	3.12E-03	1.93E-04
27	2.10E+02	0.00E+00	2.60E+00	3.37E-01	0.00E+00	7.98E-03
28	1.36E+02	0.00E+00	2.60E+00	2.56E-01	0.00E+00	7.09E-03
29	5.97E+01	0.00E+00	2.60E+00	8.51E-02	0.00E+00	7.02E-03
30	2.78E+02	3.98E+02	2.60E+00	9.75E-01	3.18E-04	2.19E-03
31	4.27E+02	0.00E+00	2.60E+00	6.12E-01	0.00E+00	8.53E-03
32	2.87E+02	6.36E+02	2.60E+00	7.45E-01	7.51E-02	1.81E-03
33	1.44E+02	8.84E+02	2.60E+00	5.49E-01	8.04E-02	2.02E-03
34	1.22E+02	3.87E+03	2.60E+00	4.68E-01	5.54E-02	1.31E-03
35 [d]	1.64E+02	7.96E+02	2.60E+00	5.88E-01	6.47E-02	0.00E+00
36	4.34E+02	2.18E+02	2.60E+00	7.59E-01	8.71E-05	7.91E-03
37	5.23E+02	0.00E+00	2.60E+00	1.27E+00	0.00E+00	5.97E-03
38	2.45E+02	7.08E+02	2.60E+00	5.16E-01	3.30E-02	5.27E-03
39	3.00E+01	4.76E+02	2.60E+00	9.46E-02	1.11E-01	0.00E+00
40	1.20E+02	2.58E+02	2.60E+00	1.69E-01	1.56E-01	0.00E+00
41	6.76E+01	5.69E+01	2.60E+00	1.69E-01	4.22E-04	2.37E-03
42	2.18E+02	2.38E+02	2.60E+00	1.02E+00	4.75E-03	0.00E+00
43	6.71E+00	7.46E+01	2.60E+00	1.77E-02	2.02E-02	0.00E+00
44	1.42E+02	0.00E+00	2.60E+00	2.81E-01	0.00E+00	6.95E-03
45	2.01E+02	0.00E+00	2.60E+00	2.83E-01	0.00E+00	8.53E-03
46	2.59E+02	0.00E+00	2.60E+00	3.72E-01	0.00E+00	8.60E-03
47	2.36E+02	8.68E+00	2.60E+00	5.75E-01	2.44E-03	5.32E-03
48	3.74E+00	0.00E+00	2.60E+00	3.43E-03	0.00E+00	0.00E+00
49 [e]	4.82E+01	0.00E+00	2.60E+00	1.96E-01	0.00E+00	4.83E-05
50	3.23E+01	0.00E+00	2.60E+00	8.29E-02	0.00E+00	0.00E+00
51 [b]	1.19E+03	1.19E+03	2.60E+00	1.34E-01	1.99E-02	0.00E+00

Notes: See notes on following page.

Notes for Table 4-4:
(a) For simplicity, the concentration of 2.60E+00 pCi/mL is applied to all solid salts.
(b) For Tank 51, the sludge concentration is conservatively applied to the supernate and interstitial liquids. Values for Tank 51 are based on SRNL-STI-2016-00026.
(c) For Tank 15, the I-129 sludge concentration was predicted using a Cs-137 sludge concentration recently measured (SRNL-L3100-2017-00070) in conjunction with Equation 3-6.
(d) The most recent sample for Tank 35 was taken on 3/9/2015. Given the proximity of this sampling date to the "applicability date" for Tank 35 (listed as 3/30/2015 in Table B-2), the sample value was used. This assumption is conservative in that it yields an I-129 supernate concentration of 1.64E+02 pCi/mL versus 1.42E+02 pCi/mL (as predicted using WCS Cs-137 data in conjunction with Equation 3-6).
(e) The most recent Tank 49 sample is a calculated estimate from X-ESR-H-00844.

Figure 4-1: Best Estimate of Current I-129 Inventory in SRS Tank Farms



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5.0 CONCLUSIONS

Based upon the analysis of data provided herein, it is recommended to update the approach for projecting I-129 inventories. Specifically, wherever appropriate sampled data is not available, the I-129 inventory (in Ci) should be determined based on the available Cs-137 data (decayed to October 1, 2032) and the application of Equation 3-6.

Based upon this approach, as of early 2018 there is a total of 15.7 Ci projected in the tank farms (14.89 Ci in supernate or interstitial liquid, 0.72 Ci in sludge, and 0.11 Ci in salt). Given that this total I-129 inventory is based on an analytical approach using real measured data, and results in a total inventory that is within expected ranges, these final values are considered appropriate and defensible.

5.1 Recommendations for Future Performance Modeling

Based on the results of this analysis, three I-129 inventory values are suggested for future SDF modeling purposes:

- For **realistic** models, the total soluble I-129 inventory (i.e., supernate (14.89 Ci) plus salt (0.11 Ci)) plus the 0.85 Ci already disposed in the SDF should be used: **15.9 Ci**. Note that this value is approximately 25% higher than the value assumed in the FY2014 SDF SA and FY2016 SDF SA (i.e., 12.2 Ci).
- For **compliance** models (i.e., reasonable and defensible), the total I-129 inventory in the tank farms (15.7 Ci) plus the 0.85 Ci already disposed in the SDF should be used: **16.6 Ci**.
- For **defense-in-depth** models, the total I-129 inventory in the tank farms increased by 50% (23.6 Ci) plus the 0.85 Ci already disposed in the SDF should be used: **24.4 Ci**.

For deterministic simulations used to demonstrate or support compliance, the compliance value should be used; for probabilistic simulations used to assess uncertainty, the realistic value should be used along with the sampling distribution described in Appendix C.

5.2 Recommendations to Reduce Uncertainty in Concentration Projections

Of the estimated 15.7 Ci in the tank farms, 10.7 Ci (68% of the total) either reflect measured I-129 concentrations or were based on measured Cs-137 concentrations. The remaining 5.0 Ci (32% of the total) are based on Cs-137 values from a recent *Curie and Volume Inventory Report* (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 31, 33, and 47 are estimated to have the most I-129 (wherein each of these tanks are each estimated to have approximately 0.6 Ci of I-129). Therefore, to reduce future uncertainty it is recommended that if future sampling is performed that samples be collected and analyzed from Tanks 31, 33, and 47.

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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] These volumes are multiplied by the Cs-137 concentrations to estimate the Cs-137 inventory 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). These volume percentages are based on a file used for developing an earlier *Curie and Volume Inventory Report* (SRR-LWP-2016-00045; Excel File: *Copy of Adjusted WCS 1.5 v011.1 9-30-2016 TAL.xls* [Inputs: *Sludge_Interstitial_Fraction* and *Salt_Interstitial_Fraction*]). Table A-2 provides the volume data used in the inventory estimates.

The supernate inventories are then based on the volume of the supernate and the volumes of the interstitial liquids. The sum of these inventories is referred to as "soluble waste". The sludge and salt inventories are based on the volumes excluding the interstitial liquids (i.e., only the solids volumes).

It is also noted that while a recent *Curie and Volume Inventory Report* (SRR-LWP-2017-00033) provides total curies for each radionuclide, the tank-specific curie estimates are not explicitly provided. The tank-specific curie estimates are available in the Excel File: *March 2017 Inventory Report.xlsx*.

The tank-specific inventories for Cs-137 are provided in Table A-3. Table A-4 provides the tank-specific inventories for I-129. Finally, Tables A-5 and A-6 provide the equivalent waste concentrations based on the given inventories and volumes. For the estimated concentrations of Cs-137, the values were decayed to October 1, 2032. The I-129 inventories were not decayed because the long half-life of I-129 negates the impact of decay between March 2017 and October 2032.

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, 3/30/2017, Based on the March 2017 Curie and Volume Inventory Report

Tank	Supernate (Ci)	Sludge (Ci)	Salt/Insol (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

Table A-4: Tank-Specific Inventory of I-129, 3/30/2017, Based on the March 2017 Curie and Volume Inventory Report

Tank	Supernate (Ci)	Sludge (Ci)	Salt/Insol (Ci)
1	5.61E-01	1.24E-03	0.00E+00
2	2.24E-01	1.90E-04	0.00E+00
3	2.27E-01	1.59E-04	0.00E+00
4	1.96E-02	4.69E-04	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.		
7	5.72E-02	6.72E-04	0.00E+00
8	4.24E-02	1.98E-03	0.00E+00
9	1.29E-01	2.05E-04	0.00E+00
10	1.66E-02	2.10E-05	0.00E+00
11	3.86E-03	7.51E-04	0.00E+00
12	Not Applicable. Tank(s) closed.		
13	1.46E-01	6.96E-03	0.00E+00
14	3.07E-01	3.97E-04	0.00E+00
15	1.32E-01	3.49E-03	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.		
21	1.11E-01	8.55E-04	0.00E+00
22	1.02E-02	2.03E-02	0.00E+00
23	7.30E-02	6.54E-03	0.00E+00
24	2.13E+00	0.00E+00	0.00E+00
25	5.25E-01	0.00E+00	0.00E+00
26	4.30E-01	2.19E-04	0.00E+00
27	4.74E-01	0.00E+00	0.00E+00
28	5.77E-01	0.00E+00	0.00E+00
29	9.90E-02	0.00E+00	0.00E+00
30	2.25E+00	2.76E-05	0.00E+00
31	9.58E-01	0.00E+00	0.00E+00
32	9.06E-01	8.74E-03	0.00E+00
33	7.29E-01	1.06E-02	0.00E+00
34	1.23E+00	9.80E-03	0.00E+00
35	6.78E-01	7.18E-03	0.00E+00
36	1.91E+00	8.28E-06	0.00E+00
37	4.76E-01	0.00E+00	0.00E+00
38	4.96E-02	0.00E+00	0.00E+00
39	8.09E-02	9.37E-03	0.00E+00
40	2.41E-02	1.01E-01	0.00E+00
41	2.09E-02	6.54E-03	0.00E+00
42	2.37E+00	2.94E-02	0.00E+00
43	9.84E-02	1.28E-03	0.00E+00
44	3.72E-01	0.00E+00	0.00E+00
45	3.96E-01	0.00E+00	0.00E+00
46	5.39E-01	0.00E+00	0.00E+00
47	8.24E-01	1.73E-04	0.00E+00
48	3.83E-03	0.00E+00	0.00E+00
49	2.03E-01	0.00E+00	0.00E+00
50	1.18E-01	0.00E+00	0.00E+00
51	2.44E-03	8.49E-04	0.00E+00

Table A-5: 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/Insol (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	0.00E+00
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	8.08E+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	1.29E+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-6: Tank-Specific Concentrations of I-129, Based on the March 2017 Curie and Volume Inventory Report

Tank	Supernate (pCi/mL)	Sludge (pCi/mL)	Salt/Insol (pCi/mL)
1	9.95E+02	1.55E+02	0.00E+00
2	3.62E+02	4.11E+01	0.00E+00
3	3.66E+02	3.45E+01	0.00E+00
4	4.36E+01	5.17E+01	0.00E+00
5 & 6	Not Applicable. Tank(s) closed.		
7	5.31E+01	4.35E+01	0.00E+00
8	3.16E+01	4.32E+02	0.00E+00
9	2.05E+02	6.67E+01	0.00E+00
10	4.53E+01	6.82E+00	0.00E+00
11	8.98E+00	3.42E+01	0.00E+00
12	Not Applicable. Tank(s) closed.		
13	9.24E+01	1.59E+02	0.00E+00
14	1.38E+03	1.25E+01	0.00E+00
15	8.15E+01	1.64E+01	0.00E+00
16 to 20	Not Applicable. Tank(s) closed.		
21	3.88E+01	1.28E+01	0.00E+00
22	3.63E+00	2.46E+02	0.00E+00
23	4.08E+01	7.47E+01	0.00E+00
24	4.74E+02	0.00E+00	0.00E+00
25	1.81E+02	0.00E+00	0.00E+00
26	1.20E+02	7.55E-01	0.00E+00
27	2.95E+02	0.00E+00	0.00E+00
28	3.07E+02	0.00E+00	0.00E+00
29	6.94E+01	0.00E+00	0.00E+00
30	6.41E+02	3.46E+01	0.00E+00
31	6.68E+02	0.00E+00	0.00E+00
32	3.49E+02	7.40E+01	0.00E+00
33	1.92E+02	1.17E+02	0.00E+00
34	3.22E+02	6.85E+02	0.00E+00
35	1.88E+02	8.83E+01	0.00E+00
36	1.09E+03	2.08E+01	0.00E+00
37	1.96E+02	0.00E+00	0.00E+00
38	2.36E+01	0.00E+00	0.00E+00
39	2.57E+01	4.03E+01	0.00E+00
40	1.71E+01	1.67E+02	0.00E+00
41	8.38E+00	8.81E+02	0.00E+00
42	5.08E+02	1.47E+03	0.00E+00
43	3.72E+01	4.72E+00	0.00E+00
44	1.88E+02	0.00E+00	0.00E+00
45	2.80E+02	0.00E+00	0.00E+00
46	3.76E+02	0.00E+00	0.00E+00
47	3.38E+02	6.14E-01	0.00E+00
48	4.18E+00	0.00E+00	0.00E+00
49	4.99E+01	0.00E+00	0.00E+00
50	4.59E+01	0.00E+00	0.00E+00
51	2.17E+01	5.09E+01	0.00E+00

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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 when tanks last underwent substantial waste transfers 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

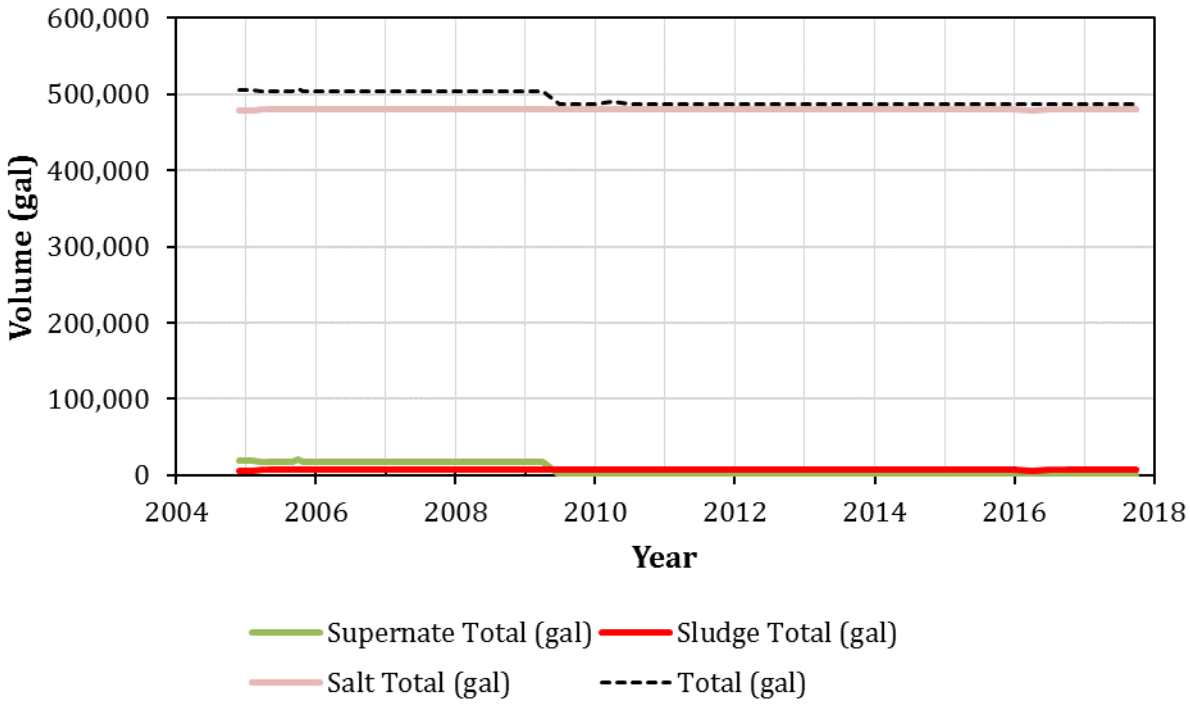


Figure B-2: Volume History (2005 to 2017) for Tank 2

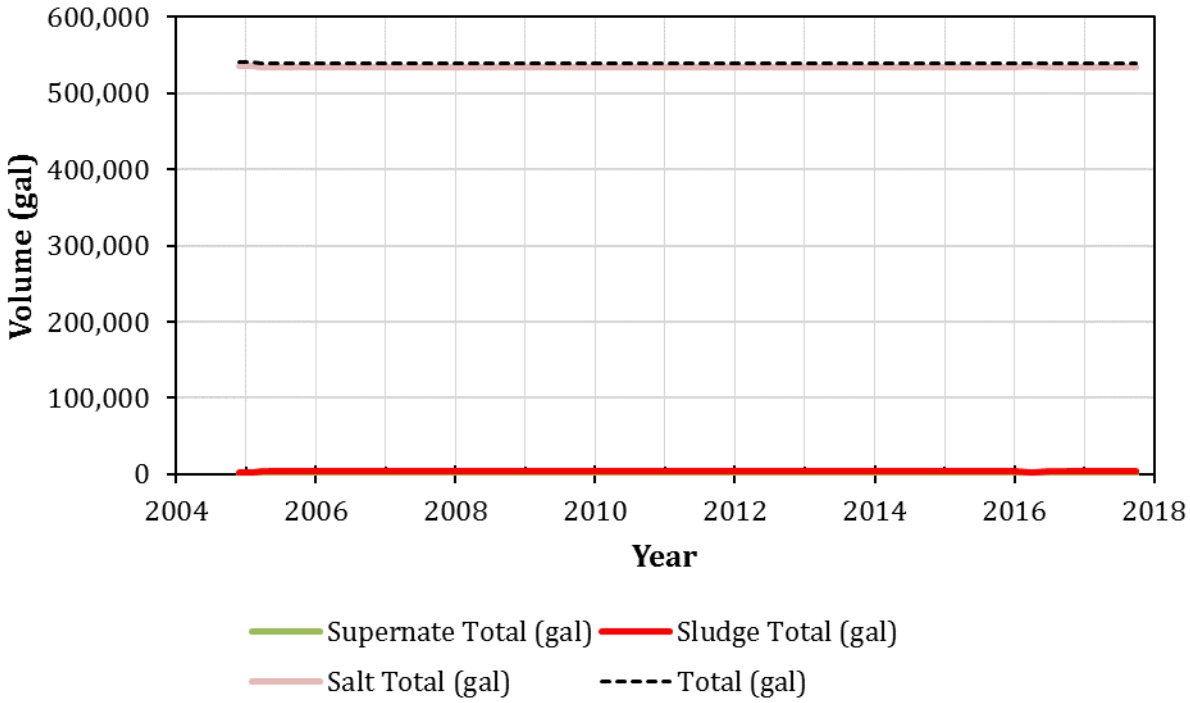


Figure B-3: Volume History (2005 to 2017) for Tank 3

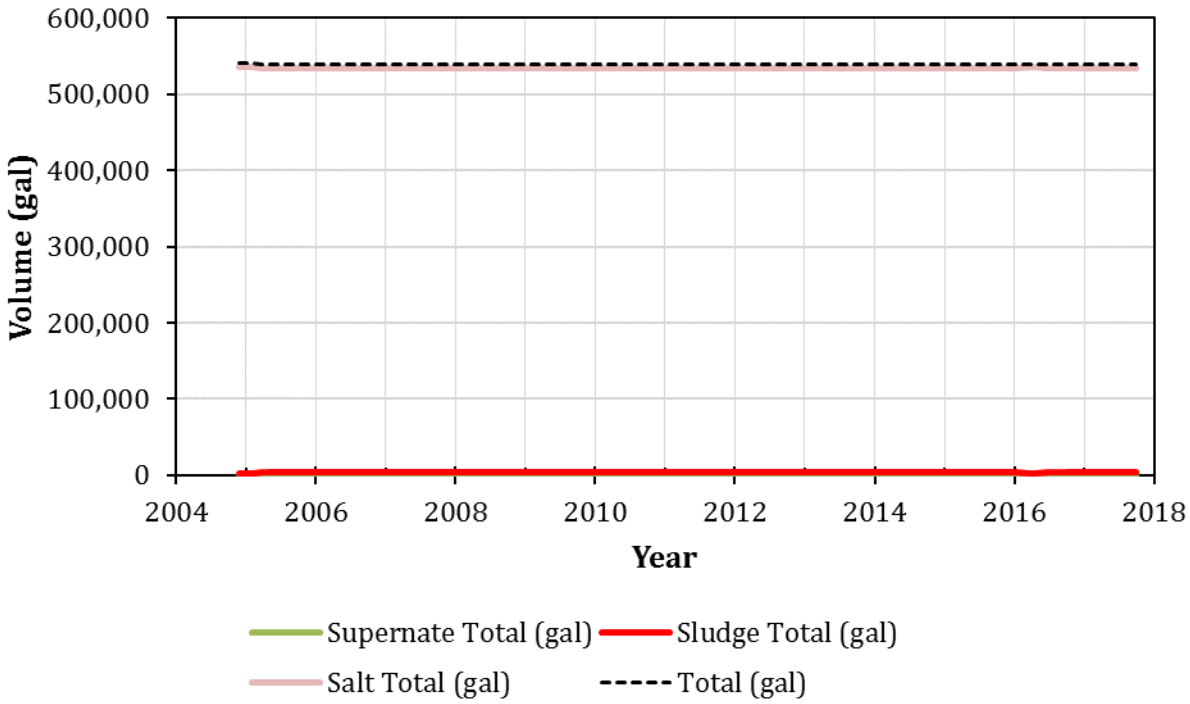


Figure B-4: Volume History (2005 to 2017) for Tank 4

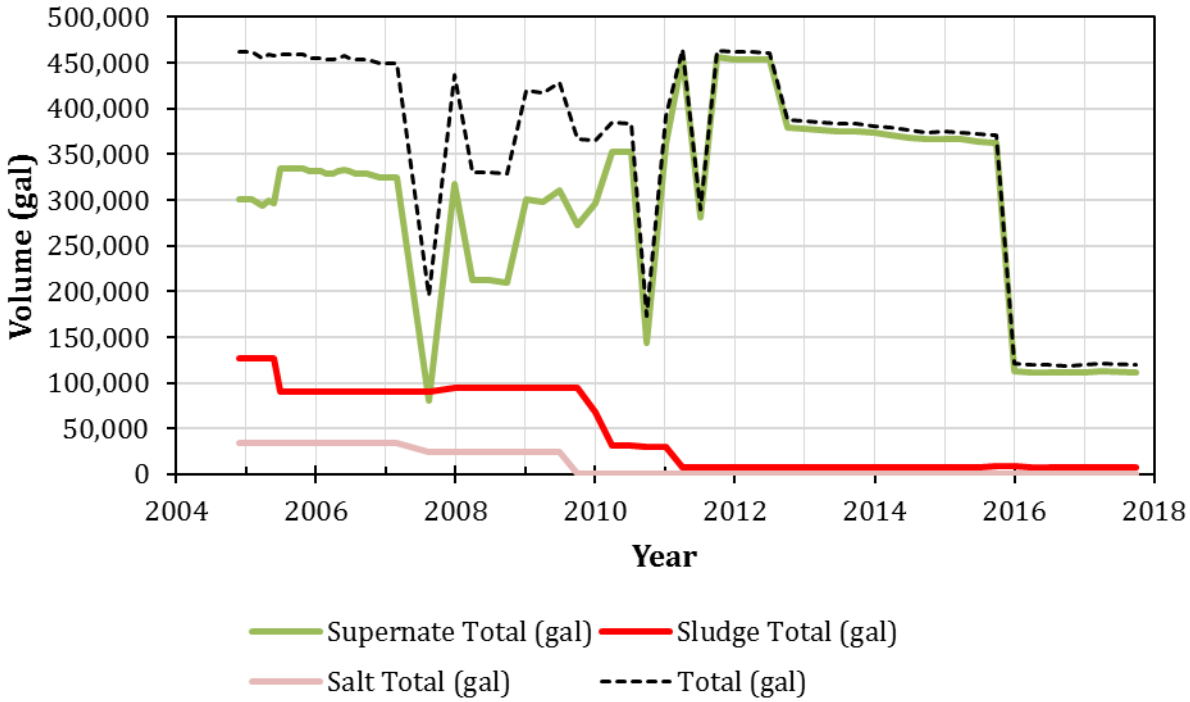


Figure B-5: Volume History (2005 to 2017) for Tank 5

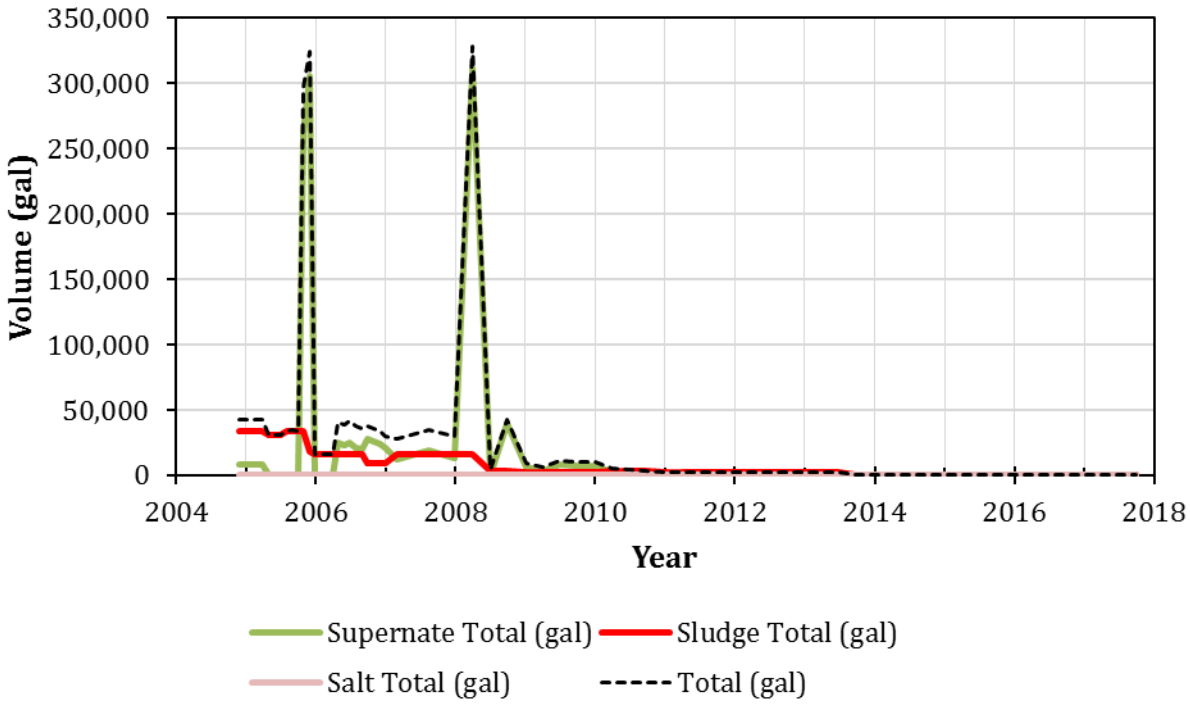


Figure B-6: Volume History (2005 to 2017) for Tank 6

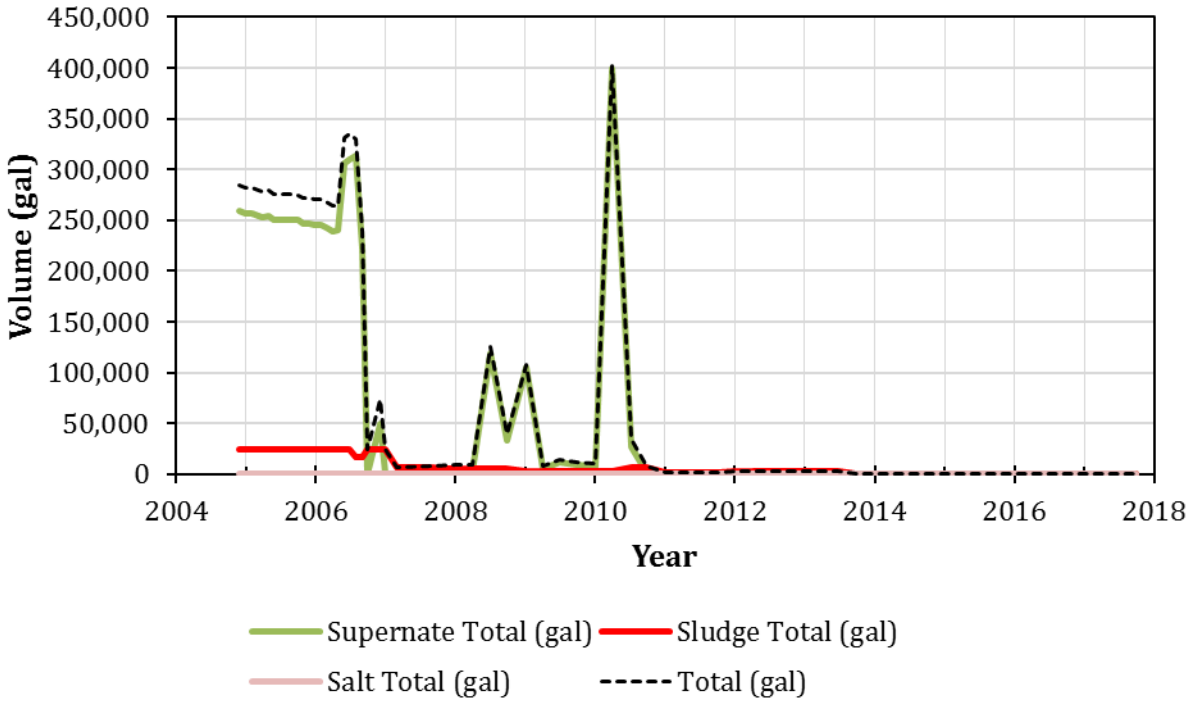


Figure B-7: Volume History (2005 to 2017) for Tank 7

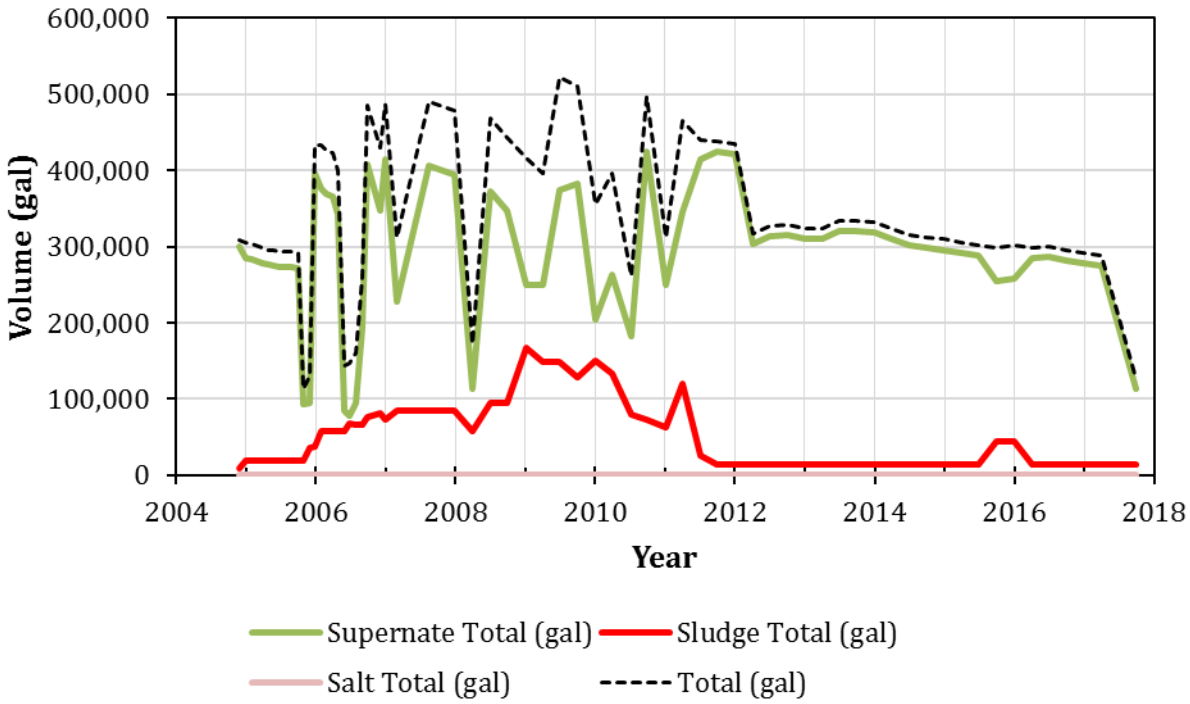


Figure B-8: Volume History (2005 to 2017) for Tank 8

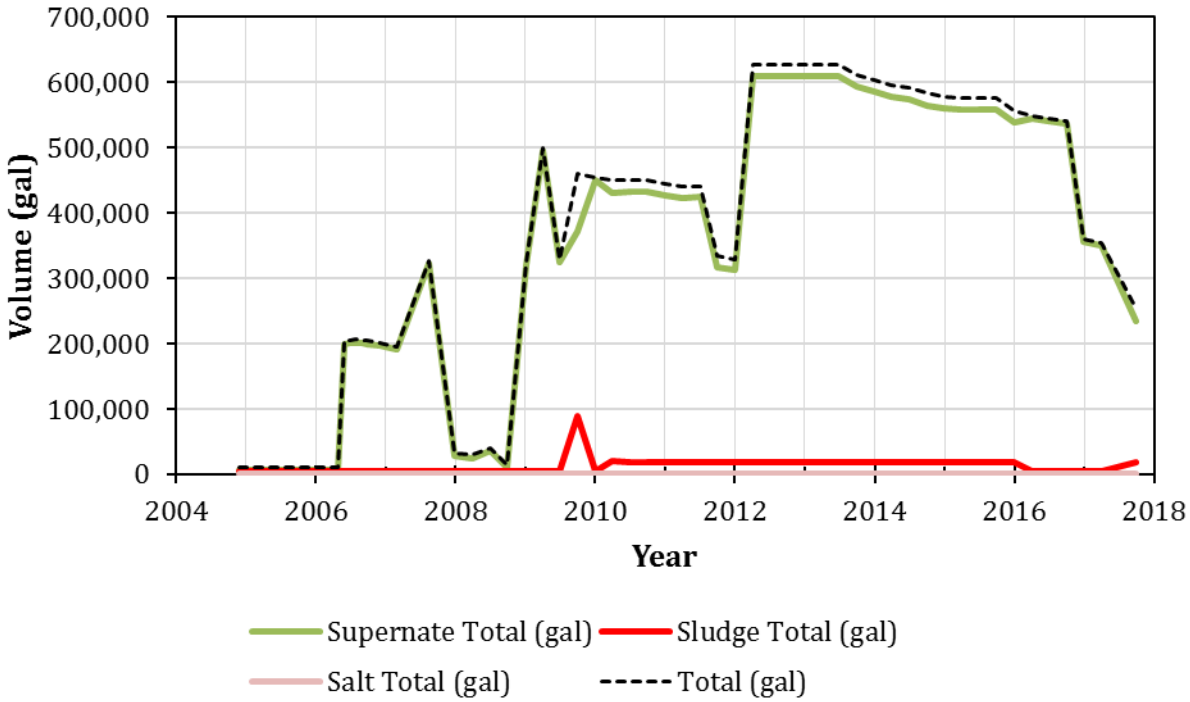


Figure B-9: Volume History (2005 to 2017) for Tank 9

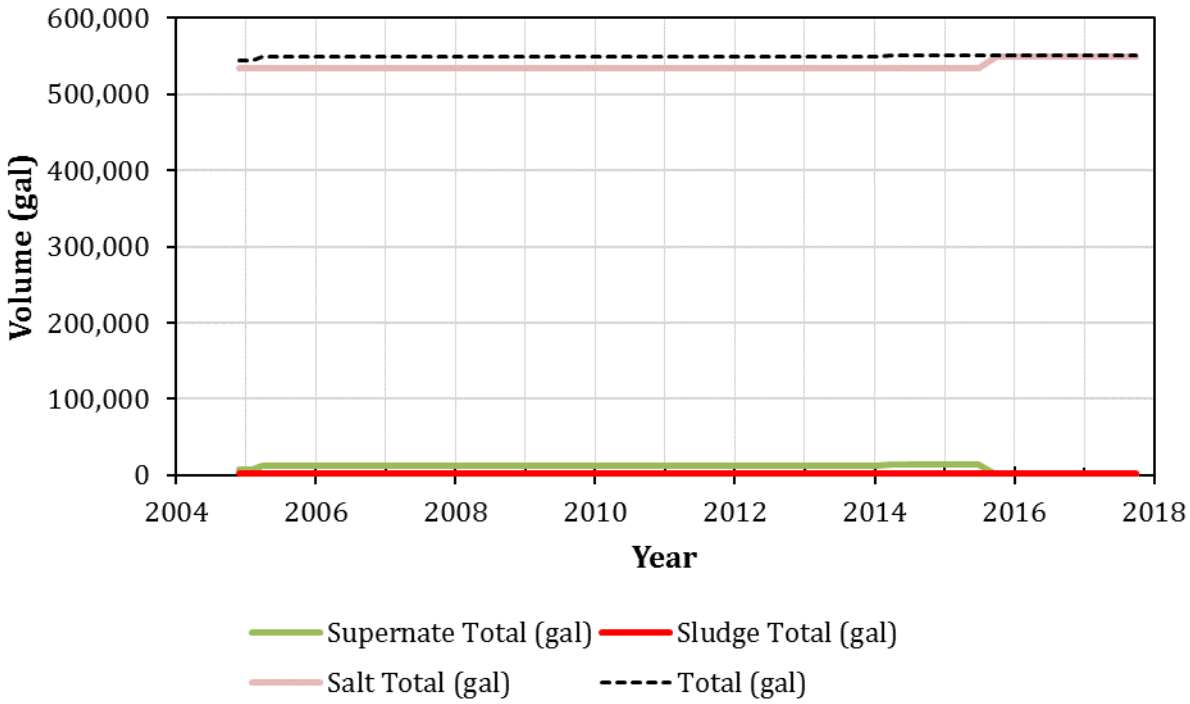


Figure B-10: Volume History (2005 to 2017) for Tank 10

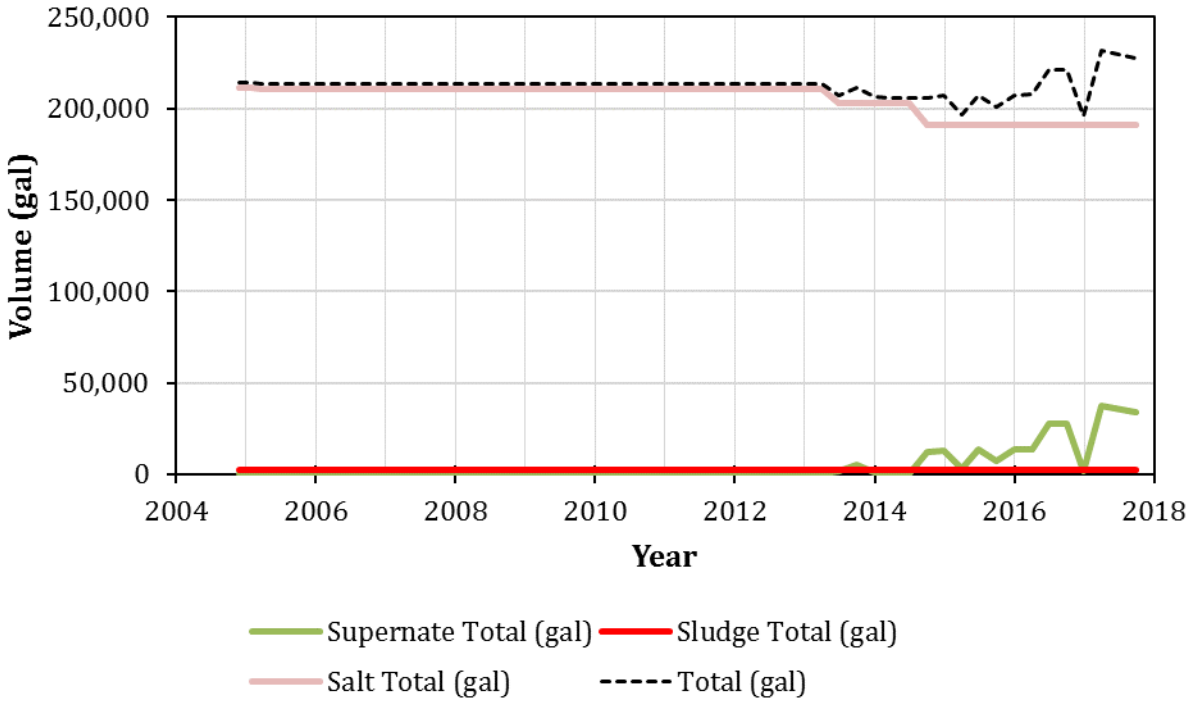


Figure B-11: Volume History (2005 to 2017) for Tank 11

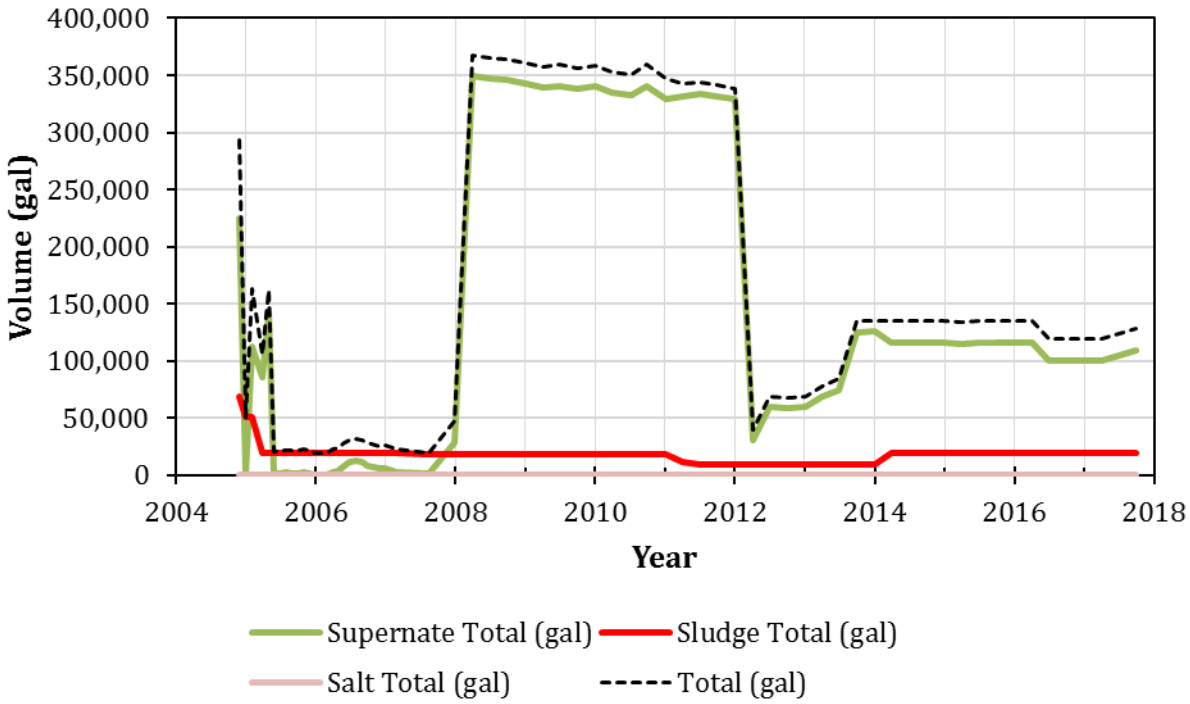


Figure B-12: Volume History (2005 to 2017) for Tank 12

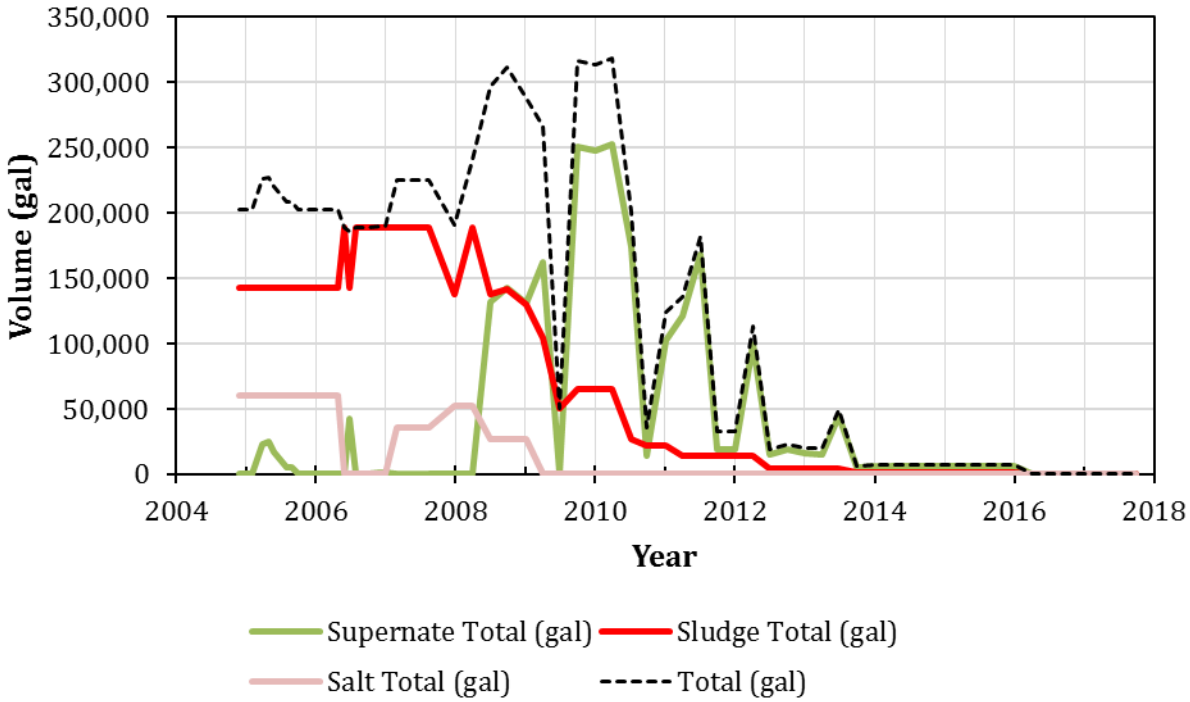


Figure B-13: Volume History (2005 to 2017) for Tank 13

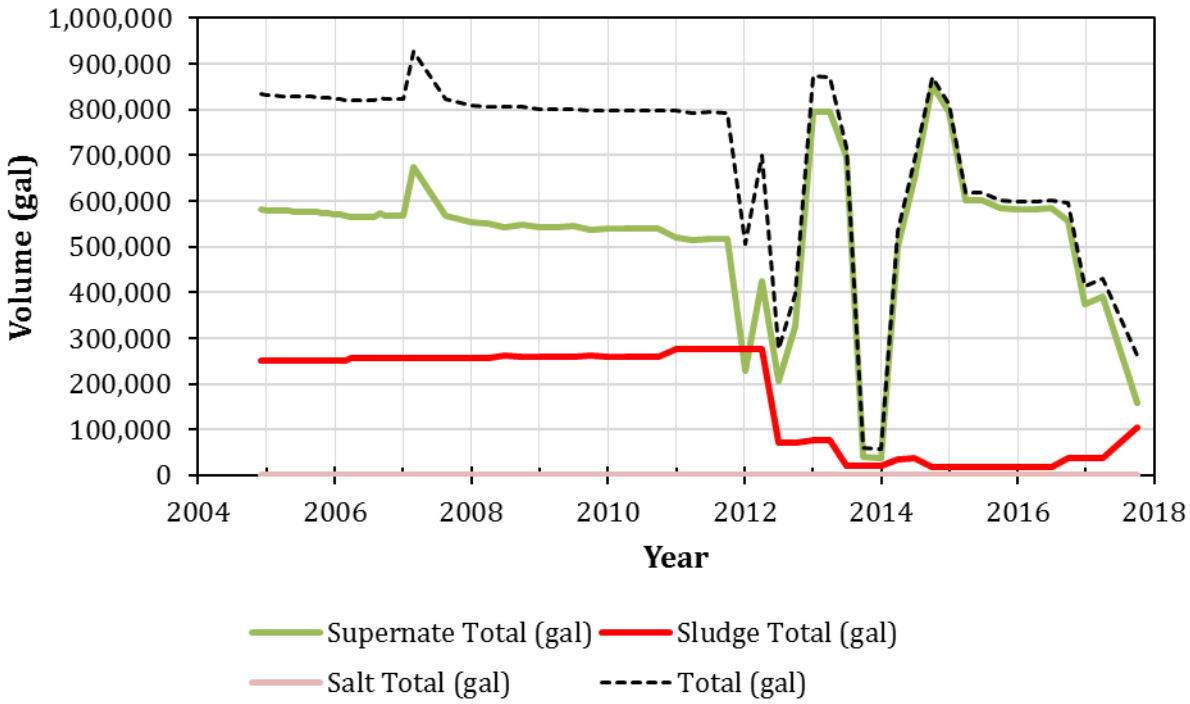


Figure B-14: Volume History (2005 to 2017) for Tank 14

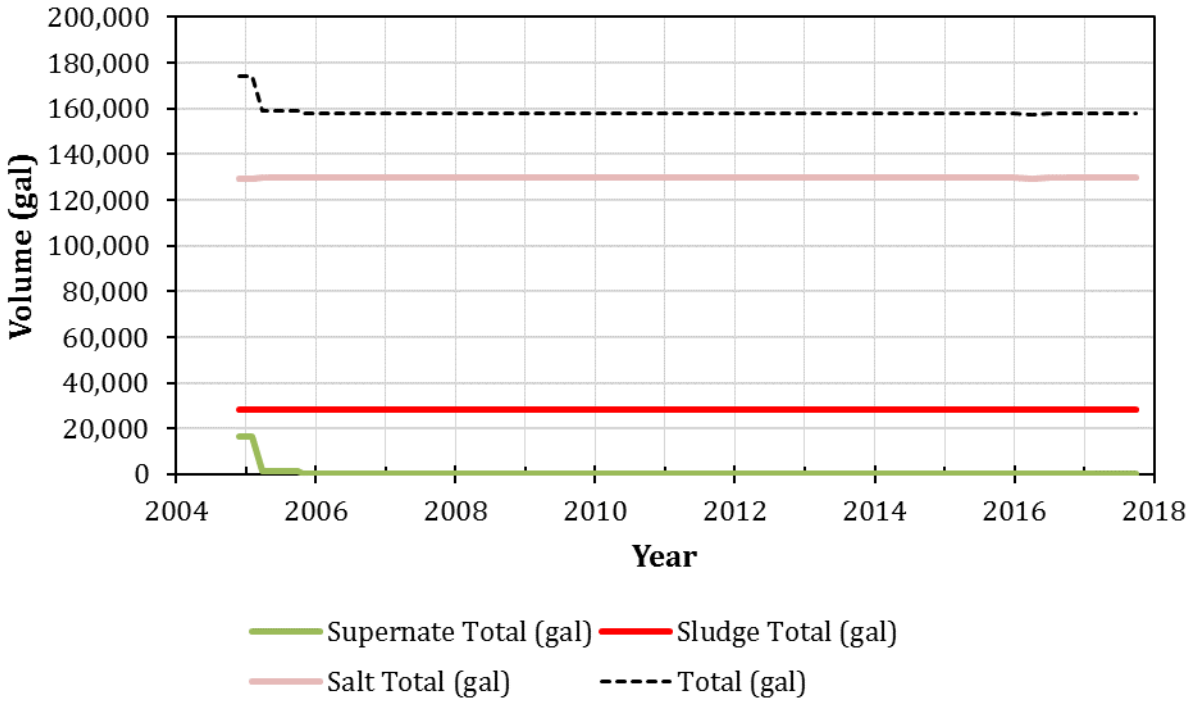


Figure B-15: Volume History (2005 to 2017) for Tank 15

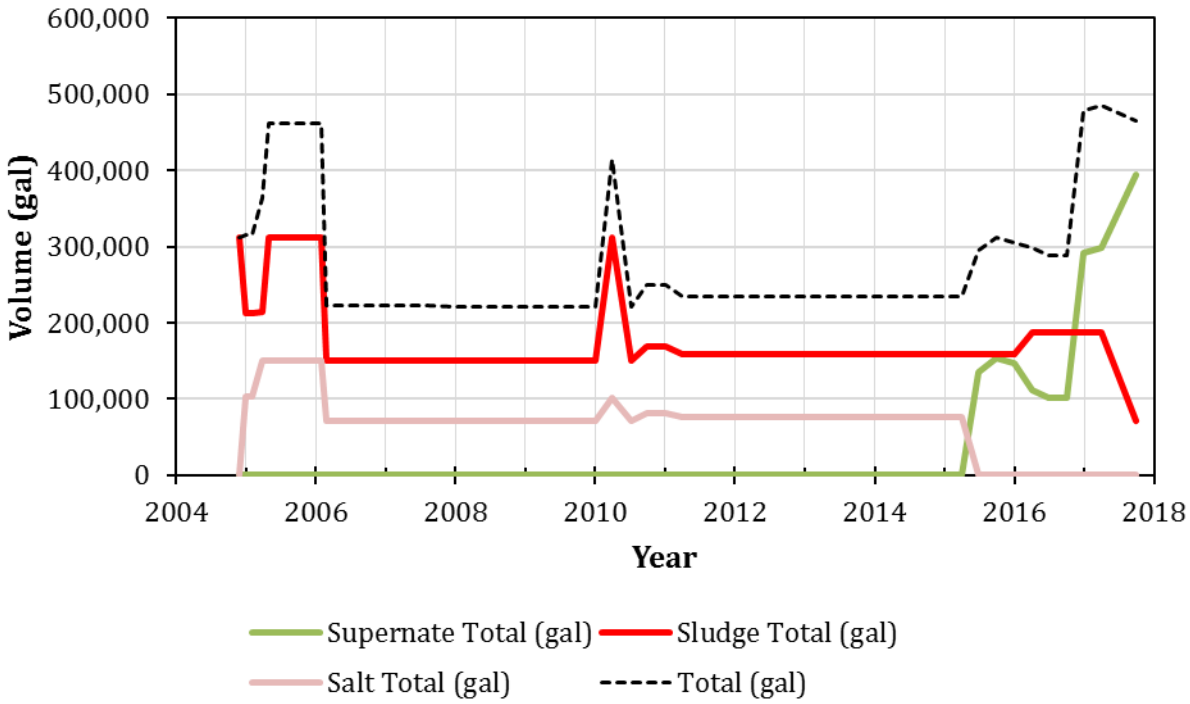


Figure B-16: Volume History (2005 to 2017) for Tank 16

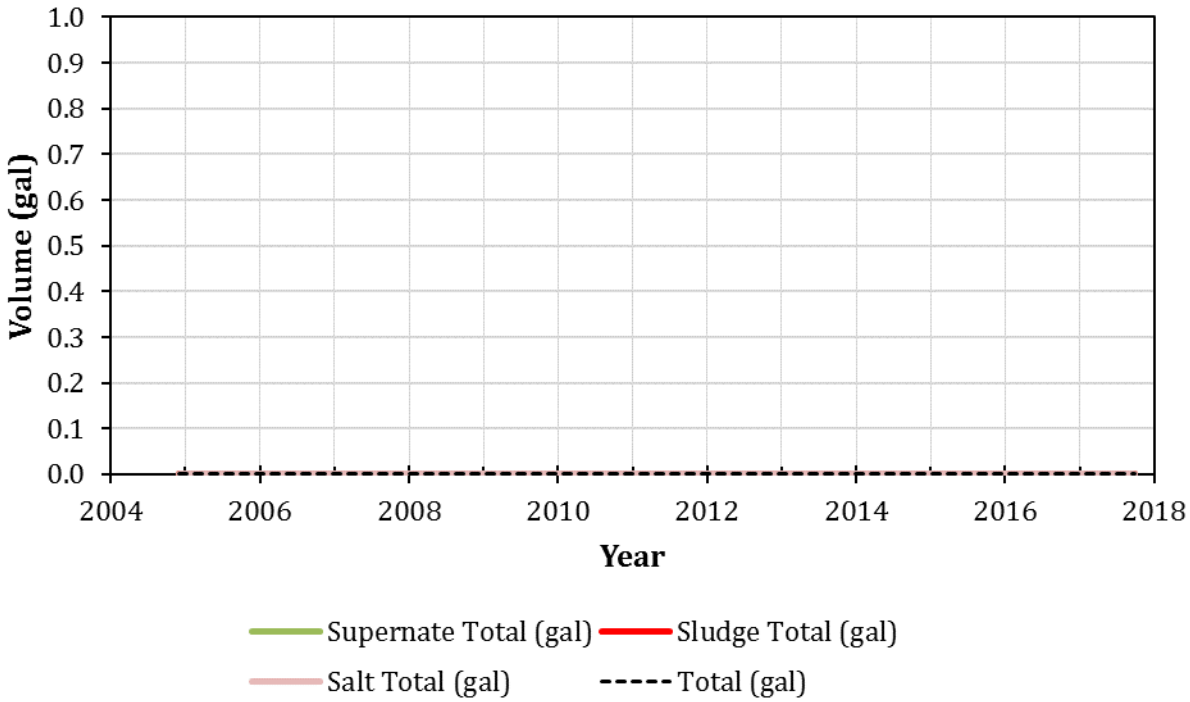


Figure B-17: Volume History (2005 to 2017) for Tank 17

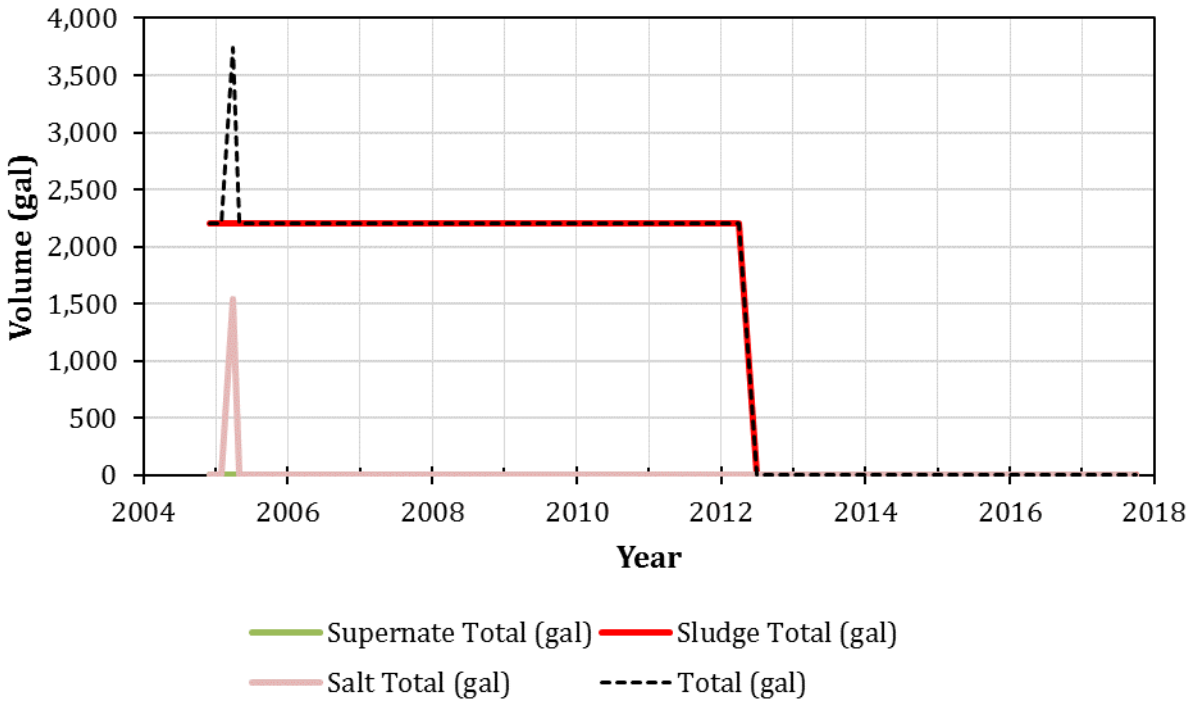


Figure B-18: Volume History (2005 to 2017) for Tank 18

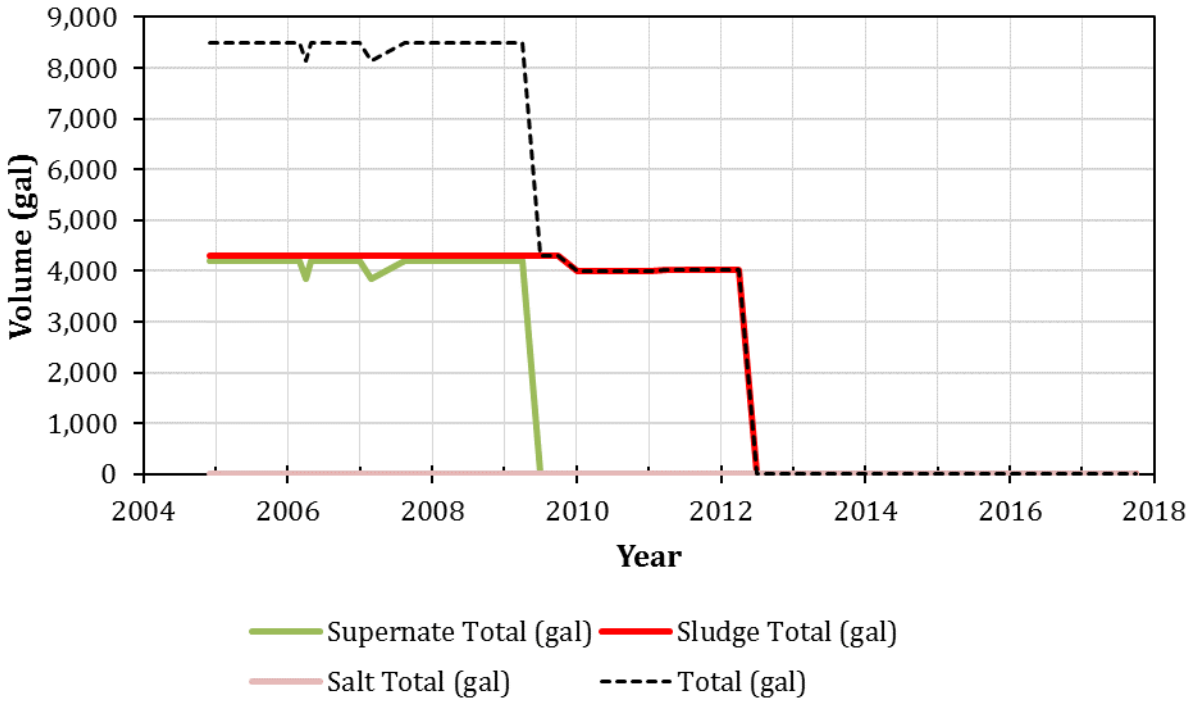


Figure B-19: Volume History (2005 to 2017) for Tank 19

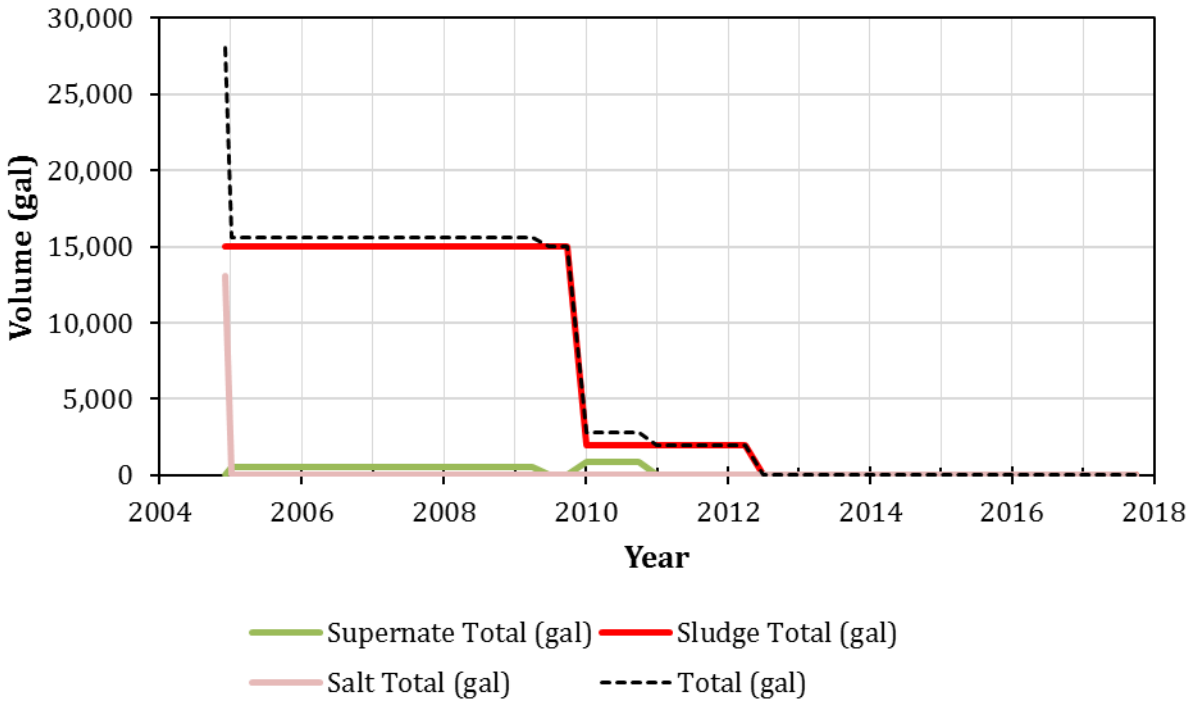


Figure B-20: Volume History (2005 to 2017) for Tank 20

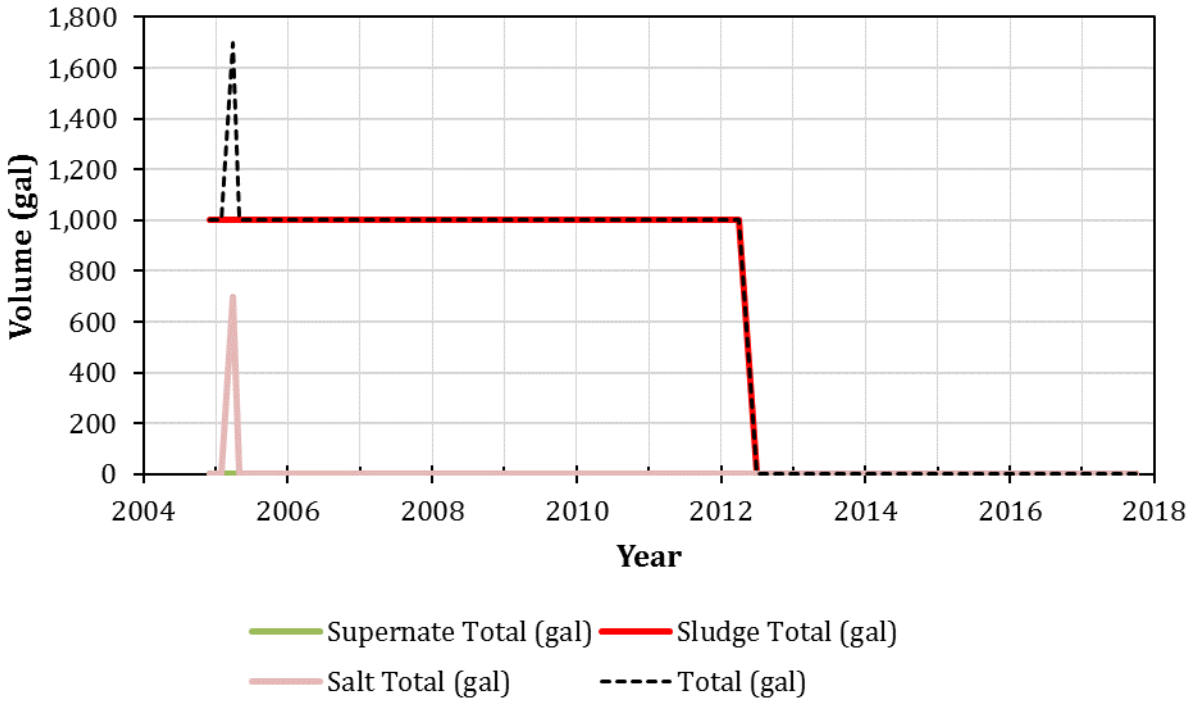


Figure B-21: Volume History (2005 to 2017) for Tank 21

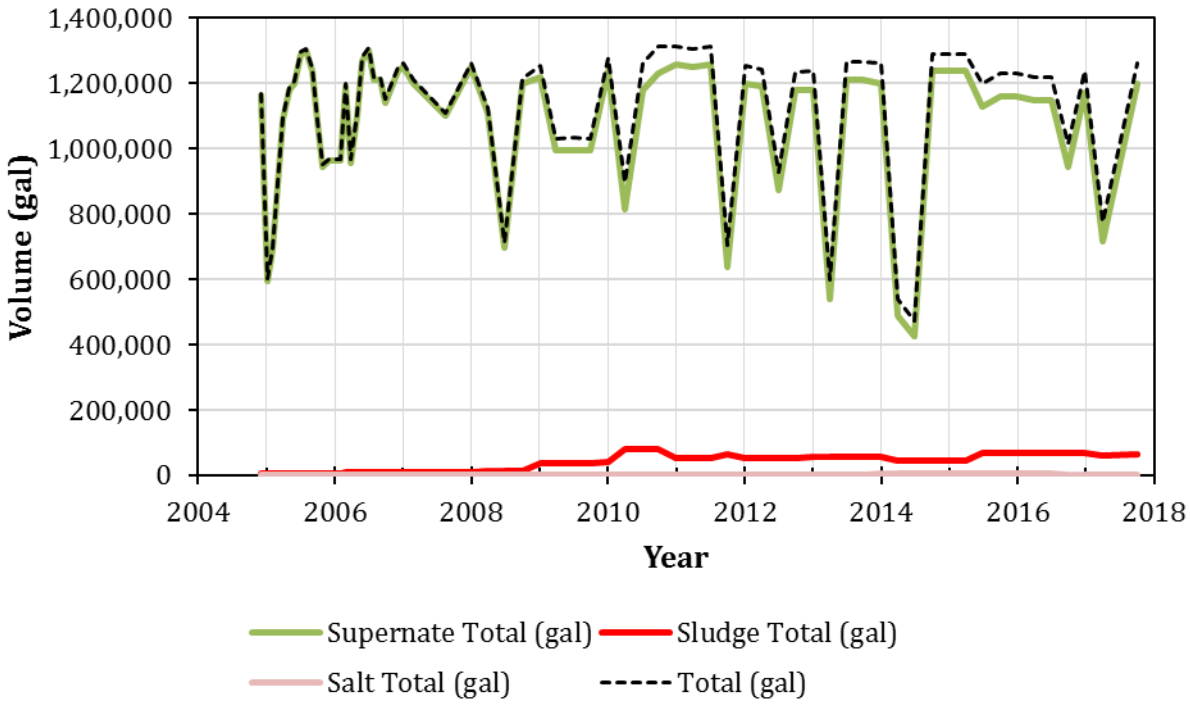


Figure B-22: Volume History (2005 to 2017) for Tank 22

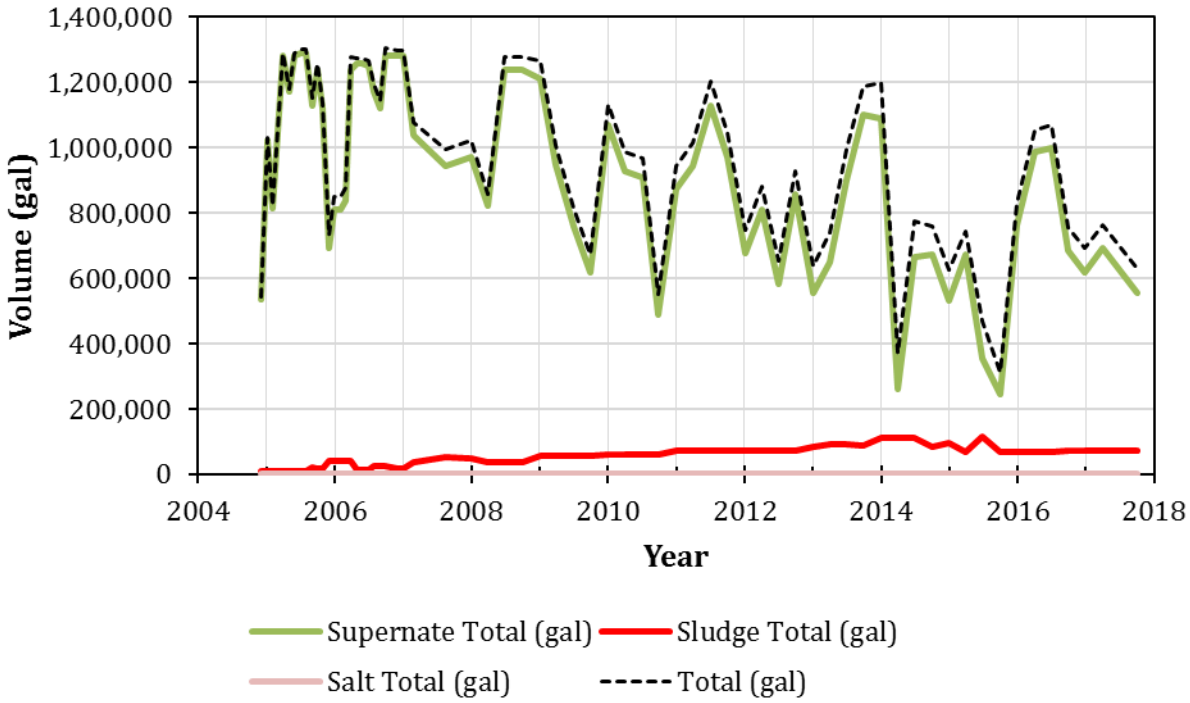


Figure B-23: Volume History (2005 to 2017) for Tank 23

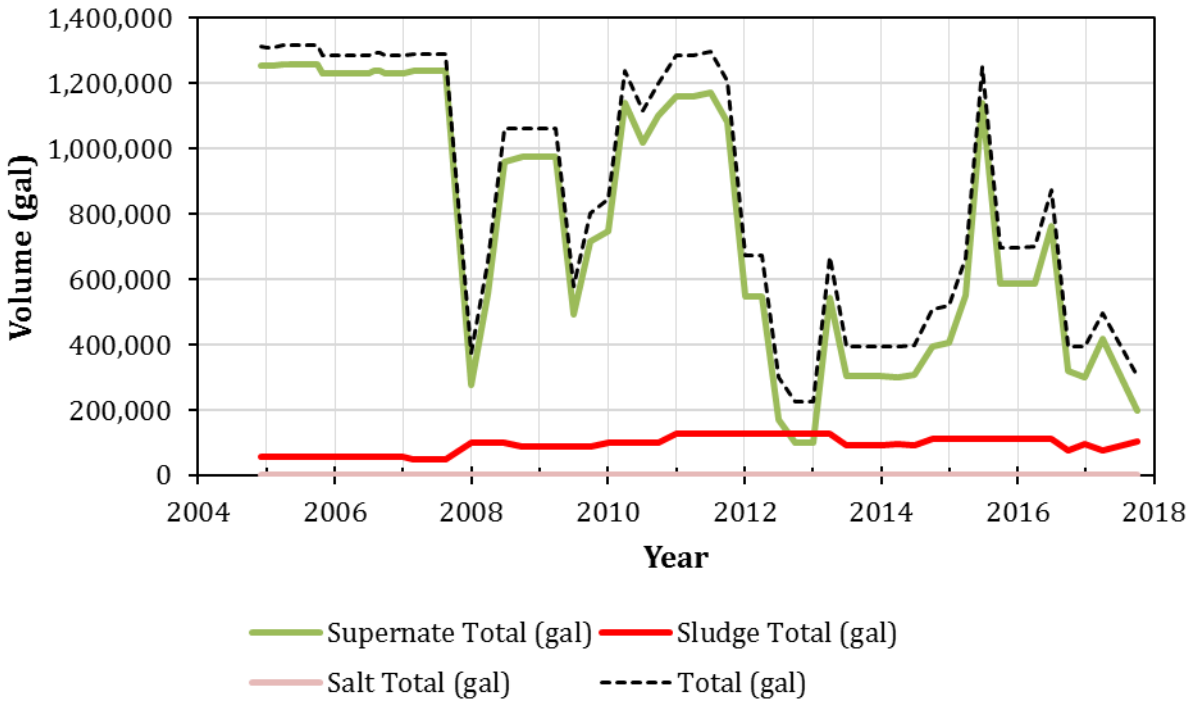


Figure B-24: Volume History (2005 to 2017) for Tank 24

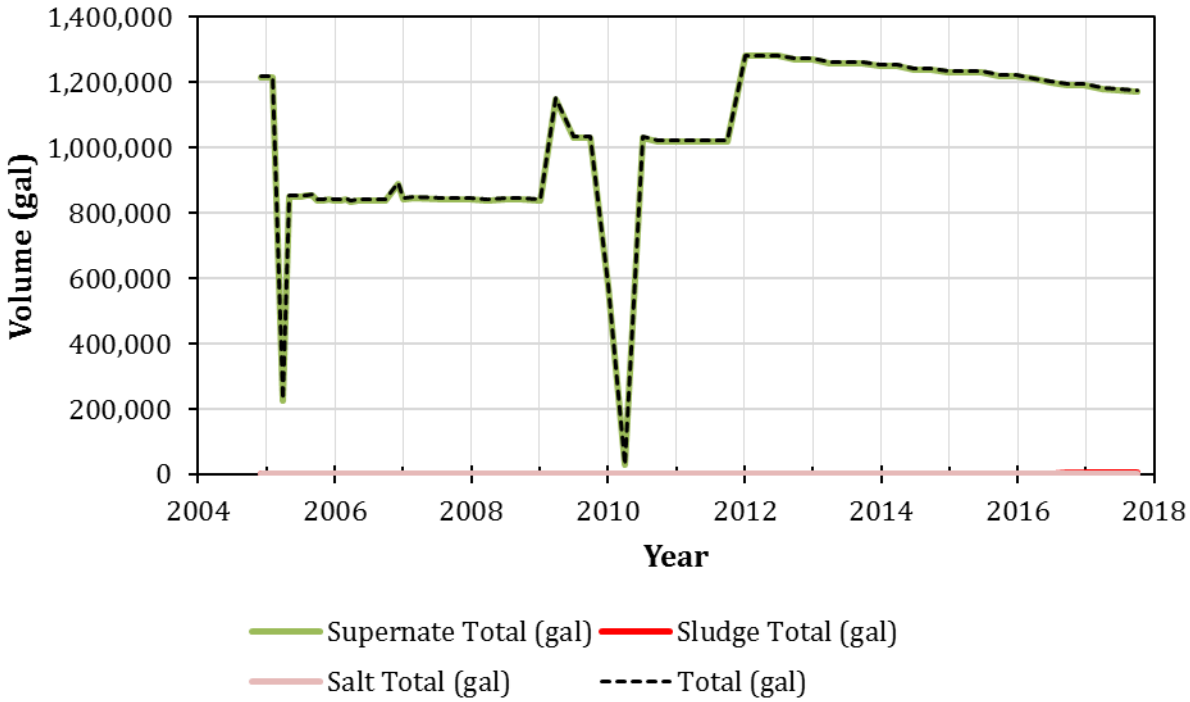


Figure B-25: Volume History (2005 to 2017) for Tank 25

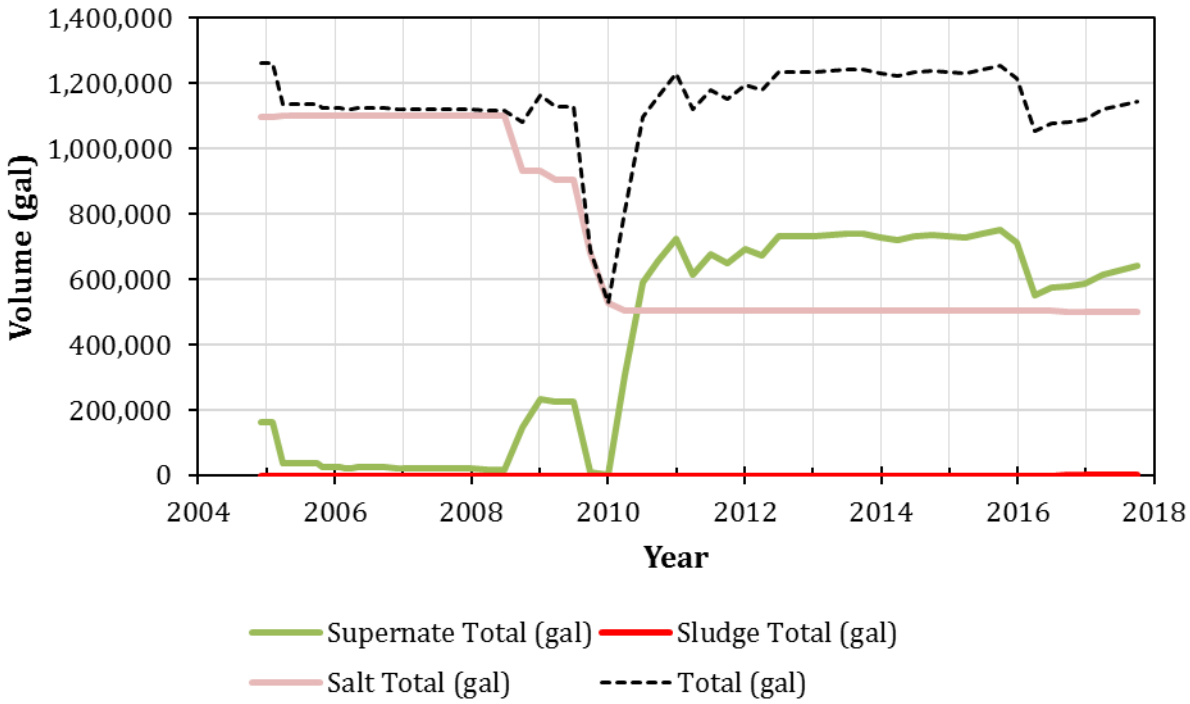


Figure B-26: Volume History (2005 to 2017) for Tank 26

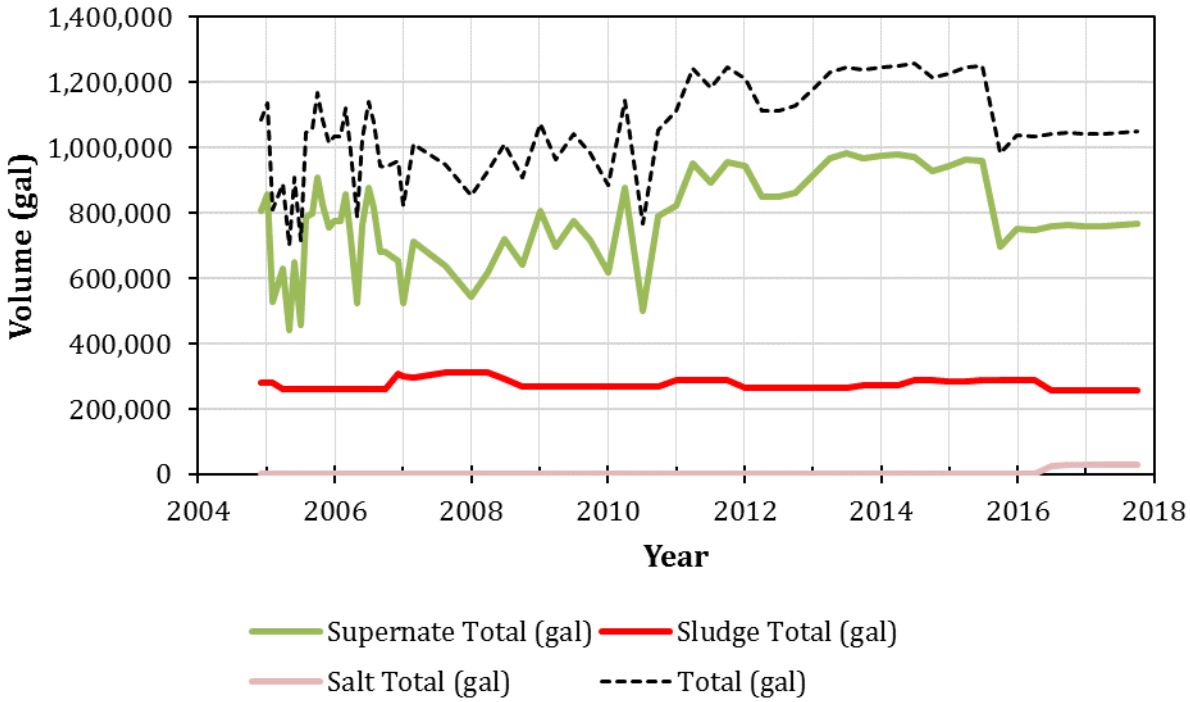


Figure B-27: Volume History (2005 to 2017) for Tank 27

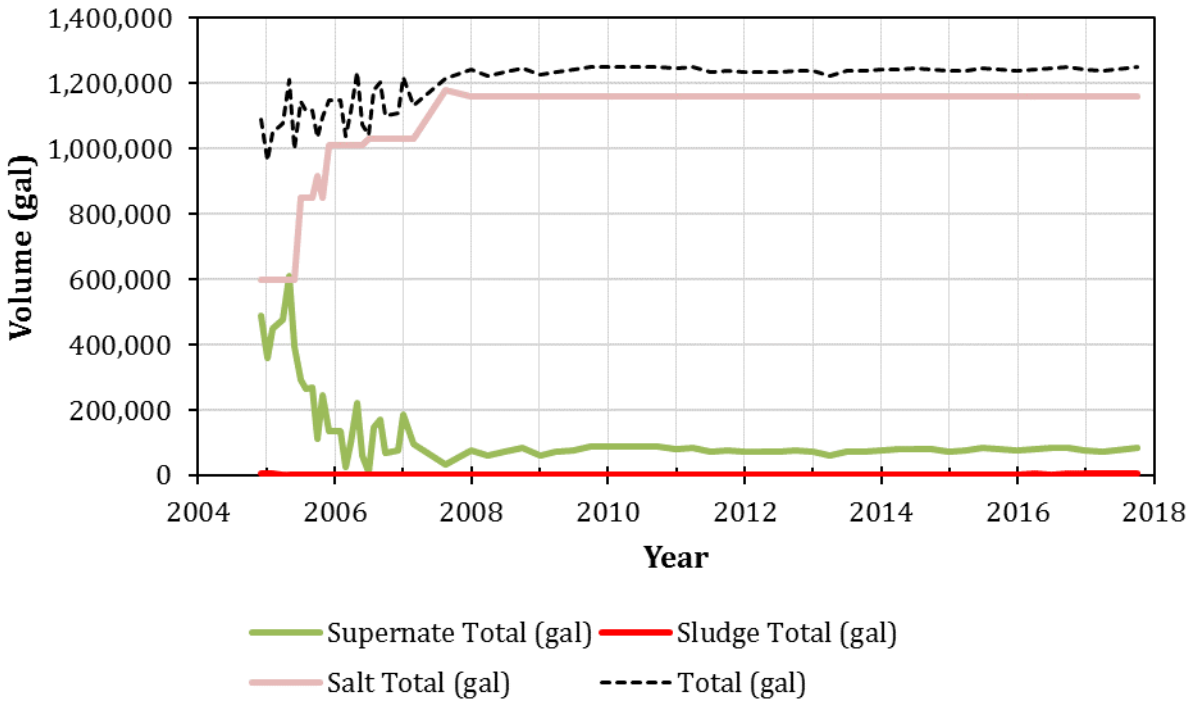


Figure B-28: Volume History (2005 to 2017) for Tank 28

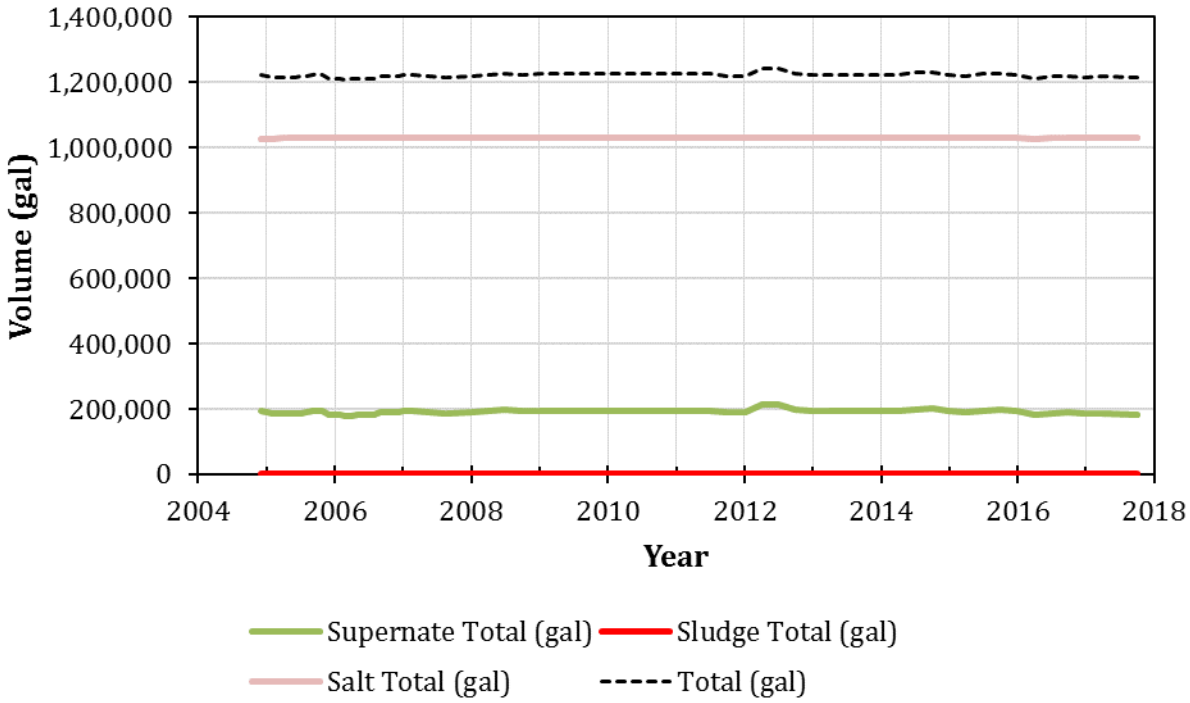


Figure B-29: Volume History (2005 to 2017) for Tank 29

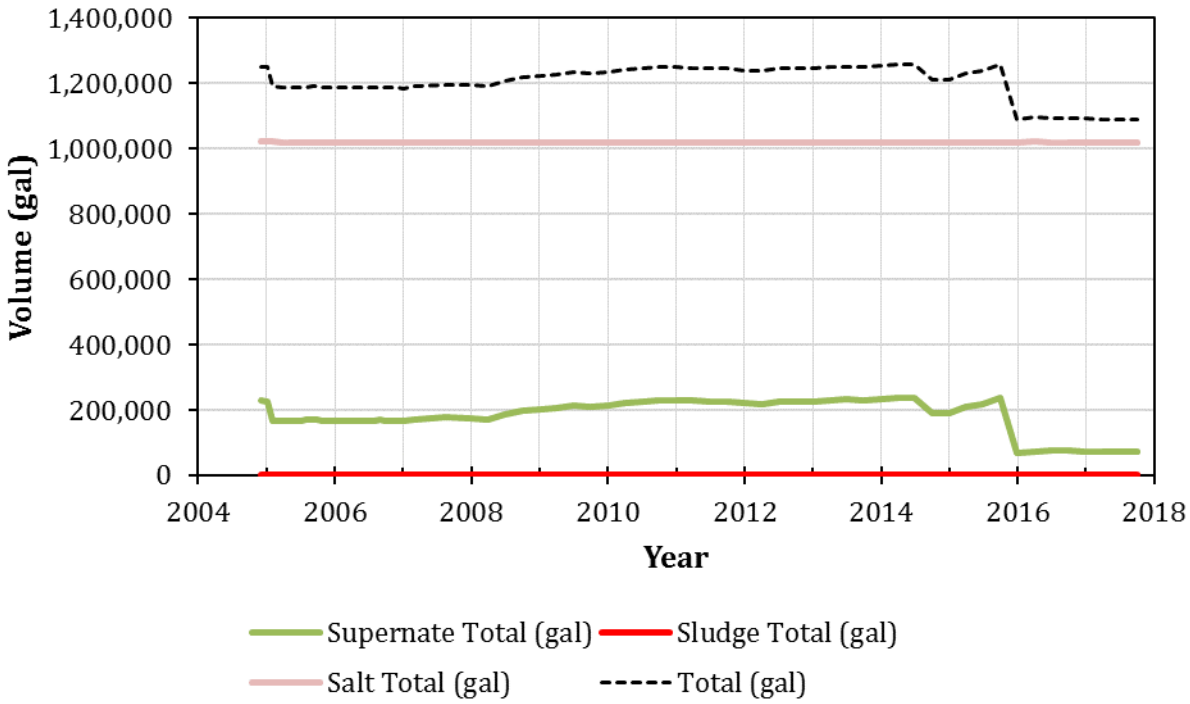


Figure B-30: Volume History (2005 to 2017) for Tank 30

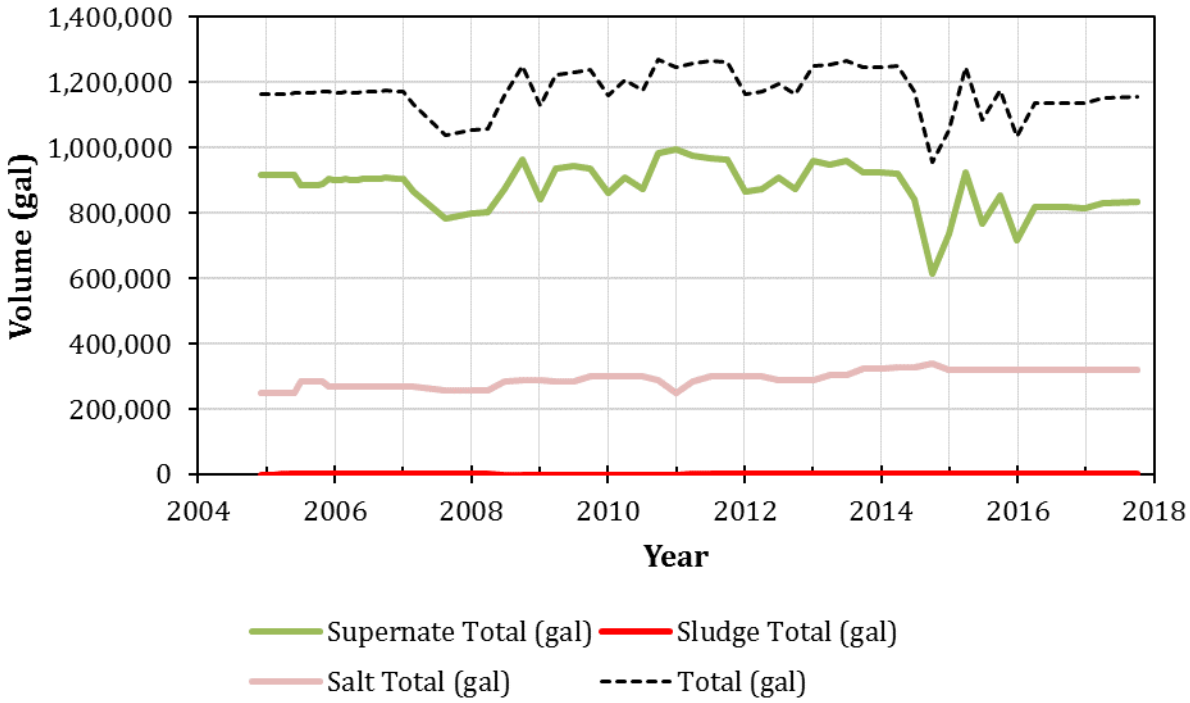


Figure B-31: Volume History (2005 to 2017) for Tank 31

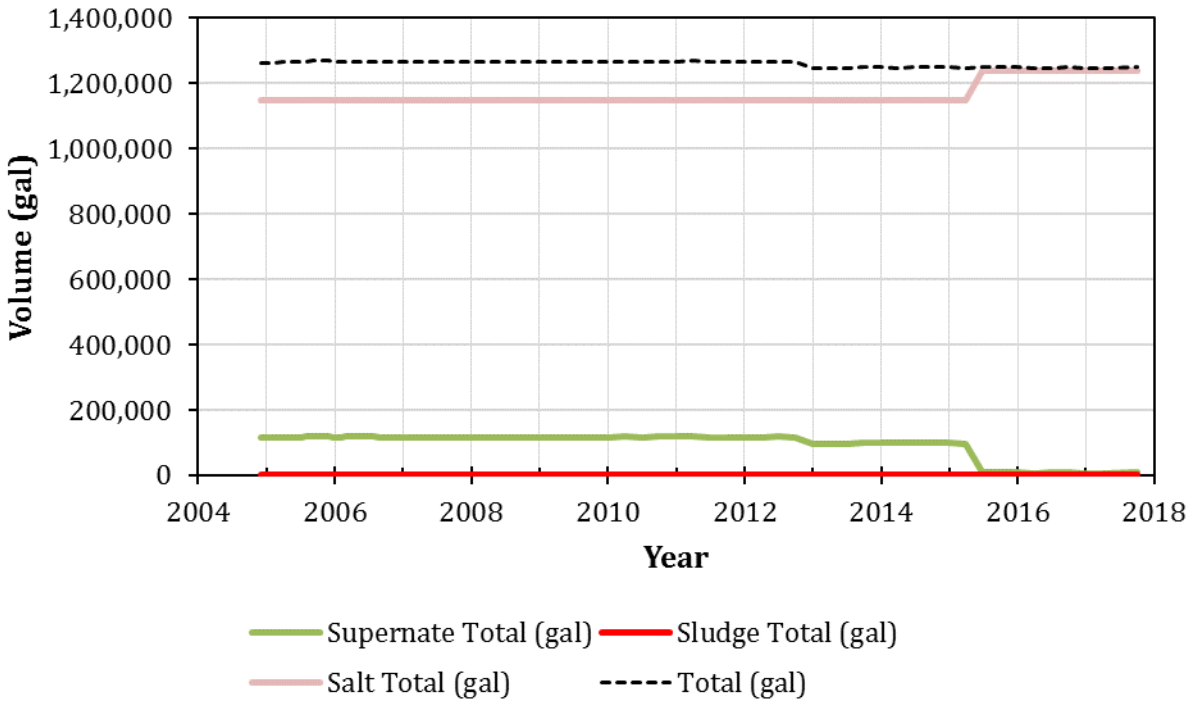


Figure B-32: Volume History (2005 to 2017) for Tank 32

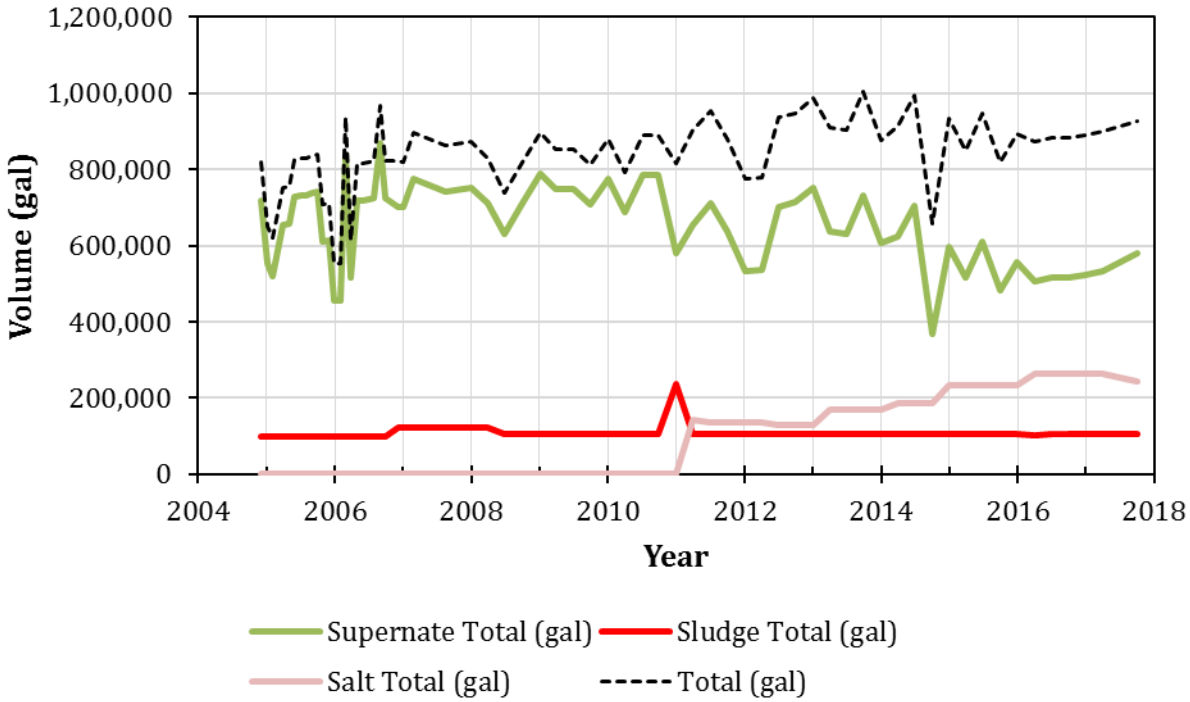


Figure B-33: Volume History (2005 to 2017) for Tank 33

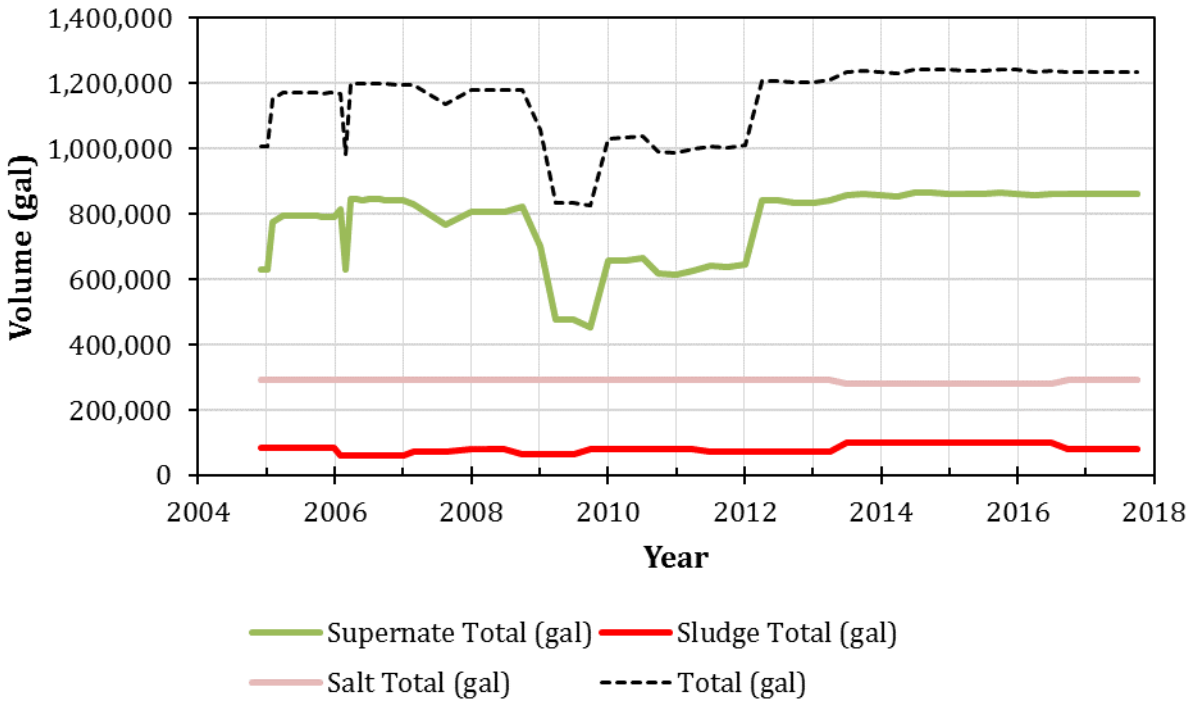


Figure B-34: Volume History (2005 to 2017) for Tank 34

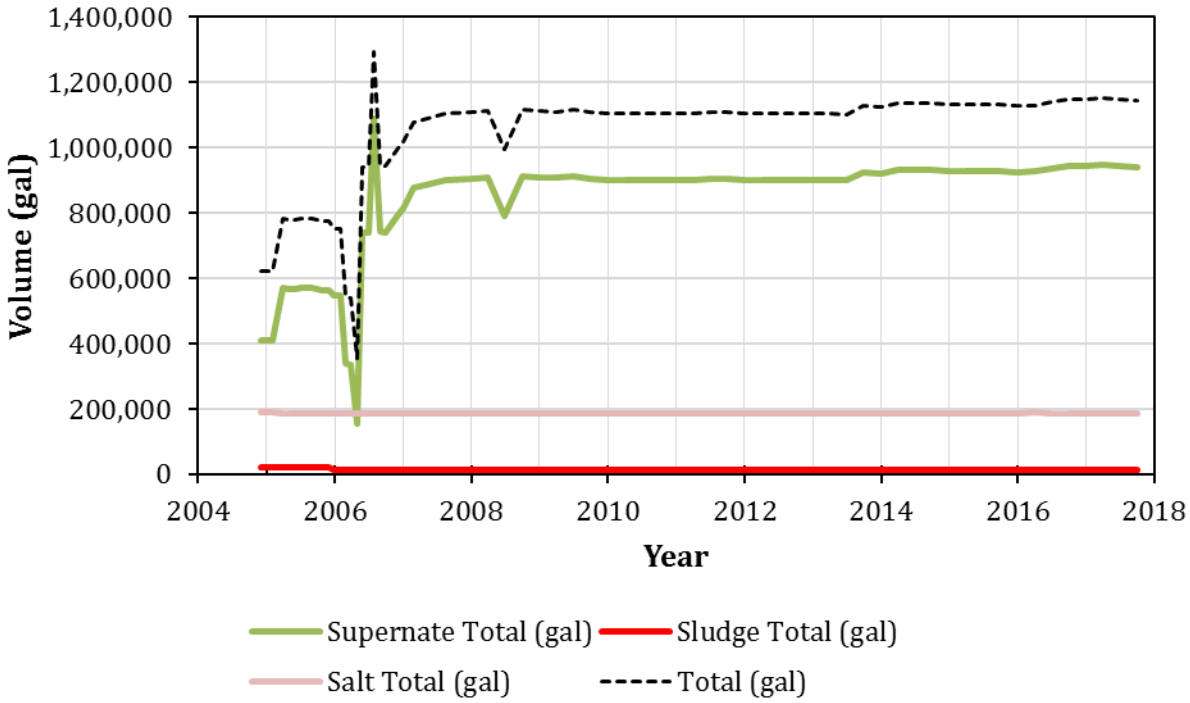


Figure B-35: Volume History (2005 to 2017) for Tank 35

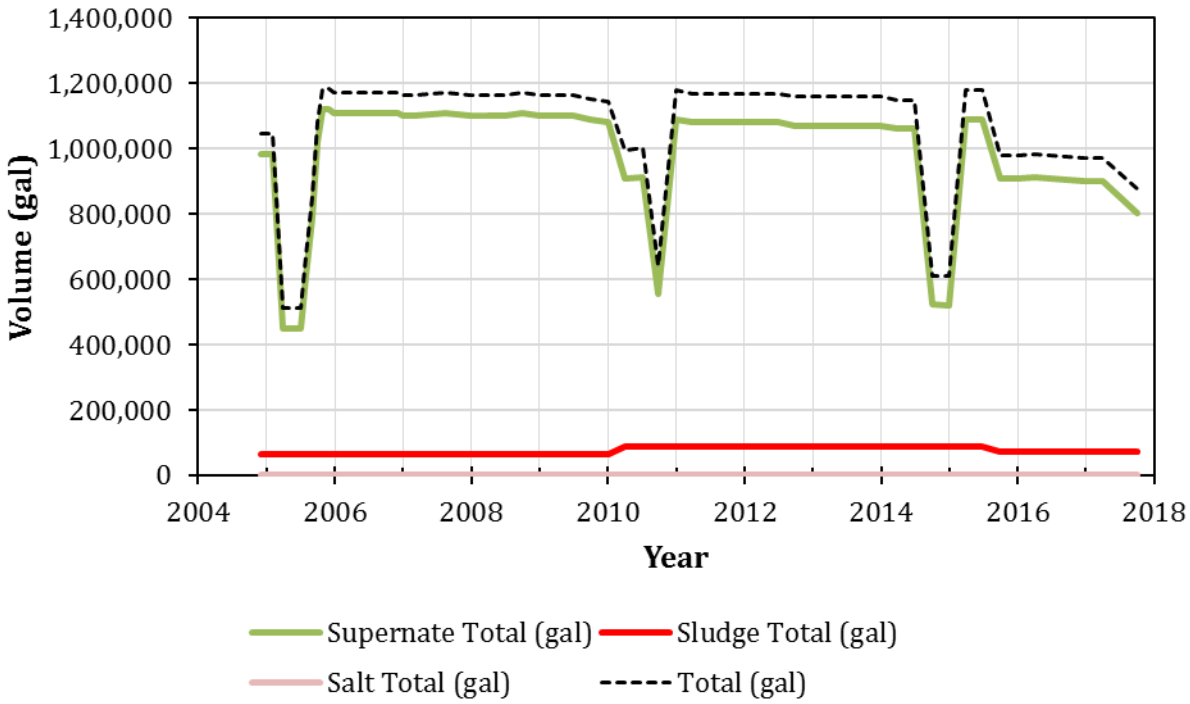


Figure B-36: Volume History (2005 to 2017) for Tank 36

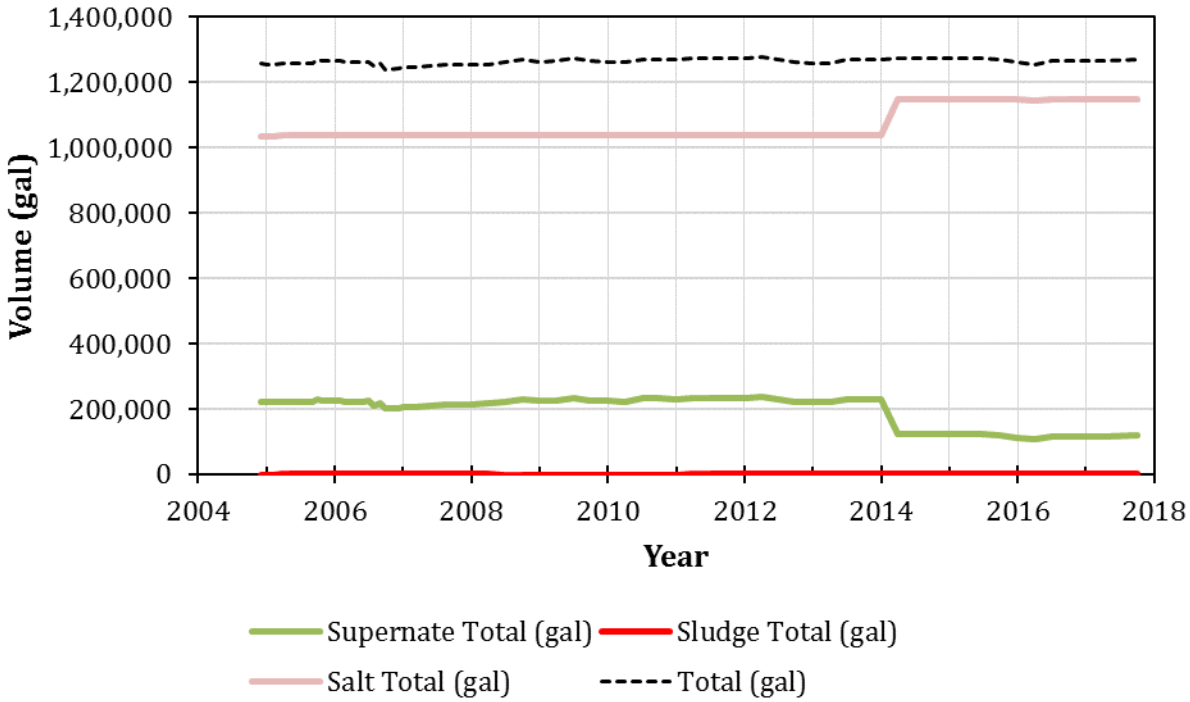


Figure B-37: Volume History (2005 to 2017) for Tank 37

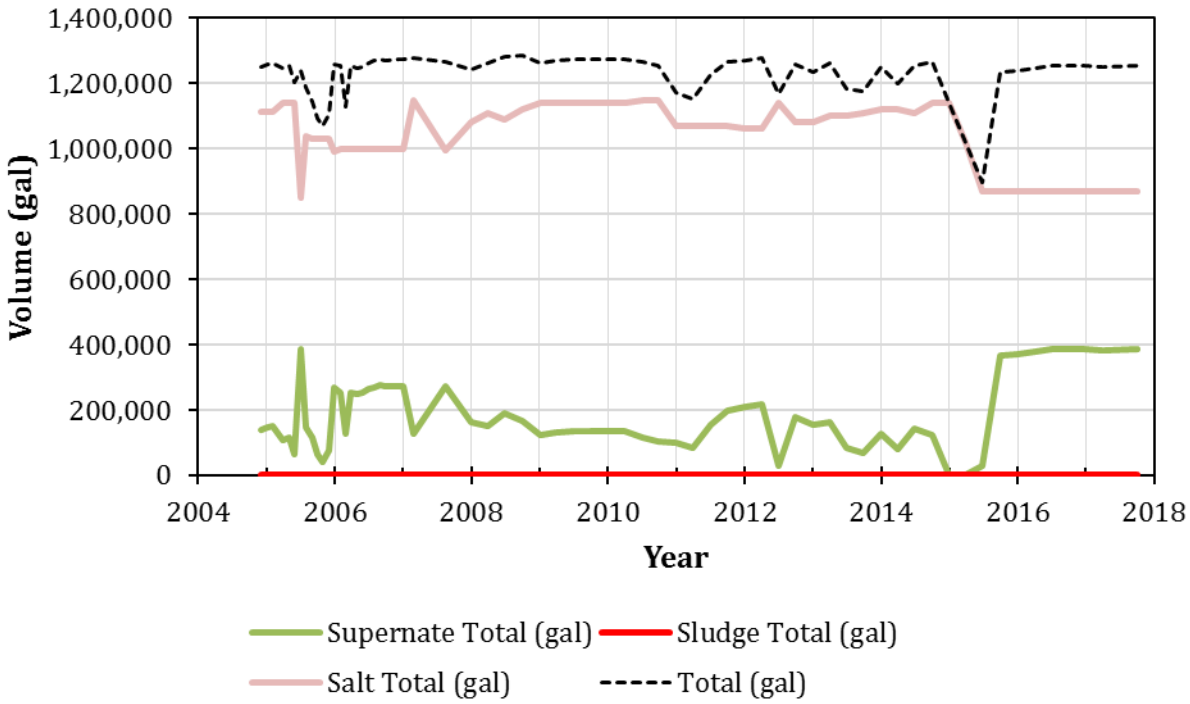


Figure B-38: Volume History (2005 to 2017) for Tank 38

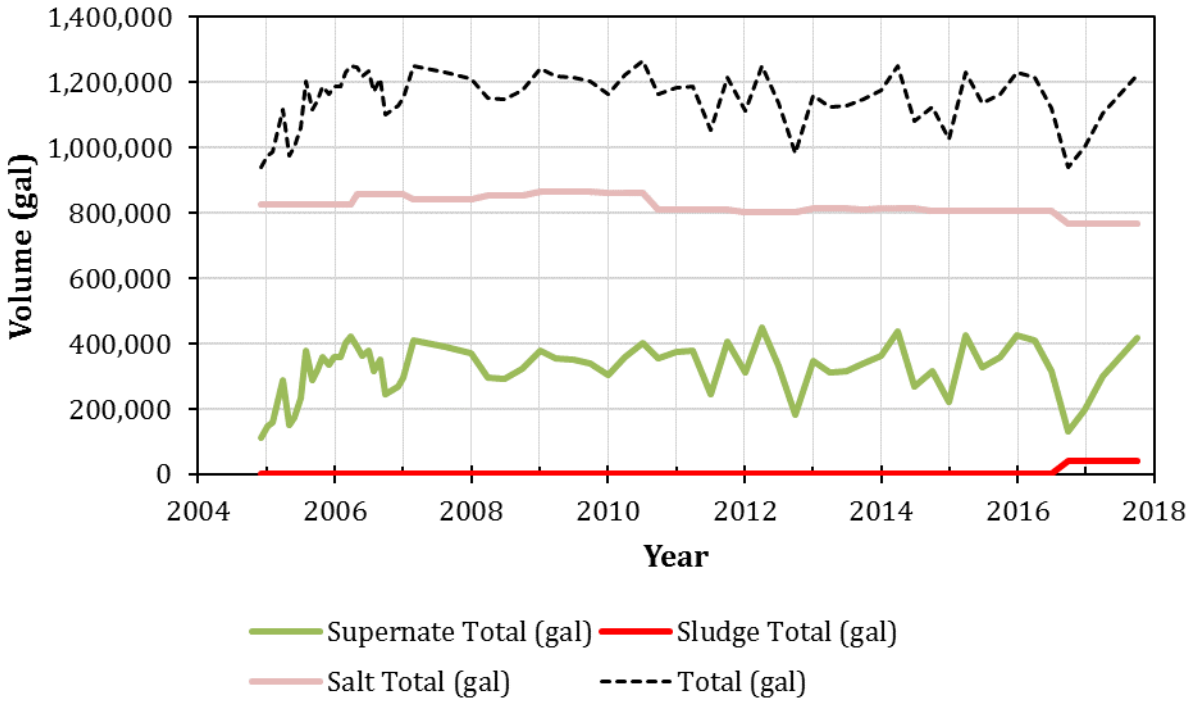


Figure B-39: Volume History (2005 to 2017) for Tank 39

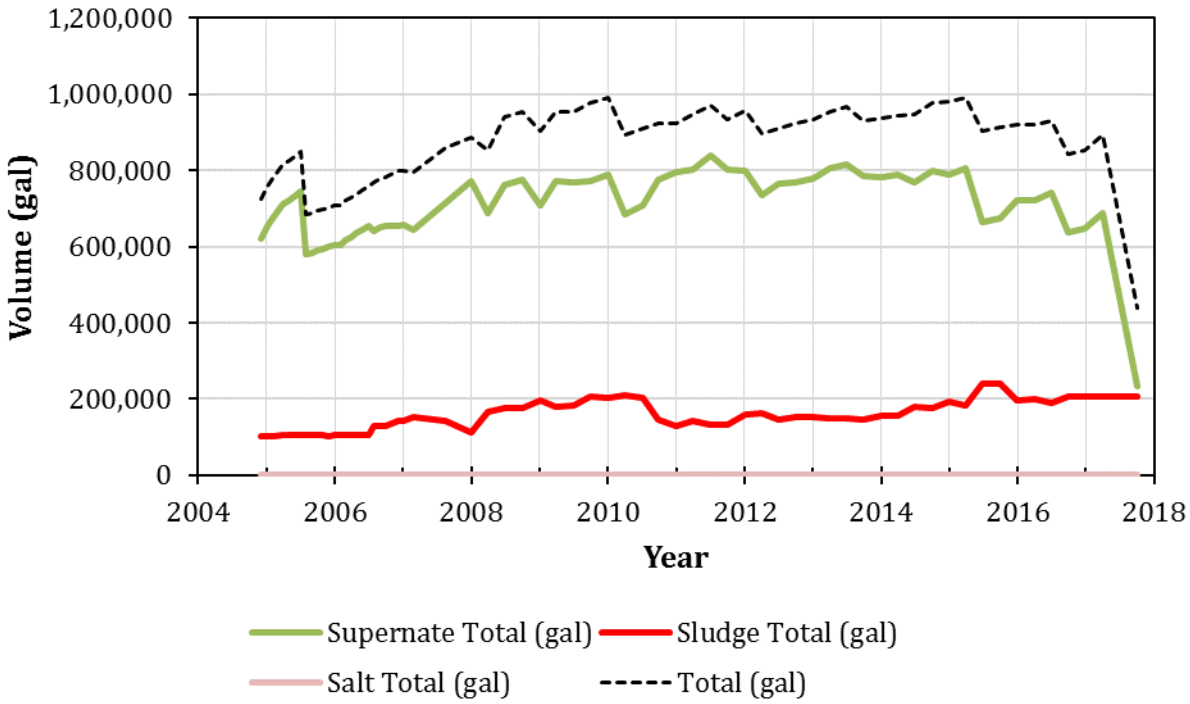


Figure B-40: Volume History (2005 to 2017) for Tank 40

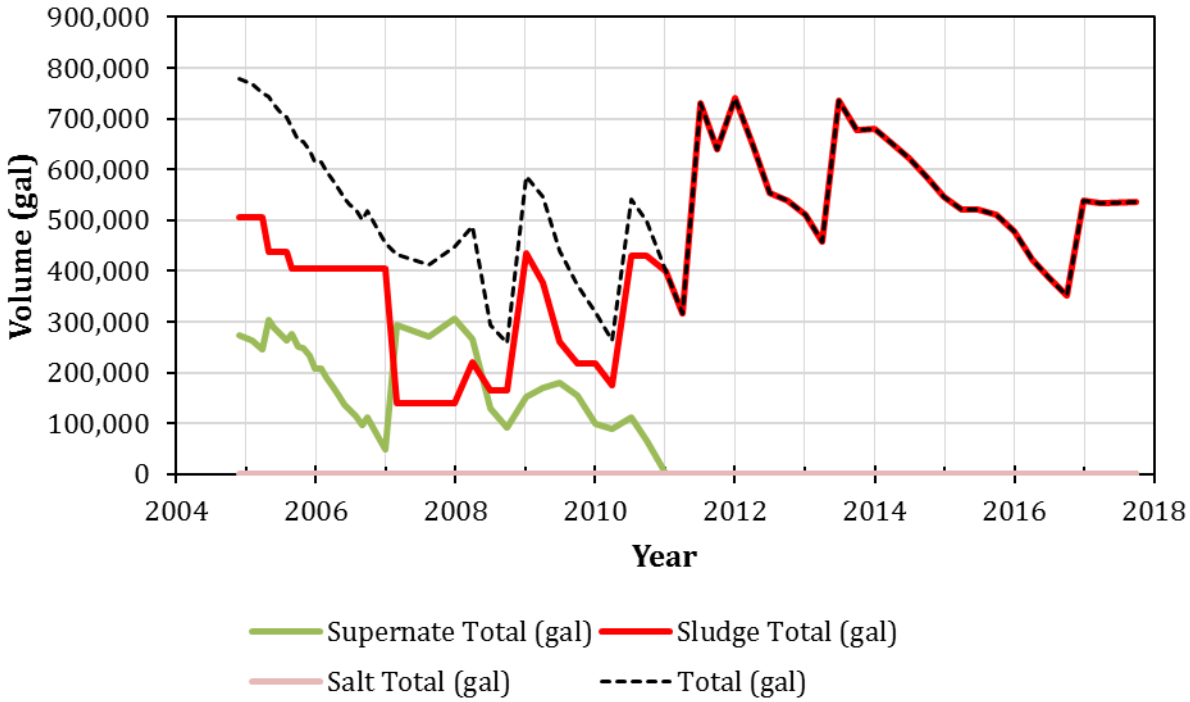


Figure B-41: Volume History (2005 to 2017) for Tank 41

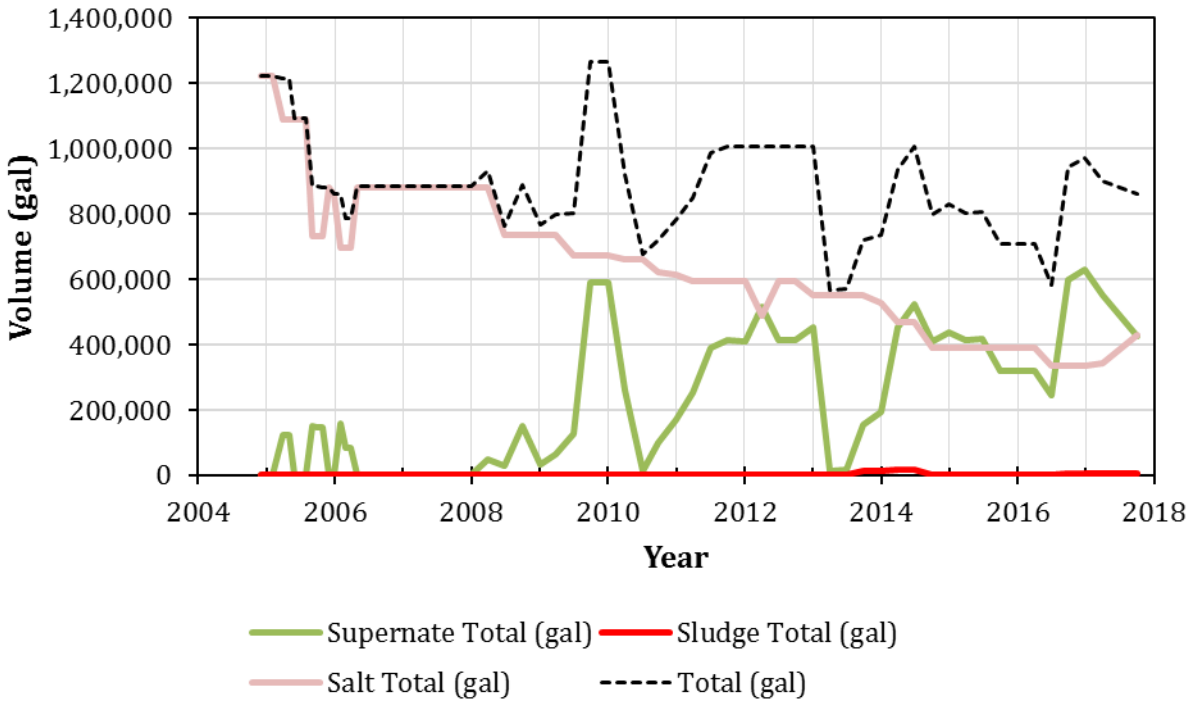


Figure B-42: Volume History (2005 to 2017) for Tank 42

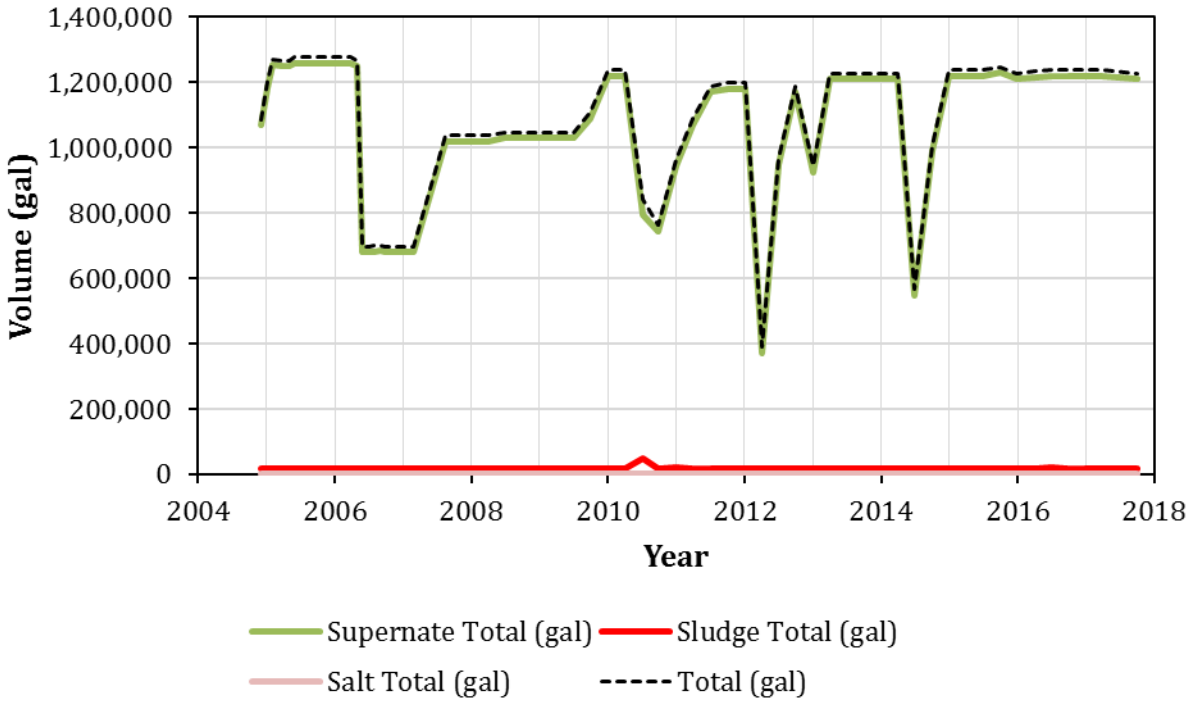


Figure B-43: Volume History (2005 to 2017) for Tank 43

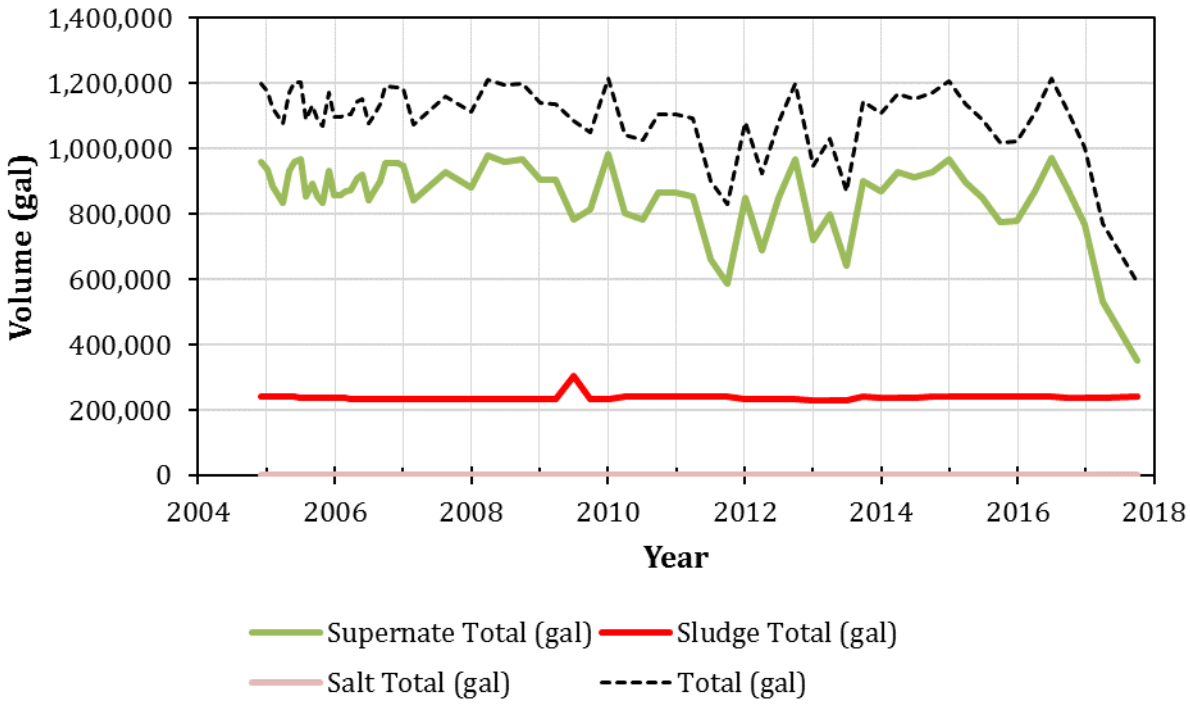


Figure B-44: Volume History (2005 to 2017) for Tank 44

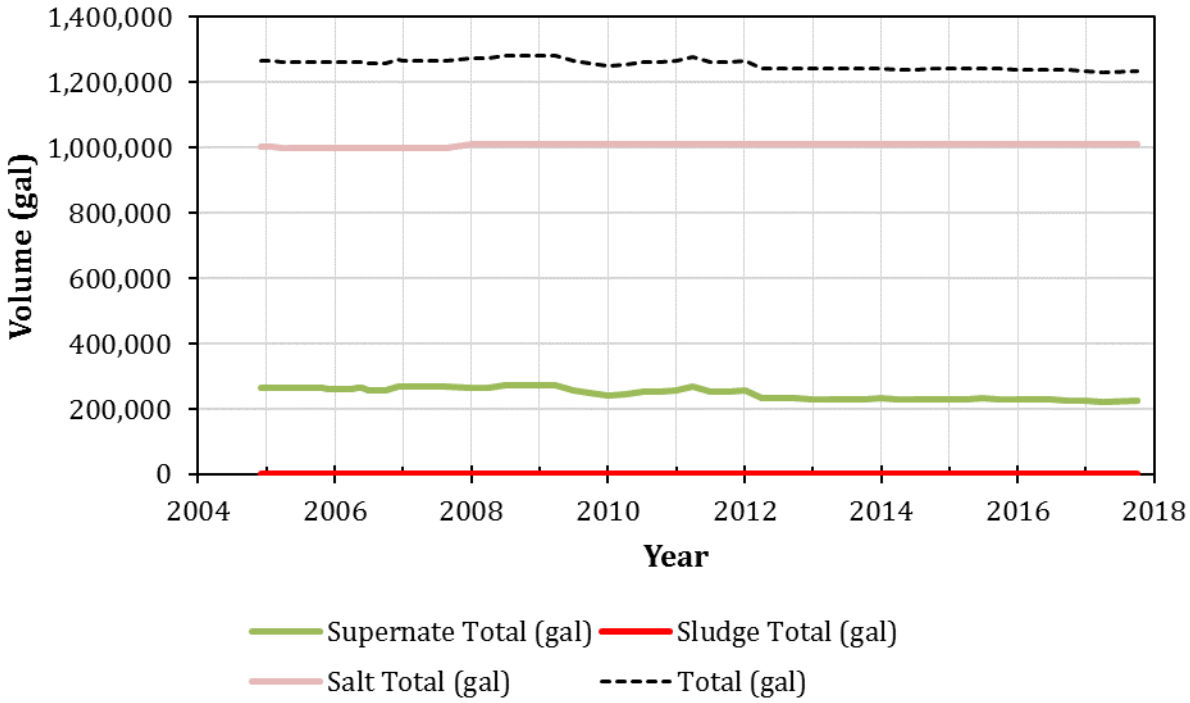


Figure B-45: Volume History (2005 to 2017) for Tank 45

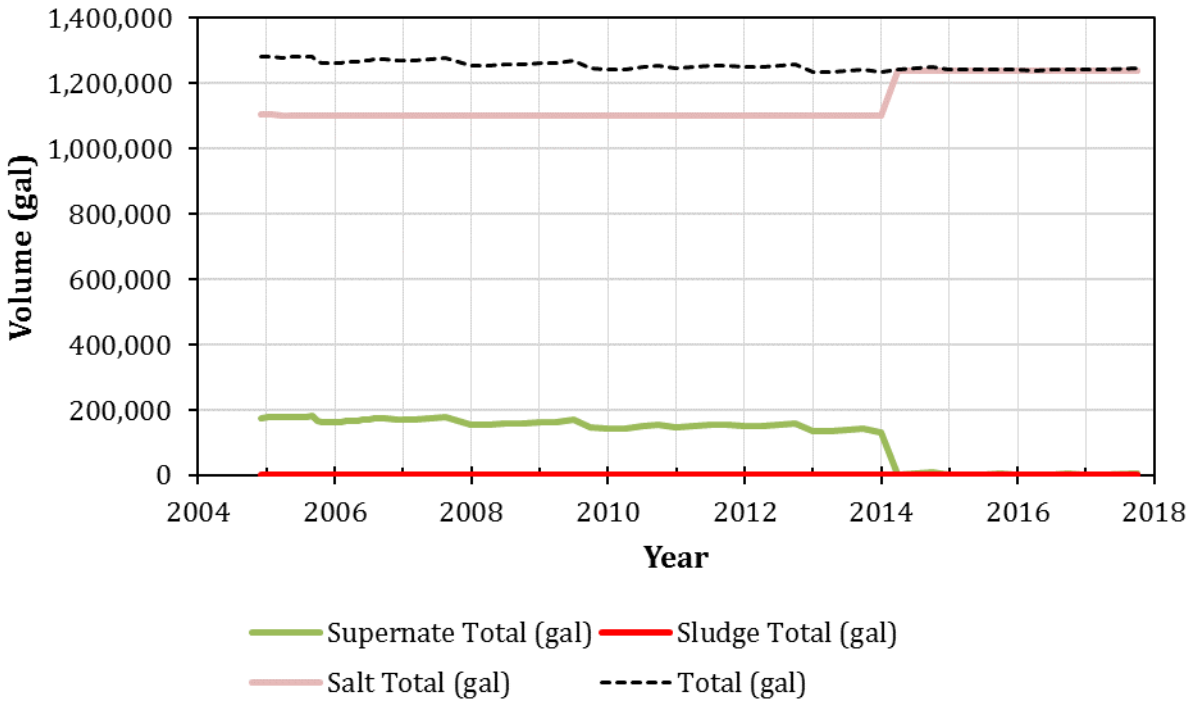


Figure B-46: Volume History (2005 to 2017) for Tank 46

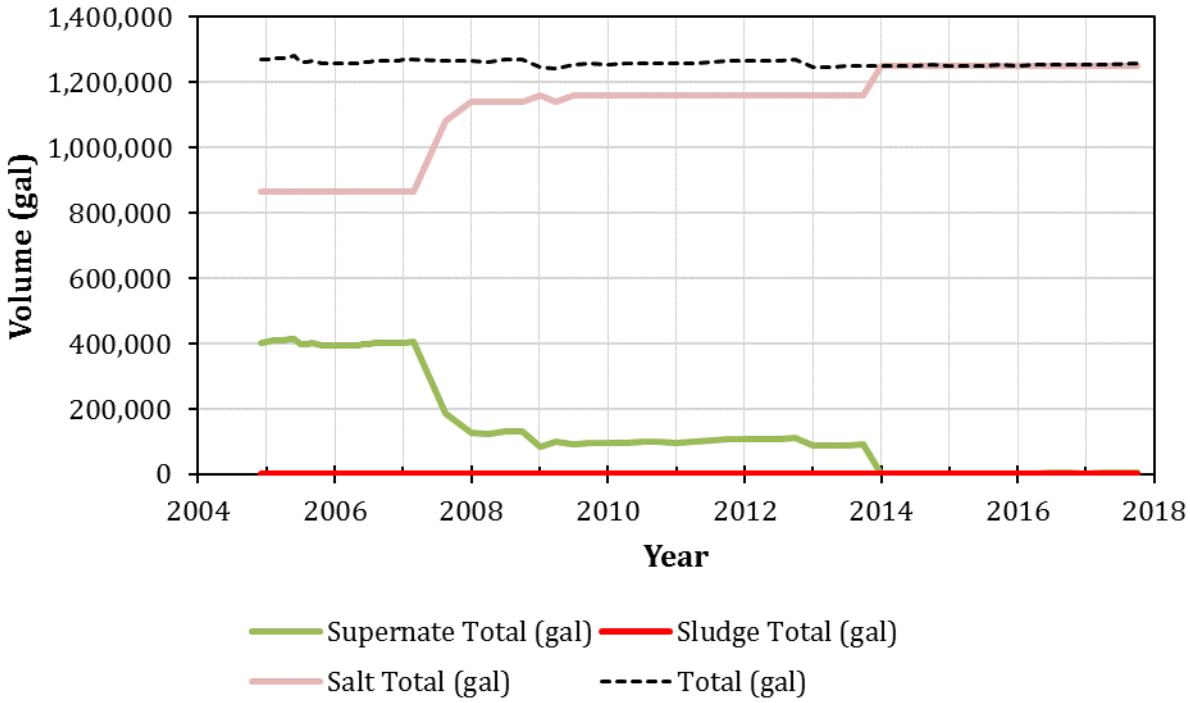


Figure B-47: Volume History (2005 to 2017) for Tank 47

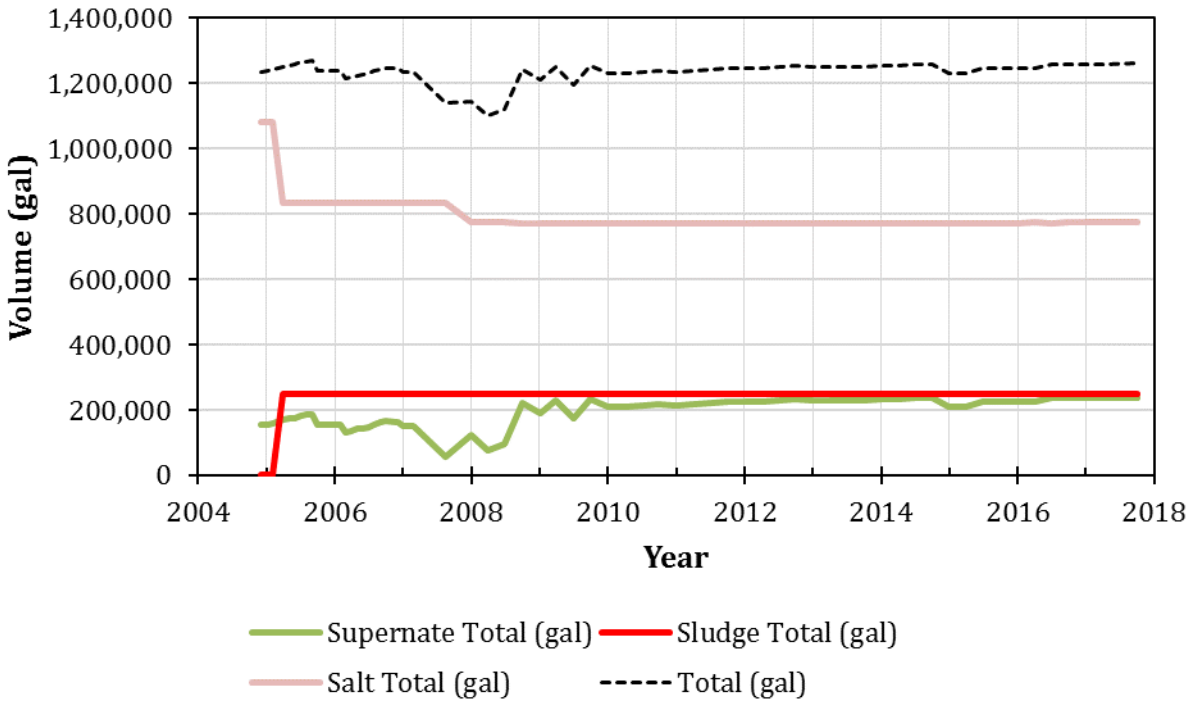


Figure B-48: Volume History (2005 to 2017) for Tank 48

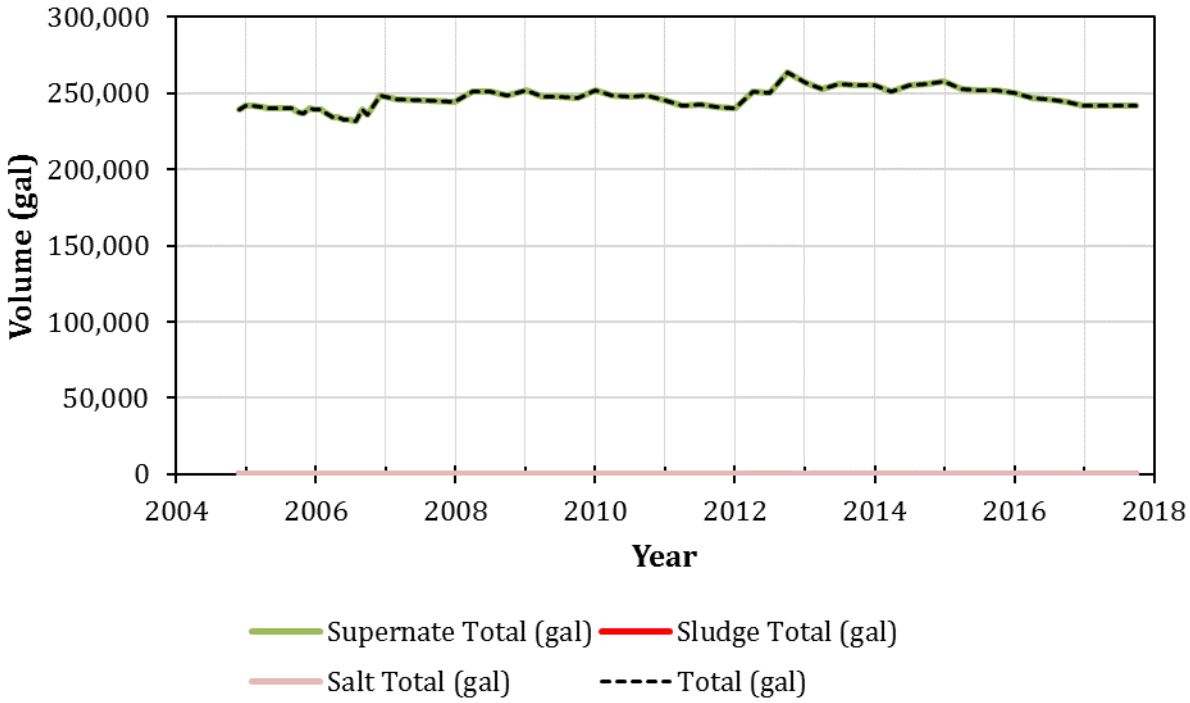


Figure B-49: Volume History (2005 to 2017) for Tank 49

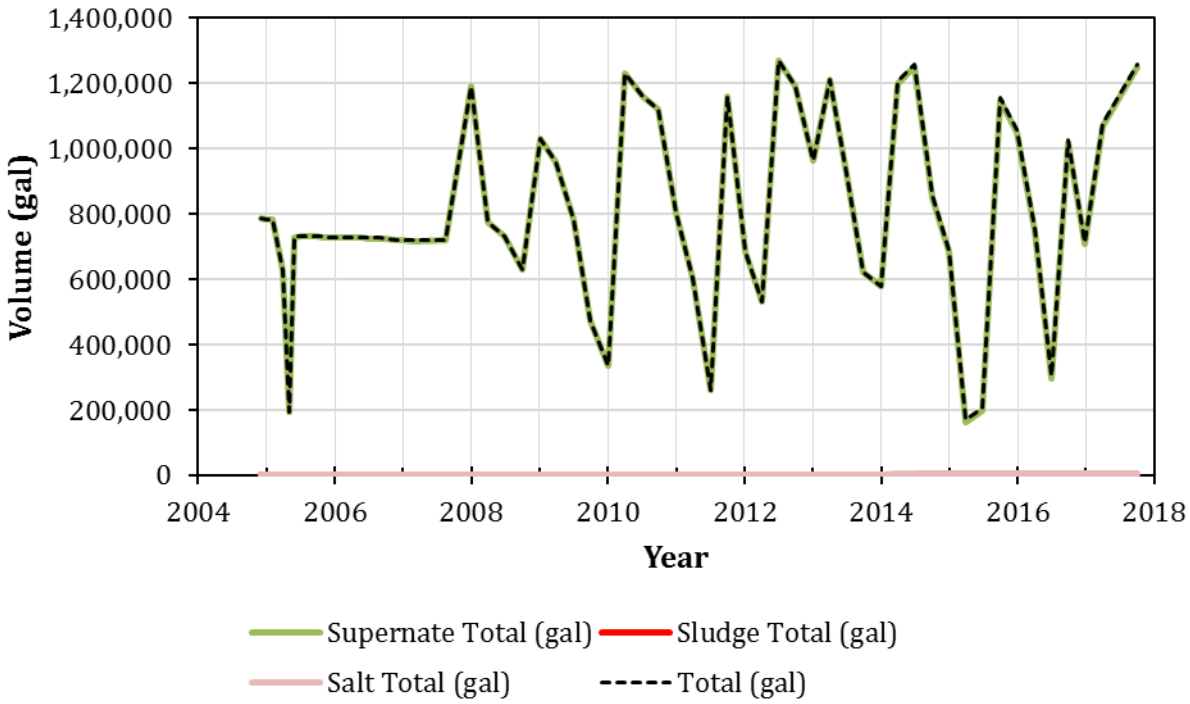


Figure B-50: Volume History (2005 to 2017) for Tank 50

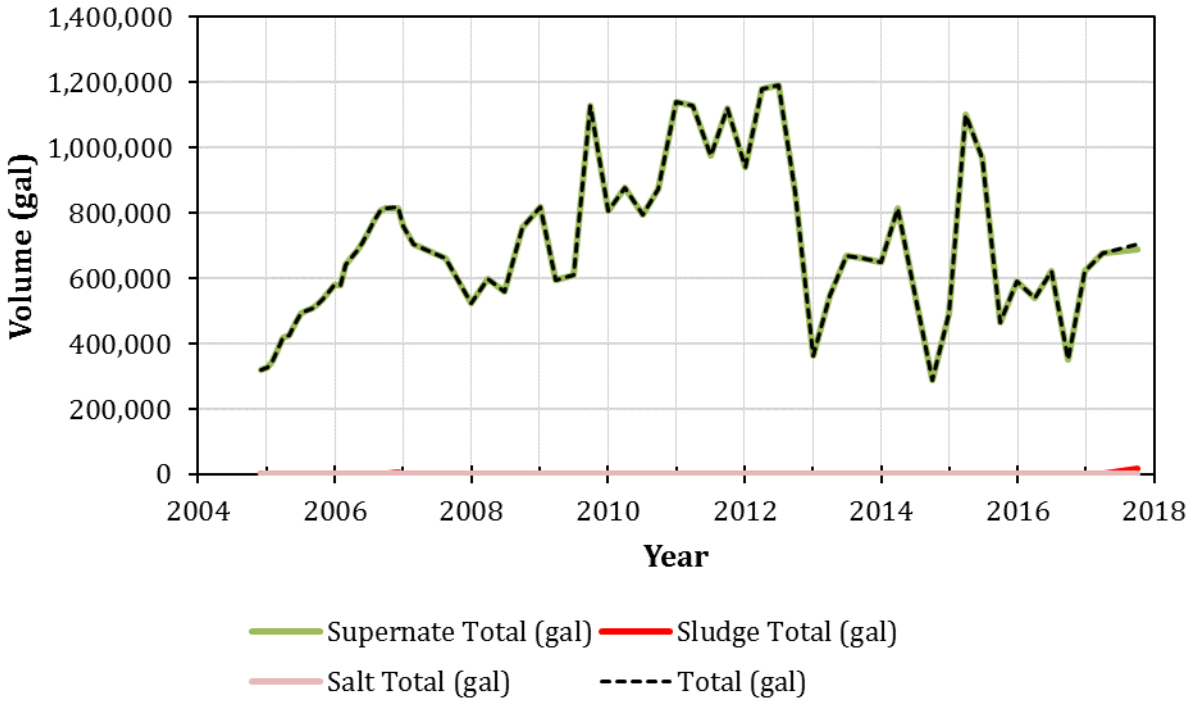
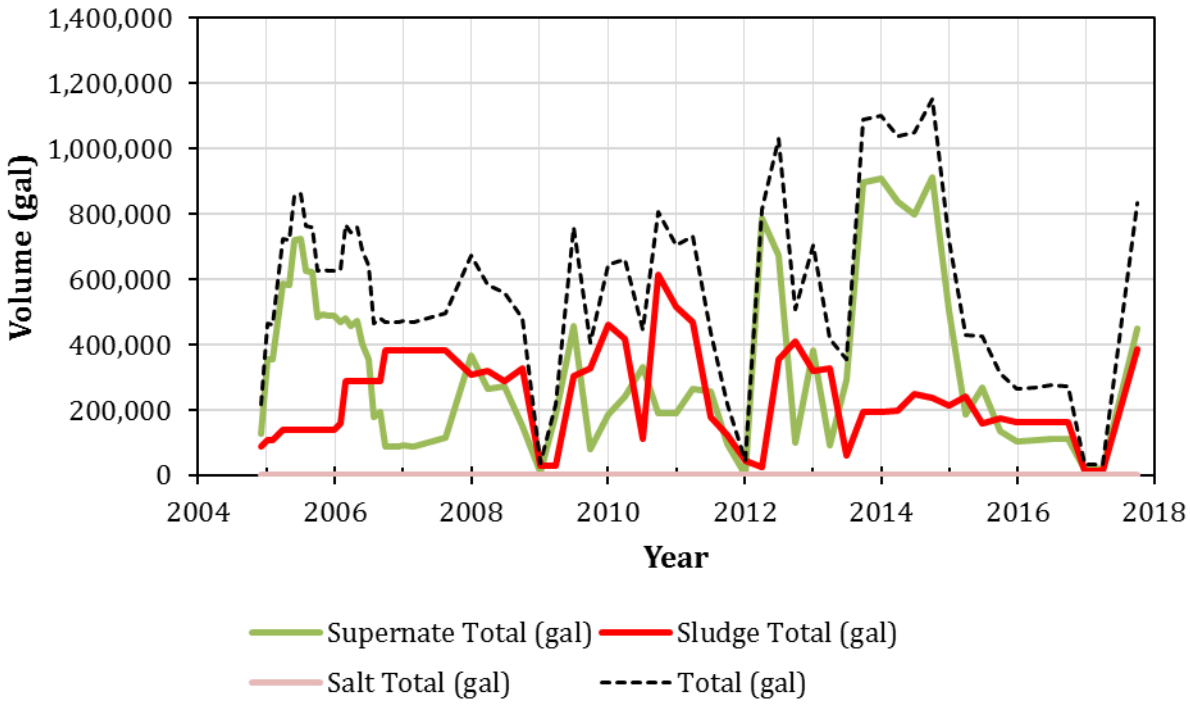


Figure B-51: Volume History (2005 to 2017) for Tank 51



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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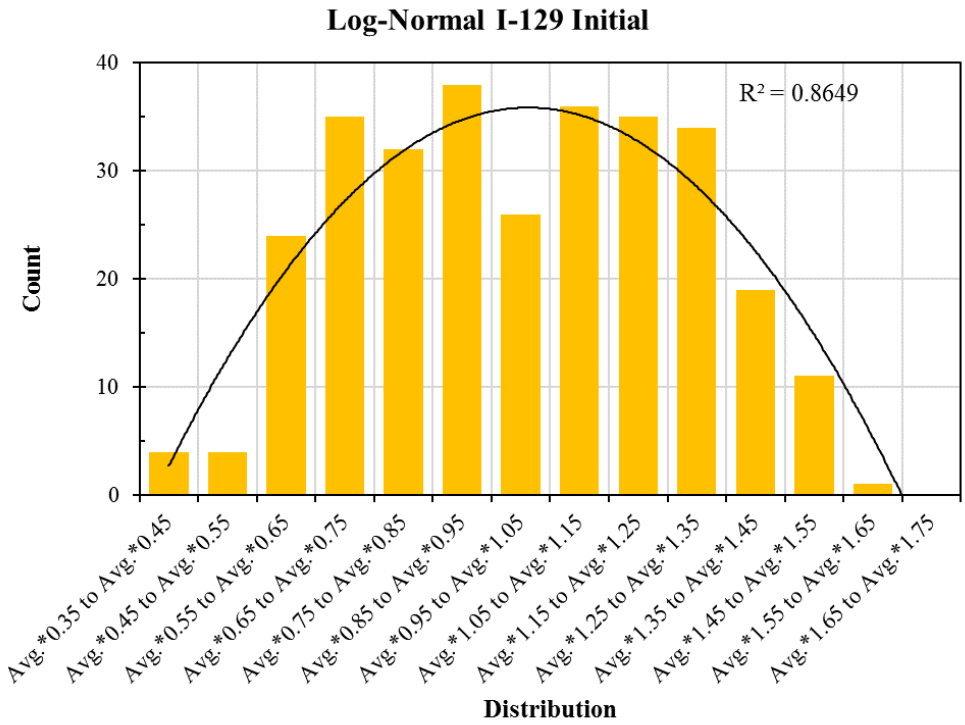
APPENDIX C. MODEL DISTRIBUTION RECOMMENDATION

This appendix provides a recommendation for a sampling distribution for I-129 inventory, to use when modeling. This distribution is developed based on analysis of the normalized data set in Section 3. Specifically, Figure 3-14 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 3-14 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 0.35 times the logarithmic mean then increases the multiplier in increments of 0.1.

This figure shows the range of data variability for I-129 (from a minimum of 0.35 × the logarithmic mean, to a maximum of 1.75 × the logarithmic mean).

Figure C-1: Logarithmic Distribution Behavior of Sampled Concentrations of I-129, Based on Increments of 0.1 × Logarithmic Mean



Given these ranges and the logarithmic behavior of this data, it is recommended that, when I-129 or Cs-137 data is completely unavailable, probabilistic modeling may apply the following:

$$r^{P} \qquad \text{(Eq. C-1)}$$

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, a standard deviation of 0.1, a minimum of 0.35 and a maximum of 1.75.

Section 5.1 recommends a realistic modeling inventory of 15.9 Ci. Due to the limited standard deviation, applying Equation C-1 to this value results in a minimum inventory of approximately 5.8 Ci and a maximum inventory of approximately 37 Ci when sampling 1,000 realizations. The middle 50% of the results (i.e., from the 25th percentile to the 75th percentile) exhibit a range from approximately 13 Ci to 19 Ci, which is a reasonable range of uncertainty, given this improved understanding of I-129 data.

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