LOCKHEED MARTIN

ORNL/ER-365

ENVIRONMENTAL RESTORATION PROGRAM

Evaluation of Phase I and Phase II Sampling and Analysis Data for the Gunite and Associated Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee

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ORNL/ER-365

Energy Systems Environmental Restoration Program

Evaluation of Phase I and Phase II Sampling and Analysis Data for the Gunite and Associated Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee

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PREFACE

This report (ORNL/ER-365) was developed under Work Breakdown Structure 1.4.12.6.1.01.41.12.02.11 (Activity Data Sheet 3301, "WAG 1"). This document provides the Environmental Restoration Program with analytical results and statistical analyses from sludge and supernate samples from the Gunite and Associated Tanks. Information in this report forms part of the technical basis for criticality safety, systems safety, engineering design, and waste management as they apply to the Gunite and Associated Tanks treatability study and remediation.

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ABBREVIATIONS

DQO	Data Quality Objective
GAAT	Gunite and Associated Tanks
LLLW	liquid low-level (radioactive) waste
NTF	North Tank Farm
ORNL	Oak Ridge National Laboratory
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RSD	relative standard deviation
STF	South Tank Farm
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TOC	total organic carbon
TRU	transuranic
TS	treatability study
TSS	total suspended solids
WAG	waste area grouping

EXECUTIVE SUMMARY

The Gunite and Associated Tanks (GAAT) are located at Oak Ridge National Laboratory in Waste Area Grouping 1. GAAT is designated as a Comprehensive Environmental Response, Compensation, and Liability Act site. GAAT is considered a high priority for remediation because of the potential risk associated with the contaminants of concern and the condition of the Gunite walls.

The objective of this report is to (1) support the GAAT treatability study and (2) provide input to the Record of Decision for the remediation of selected tanks that are part of the North Tank Farm and the South Tank Farm.

This report presents a statistical and operational evaluation of GAAT sampling and analysis data from various tanks in the North Tank Farm and the South Tank Farm.

1. INTRODUCTION AND OVERVIEW

The Gunite and Associated Tanks (GAAT) are located at the Oak Ridge National Laboratory (ORNL) in Waste Area Grouping (WAG) 1. The tanks and the associated structures and appurtenances were constructed between 1943 and 1951. The tanks were designed to contain radioactive and chemical wastes generated by ORNL operations. GAAT is designated as a Comprehensive Environmental Response, Compensation, and Liability Act site.

There are 12 Gunite tanks and four stainless-steel tanks (W-1A, W-13, W-14, and W-15) located in the GAAT Operable Unit (OU). The GAAT OU is situated in a high-traffic area in the middle of the ORNL site. The North Tank Farm (NTF) is composed of tanks W-1, W-1A, W-2, W-3, W-4. W-13, W-14, and W-15. The South Tank Farm (STF) is composed of tanks W-5, W-6, W-7, W-8, W-9, and W-10. Tank W-11 is located east of the STF. Tank TH-4 is located southwest of Building 3500.

1.1 OBJECTIVES

The objective of this report is to (1) support the GAAT treatability study (TS) and (2) provide input to the Record of Decision (ROD) for the remediation of selected tanks that are part of the NTF and STF. This report presents an evaluation of GAAT sampling and analysis data from various tanks in the NTF and the STF.

1.1.1 GAAT Phase II Major Questions

The key questions associated with the Data Quality Objectives (DQOs) identified for Phase II sampling and analysis (U.S. DOE 1995) are presented. Only Question 1 is examined in this report.

- Question 1. What is the spatial homogeneity or heterogeneity of key chemical and radionuclide concentrations in tanks suspected of significant curie loading?
- Question 2. What are the locations and the composition of sludge and debris in the tanks?
- Question 3. What is the integrity of the tank walls?
- Question 4. What is the extent of contamination in the tank walls?

1.1.2 Additional Areas of Evaluation

Additional areas of evaluations and their scope are presented as follows:

- Determine current values for tank volumes. Sludge and supernate volumes for all tanks are updated based on Phase II sludge mapping information.
- Determine curie loading for each tank. Using Phase I and Phase II data, in addition to 1988 sampling data, curie loadings for sludge and supernate are determined.
- Determine tanks that are transuranic (TRU) and non-TRU under DOE Order 5820.2A. Using Phase I and Phase II data, tanks are classified as TRU or non-TRU.

- Describe risk/transport drivers for tanks. Using Phase I and Phase II data, the beta/gamma radioisotopes in the sludge and supernate that significantly affect GAAT transport modeling are determined.
- Describe physical properties of tanks. The physical properties of the sludge and supernate are updated based on additional Phase II data.
- Determine which tanks exceed Resource Conservation and Recovery Act (RCRA) metals standards. Identification of which tanks exceed RCRA metals standards in the sludge and supernate are updated based on additional Phase II data.
- Describe concentrations of process metals for tanks. The concentrations of process metals in the sludge and supernate are updated based on additional Phase II data.
- Describe concentrations of anions for tanks. The concentrations of anions in the sludge and supernate are updated based on additional Phase II data.
- Describe concentrations of other chemicals and radioisotopes [e.g., alkaloids, polychlorinated biphenyls (PCBs), etc.] for tanks. The concentrations in the sludge and supernate are updated based on additional Phase II data.

1.2 SCOPE

The scope of this evaluation is to evaluate sludge and supernate radiological, inorganic, and wet chemistry sample data for the Gunite tanks W-1, W-2, W-3, W-4, W-5, W-6, W-7, W-8, W-9, W-10, W-11, and TH-4. Tank Group 1 (W-1, W-2, W-11); Tank Group 2 (W-3, W-4, W-5, W-6, TH-4); and Tank Group 3 (W-7, W-8, W-9, W-10) represent current operational grouping definitions of the GAAT. The programmatic decision was made in the GAAT TS not to collect samples from the stainless-steel tanks (W-1A, W-13, W-14, and W-15), and these tanks are not evaluated in this report.

Organic analyses were performed in addition to radiological, inorganic, and wet chemistry sample data for Tanks W-6, W-7, W-8, W-9, and W-10 sludges or supernates. Organic results were not evaluated as part of this report.

The Toxicity Characteristic Leaching Procedure (TCLP) was performed on sludges from samples W-3S309, W-4S306, W-6S311, W-7H303, and W-10S325. TCLP results were not evaluated as part of this report. Draft TCLP results are presented for GAAT RCRA metals.

The sludge diffusion coefficient, K_d, was not evaluated as part of this report.

Sample identification is presented in Table 1.1. Phase II GAAT sampling was performed during the May through August 1995 time frame (Energy Systems 1996) and followed the GAAT Phase II sampling and analysis plan (U.S. DOE 1995). Phase I GAAT sampling was performed during the August–November 1994 time frame (Energy Systems 1995) and followed the GAAT Phase I sampling and analysis plan (U.S. DOE 1994). Sampling in 1988 (U.S. DOE 1993) followed the inactive tank sampling and analysis plan (U.S. DOE 1988). All relevant information pertaining to sample locations, sampling methods, analytical methods, and associated error sources are contained in these references. Analytical methods were selected based upon existing methods for which minimum analytical error could be expected.

Sample locations and sampling methods were selected to ensure representative samples were collected. A schematic representation of sludge sample locations is presented in Fig. 1.1. Both 1988

and Phase I sludge samples were obtained using a Lexan Push Tube. Phase II samples were obtained using Lexan Push Tube, a Stainless Push Tube, or a Clamshell Grab sampler. Supernate samples for 1988 and Phase I were obtained using a Peristatic Pump from Phase I locations. No Phase II supernate samples were collected.

Table 1.1 Identification of samples evaluated

Tank	Phase II				Phase I			1988 [1]		
	Sludge	Hard Sludge	Super-nate	Gunite Wall	Sludge	Hard Sludge	Super-nate	Sludge	Hard Sludge	Super-nate
W-1							L201			L7 L7B L8
W-2							L202			L11 L118
W-3	S309 S310				S212		L203 L204	S19		L16 L17 L19
W-4	S306 S306				S216	H217	L205	S24	H26	L119 L22 L23
W-5	S314 S315			C316	S230		L218	S75		L73
W-6	S311 S312			C313	S221		L219 L220			L77 L78 L79
W-7	S302 S304	H301 H303A H303B H303C H303D			S228 S229			S84	H85	L82
W-8	S320 S321			C317	S224		L223	S88		L86 L87
W-9	S323 S324				S227		L222	S92		L90
W-10	S325 S326				S226		L225	S96	H120	L93 L94 L95
W-11							L206 L207		H5	L3 L114 L115
TH-4					S213 S214	H215	L208 L210	S58 S59		L55 L56 L57 L116 L117

[1] 1988 samples are combined with Phase I and Phase II samples to form the curie loading data base. This data based is used to compute curie loading only. See Chap. 4 and Appendix D.

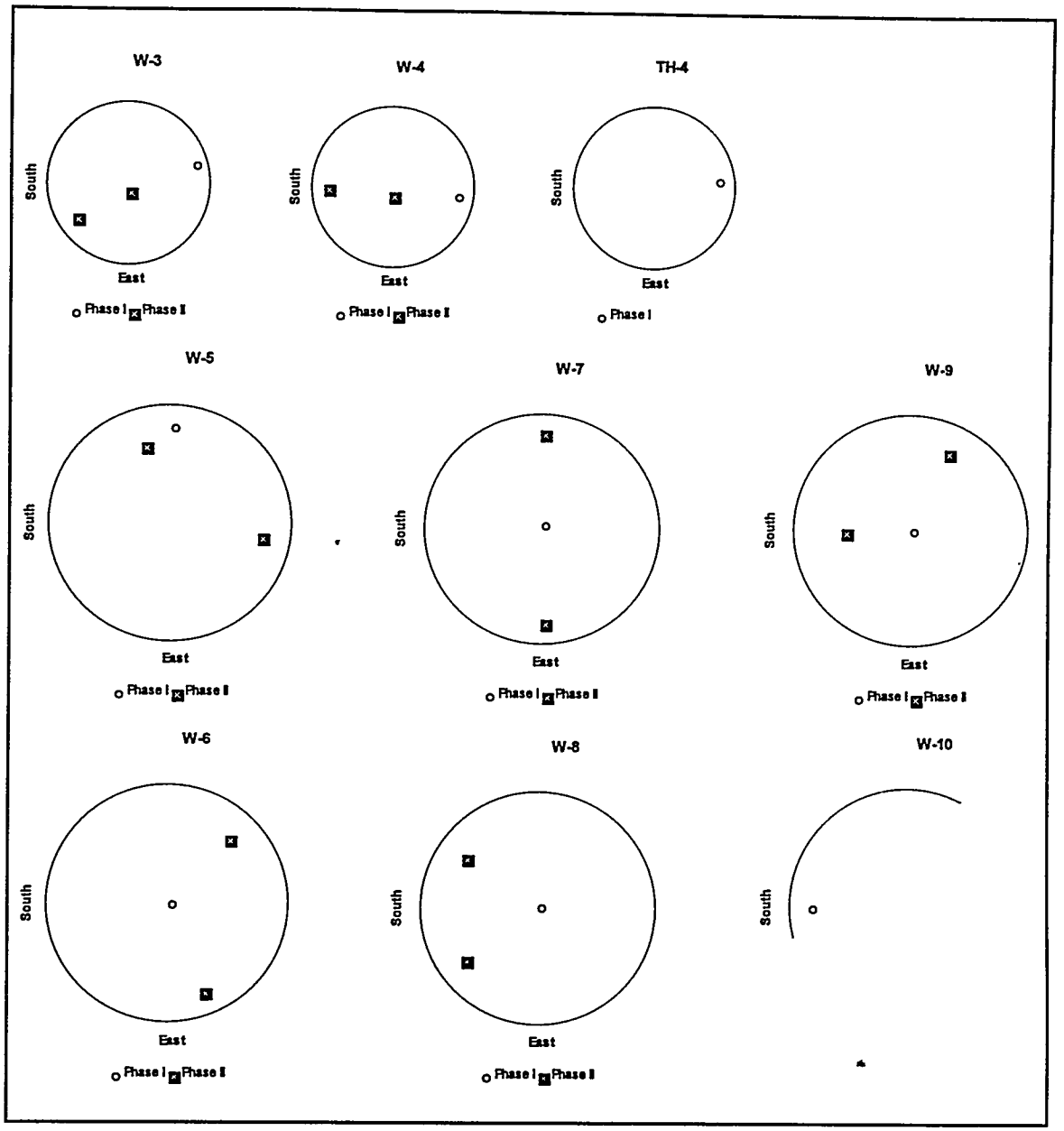

Fig. 1.1 Locations for Phase I and Phase II GAAT sludge samples.

1.3 OVERVIEW OF RESULTS

1.3.1 DQO Question 1. What is the spatial homogeneity or heterogeneity of key chemical and radionuclide concentrations in tanks suspected of significant curie loading?

The answer to this question requires three inputs: (1) an identification of the tanks suspected of significant curie loading, (2) an identification of key chemicals and radionuclides, and (3) an explanation and criteria for spatial homogeneity or heterogeneity. This information is used to identify the spatial homogeneity or heterogeneity of the key chemical and radionuclide concentrations in tanks suspected of significant curie loading.

- Input 1: Tanks contained in Tank Group 3 contains 96% of the expected (or most likely) curies in the sludge (13,420 Ci out of 14,019 Ci) and 90% of the expected curies in supernate (3,639 Ci out of 4,027 Ci) for all tank groups. Tanks suspected of significant sludge curie loading in Tank Group 3 are W-10 (6,536 Ci), W-8 (3,714 Ci), and W-7 (2,367 Ci). Tanks suspected of significant supernate curie loading in Tank Group 3 are W-8 (2,065 Ci) and W-10 (1,123 Ci). Tank W-6 in Tank Group 2 is suspected to contain 87% of the expected curies in sludge for Tank Group 2 (523 Ci out of 599 Ci) and 94% of the expected curies in supernate (364 Ci out of 388 Ci). Tank Group 1 accounts for 0% of the expected curies in the sludge and supernate. See Chap. 4 and Appendix D for details.

- Input 2: The key chemicals and radionuclides are (1) TRU radioisotopes (Np-237, Pu-238, Pu-239, Pu-240, Pu-242, Pu-244, Am-241, Am-242m, Am-243, Cm-243, Cm-246, Cm-247, Cm-248, Bk-247, Cf-249, Cf-251, and including the use of Pu-alpha measurements); (2) key risk and transport drivers (Sr-90 and Cs-137); (3) physical properties [total dissolved solids (TDS), total suspended solids (TSS), pH, moisture %, density, total carbon]; (4) RCRA metals (Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Se, Tl); (5) process metals (Al, B, Be, Ca, Co, Cu, Fe, K, Mg, Mn, Na, Sb, Si, Sr, Th, U, V, Zn); and (6) anions (Br, Cl, F, NO3, PO4, SO4). See Chaps. 5, 6, 7, 8, 9, and 10, and Appendices B and C for details.

- Input 3: Spatial homogeneity or heterogeneity is determined by the variability of average concentrations of the key chemicals and radionuclides. High variability indicates a heterogeneity in average concentrations, and low variability indicates a homogeneity in concentrations. The relative standard deviation (RSD) is a statistical measure for variability. The RSD is defined as the ratio of the standard deviation of a sample data set to the average obtained from the data set. The RSD is expressed as a percentage. Large RSD percentages (> 100%) indicate a heterogeneity in average concentrations, and low percentages (< 25%) indicate a homogeneity in average concentrations. For example, a heterogeneous average concentration of a radionuclide in sludge with an average of 1.00E+04 Bq/g and an RSD of 100% would indicate an upper 3-sigma value of 4.00E+04 Bq/g. Similarly, a heterogeneous average concentration of a radionuclide in sludge with an average of 1.00E+04 Bq/g and an RSD of 25% would indicate an upper 3-sigma value of 1.75 E+04 Bq/g. See Chaps. 5, 6, 7, 8, 9, and 10, and Appendices B and C for details.

The spatial heterogeneity of key chemical and radionuclide concentrations in tanks suspected of significant curie loading is presented in Table 1.2. If a chemical or radionuclide is presented in this table, the RSD is greater than 100%. For information purposes, the tanks with significant curie loading are presented. Note that since Tank Group 1 does not contribute to the curie loading, information for this tank group is not provided.

Note that all (1) sample locations and sampling methods were selected to ensure representative samples would be collected, and (2) analytical methods were selected to minimize analytical error. Statistics for spatial homogeneity or heterogeneity of key chemical and radionuclide concentrations are contained Appendices B and C. Details for curie loading are contained in Chap. 4 and Appendix D.

Table 1.2. Sludge spatial heterogeneity in tanks with significant curie loading

Tank ID	Chemical or Radionuclide	Heterogeneity Statistics Average Concentration and RSD	Significant Curie Loading Information
Tank Group 3			Most likely = 13,420 curies 96% of total sludge curies all Tank Groups
W-10			Most likely = 6,536 curies 59% of total sludge curies in Tank Group 3
	U-234	210.2 Bq/g, RSD = 106%	
	U-238	2.2 Bq/g, RSD = 105%	
W-8			Most likely = 3,714 curies 34% of total sludge curies in Tank Group 3
	Hg	184.23 mg/kg, RSD = 109%	
W-7			Most likely = 2,367 curies 21% of total sludge curies in Tank Group 3
	Ba in sludge	81.24 mg/kg, RSD = 108%	
	Cr in sludge layers	859 mg/kg, RSD = 114%	
	Ni in sludge layers	95.3 mg/kg, RSD = 123%	
	Pb in sludge layers	60.5 mg/kg, RSD = 106%	
	Fe in sludge layers	10,544 mg/kg, RSD = 131%	
	Mn in sludge layers	257.8 mg/kg, RSD = 121%	
	Sr-90 in sludge layers	6.9E+04 Bq/g, RSD = 102%	
	Cm-244 in sludge layers	287 Bq/g, RSD = 108%	
	Pu-240 in sludge layers	20.2 Bq/g, RSD = 117%	
	Pu-241 in sludge layers	98.6 Bq/g, RSD = 114%	
	Al in sludge Gunite chips	594 mg/kg, RSD = 137%	
	Sr-90 in sludge Gunite chips	5.9E+04 Bq/g, RSD = 98%	
Tank Group 2			Most likely = 599 curies 4% of total sludge curies all Tank Groups
W-6			Most likely = 523 curies 87% of total sludge curies in Tank Group 2
	Pb	3,480 mg/kg, RSD = 97%	
	Mg	1,459 mg/kg, RSD = 126%	
	U	39,287 mg/kg, RSD = 115%	

1.3.2 Current Values for Tank Volumes

Current values for tank sludge and supernate volumes are presented in Table 1.3. Data is from GAAT Phase I sampling and Phase II sludge mapping. Details for volumes are contained in Chap. 3.

Table 1.3 Sludge and supernate volume estimates

Tank	Capacity (gal)	Sludge Volume (gal)	Supernate Volume (gal)	Total Volume (gal)
W-1	4,800	0	2,926	2,926
W-2	4,800	0	1,995	1,995
W-3	42,500	628	15,688	16,316
W-4	42,500	1,313	29,754	31,067
W-5	170,000	3,422	27,964	31,386
W-6	170,000	7,037	41,479	48,516
W-7	170,000	8,812	3,565	12,377
W-8	170,000	10,309	64,581	74,890
W-9	170,000	2,861	45,616	48,477
W-10	170,000	9,298	105,860	115,158
W-11	1,500	0	722	722
TH-4	14,000	5,452	5,410	10,862
	Total	49,132	345,560	394,692

1.3.3 Curie Loadings for Tanks

The median and upper 95%-tile value for curie loadings in sludge and supernate are presented for all tanks in Table 1.4 and Table 1.5, respectively. For ease in discrimination of tanks and tank groups, the curie loadings are ordered by maximum to minimum median values. Data used for the curie loadings is from GAAT Phase I and Phase II, and from the 1988 data set. The minimum number of observations per tank for all radioisotopes used to compute the median and the upper 95%-tile curie values is one, and the maximum number of observations is per tank for all radioisotopes is five. Decay corrections for the 1988 data have not been included. Details for curie loading are contained in Chap. 4 and Appendix D.

Table 1.4. Sludge curie loading for all GAAT tanks ordered by tank groups

Sludge Tank	Tank Group	Median Ci(0.50)	95%-tile Ci(0.95)
W-10	3	6,536	18,764
W-8	3	3,714	4,386
W-7	3	2,367	3,461
W-9	3	803	950
W-6	2	523	861
W-4	2	32	89
W-5	2	24	40
W-3	2	16	37
TH-4	2	4	6
W-1	1	0	0
W-2	1	0	0
W-11	1	0	0

Table 1.5. Supernate curie loading for all GAAT tanks ordered by tank groups

Supernate Tank	Tank Group	Median Ci(0.50)	95%-tile Ci(0.95)
W-8	3	2,065	2,511
W-10	3	1,123	2,197
W-6	2	364	2,178
W-7	3	238	238
W-9	3	212	272
W-4	2	13	63
W-5	2	10	14
W-3	2	1	2
TH-4	2	0	0
W-1	1	0	0
W-2	1	0	0
W-11	1	0	0

1.3.4 Tanks that are TRU and Non-TRU Under DOE Order 5820.2A

Sludge in tanks as classified TRU and non-TRU under DOE Order 5820.2A as determined on a wet basis are presented in Table 1.6. The criteria for classification of GAAT tanks as TRU

is: if the concentration of TRU radioisotopes is greater than 100 nCi/g, the tank is classified as TRU; if not, the tank is classified as not TRU. Tanks that are considered TRU are: W-3, W-4, W-6, W-8, W-9, W-10.

Pu-alpha measurements and concentrations of TRU radioisotopes in sludge (Np-237, Pu-238, Pu-239, Pu-240, Pu-242, Pu-244, Am-241, Am-242m, Am-243, Cm-243, Cm-246, Cm-247, Cm-248, Bk-247, Cf-249, Cf-251) are used to determine if a tank in considered TRU or non-TRU. Pu-alpha measurements are used as a screening tool. These values are presented as the median (50%-tile) and the maximum observed value. If there is a conflict in the decision of the tank being TRU or non-TRU based on Pu-alpha values, the maximum cumulative value of TRU isotopics is used to determine if the tank is classified as TRU or non-TRU.

Using Pu-Alpha as a screening tool, the TRU conclusion differs for only Tanks W-3 and W-4. This is due to high variability observed between Phase I and Phase II sludge samples. Median and the Maximum nCi/g values are presented for comparative purposes to identify whether any difference in values can be attributed to Phase I or Phase II sampling and analysis. Such information is contained in the explanation portion of Table 1.6. Note that a "-" indicates no data or explanation is required. Details are contained in Chap. 5.

Table 1.6 Tanks that are TRU and non-TRU under DOE Order 5820.2A (determined by wet basis)

Tank Group	Tank	Pu-Alpha (nCi/g) Median	Pu-Alpha (nCi/g) Maximum	TRU Isotopes (nCi/g) Maximum (1)	Conclude TRU? Yes/No	Explanation	Min % Moisture
2	W-3	81	132	155	Yes	RSD > 80% for isotopics. Maximum in Phase I Samples	57.6
2	W-4	74	324	329	Yes	RSD > 100% for isotopics. Phase I samples < 100 nCi/g Phase II samples > 100 nCi/g	63.5
2	W-5	14	16	-	No	-	68.3
2	W-6	149	219	-	Yes	-	61.5
2	TH-4	2	2	-	No	-	34.5
3	W-7	59	89	-	No	-	57.7
3	W-8	219	246	-	Yes	-	78.6
3	W-9	324	676	-	Yes	-	82.8
3	W-10	297	432	-	Yes	-	61.1

(1) These include U-233 and Cm-244 values

1.3.5 Risk/Transport Drivers for Tanks

Beta/gamma emitters, particularly Sr-90 and Cs-137, are considered significant variables in the transport and human health and environmental risk modeling for GAAT. Summary statistics for Sr-90 and Cs-137 concentrations for individual tanks in Tank Group 2 and 3 are presented in Table 1.7. Details are contained in Chap. 6.

A graphical portrayal of the average Sr-90 and Cs-137 concentrations for each tank is presented in the stacked bar chart in Fig. 1.2. The way to read this figure is, for example, the average concentration of Cs-137 in W-10 sludge is 1.15E+06 Bq/g. The total average concentration of Sr-90 and Cs-137 in W-10 sludge is 4.52E+06 Bq/g. The average concentration of Sr-90 in W-10 sludge is the difference, namely 3.37E+06 Bq/g.

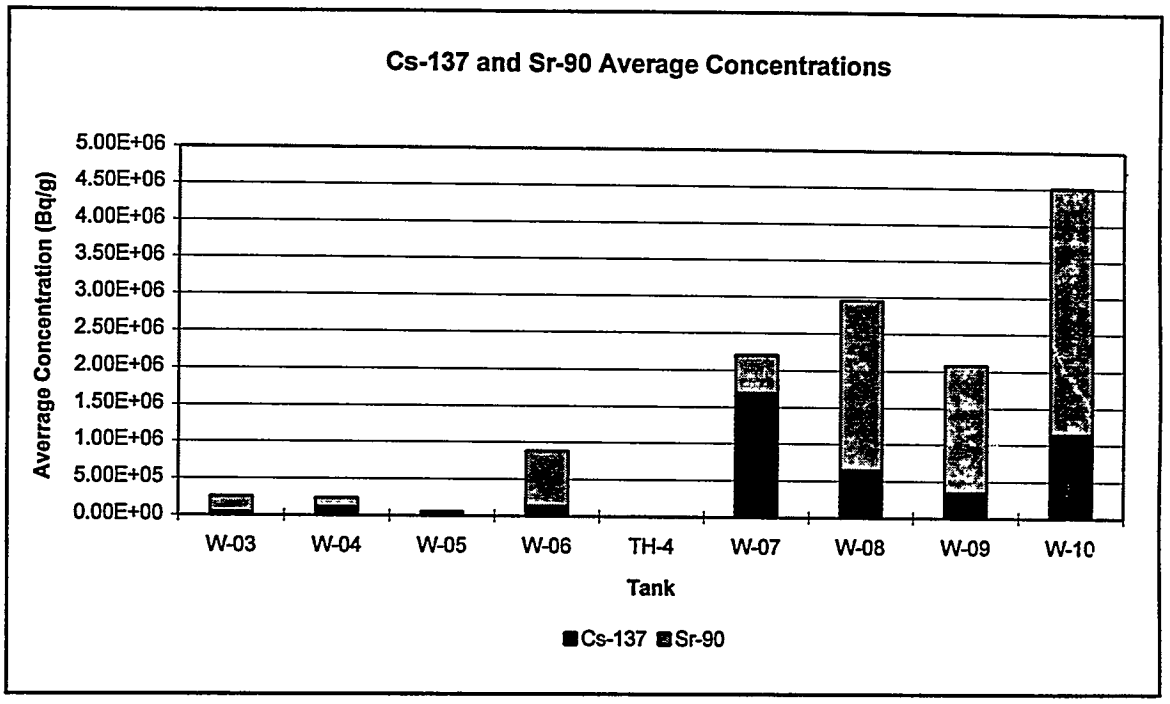

Fig. 1.2. Cs-137 and Sr-90 concentrations for sludge.

Several observations of the average concentrations and the spatial homogeneity or heterogeneity of the Sr-90 and Cs-137 concentrations are made:

- Tanks W-8, W-9, and W-10 indicate the largest average concentration of Sr-90 (> 1.73E+06 Bq/g).
- Tanks W-7 and W-10 indicate the largest average concentration of Cs-137 (> 1.15E+06 Bq/g).
- Tanks W-3 and W-4 exhibit the most heterogeneity for Sr-90 average concentration (RSD ~ 100%).
- Tank W-4 exhibits the most heterogeneity for Cs-137 average concentration (RSD > 100%).
- Tanks W-8 and W-9 exhibit the most homogeneity for Sr-90 average concentration (RSD < 25%).

- Tanks W-3, W-5, W-8, W-9, and TH-4 exhibit the most homogeneity for Cs-137 average concentration (RSD < 25%).

Table 1.7. Summary statistics for Sr-90 and Cs-137 concentrations in sludge

Tank	Tank		Sr-90 (Bq/g)		Cs-137 (Bq/g)	
ID	Group	N	Average	RSD	Average	RSD
W-3	2	3	2.13E+05	150%	4.53E+04	5%
W-4	2	4	1.22E+05	93%	1.21E+05	123%
W-5	2	3	3.97E+04	86%	1.93E+04	23%
W-6	2	3	7.47E+05	65%	1.40E+05	33%
TH-4	2	3	1.80E+03	53%	6.40E+02	3%
W-7	3	7	5.08E+05	79%	1.70E+06	47%
W-8	3	3	2.30E+06	24%	6.53E+05	20%
W-9	3	3	1.73E+06	3%	3.50E+05	10%
W-10	3	3	3.37E+06	35%	1.15E+06	42%

1.3.6 Physical Properties and Miscellaneous Data for Tanks

Supernate physical properties examined are TSS, TDS, density, pH, and total organic carbon (TOC). Sludge physical properties examined are % moisture, density, TOC, and pH. Medians of the physical properties in supernate for each tank group are presented in Table 1.8. TSS and TDS in Tank Group 2 exhibit high spatial variability, which is due to high values in TH-4 and W-6. Details are contained in Chap. 7. Medians of the physical properties in sludge for each tank group are presented in Table 1.9. The TOC RSD in Tank Group 2 is 97%, and it is due to high physical property concentrations in TH-4 and W-6. All other RSDs for Tank Group 2 and 3 are less than 75%.

Table 1.8. Summary of supernate physical properties for tank groups

Physical Property in Supernate	Tank Group 1 Median	Tank Group 2 Median	Tank Group 3 Median
TSS (mg/mL)	0.9	1.8	0.7
TDS (mg/mL)	0.2	9.6	11.0
Density (g/mL)	1.00	1.02	1.01
TOC (mg/L)	7.5	77.0	89.0
pH	8.30	9.60	9.85

NC = Not Calculated

Table 1.9. Summary of sludge physical properties for tank groups

Physical Property in Sludge	Tank Group 2 Median	Tank Group 3 Median
% Moisture (%)	69.7	72.8
Density (g/mL)	1.23	1.24
TOC (mg/L)	2,855.0	2,380.0
pH	10.50	9.90

NC = Not Calculated

1.3.7 Tanks Exceeding RCRA Metals Standards

Some GAAT supernate and sludge samples exceed RCRA criteria. The samples are derived obtained from Phase I and Phase II sampling. RCRA metals are Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Se, and Tl . RCRA metals that exceed RCRA standards for supernate are presented in Table 1.10. Table 1.11 presents information regarding sludge concentrations based upon the application of U.S. Environmental Protection Agency TOX.

In Tables 1.10 and 1.11, the criteria are contained in the table header for each RCRA metal. The tabular entries identify the number of samples upon which the statistics are based, the average, and the RSD. When there are two observations, the median and the average are equal. Blank entries indicate the RCRA metal criteria was not exceeded in the tank. Details are contained in Chap. 8.

Table 1.12 presents the results from TCLP criteria and the subsequent 20:1 dilution of metal contaminants in the leachate performed on the sludge metals (Giaquinto, Keller, and Mills 1996). Blank entries indicate the RCRA metal criteria was not exceeded in the tank.

Table 1.10. RCRA metals in GAAT supernates that exceed dilution-based RCRA standards

Tank	Statistic	Cr (5 mg/L)	Hg (0.2 mg/L)	Tl (0.9 mg/L)
W-3	N Average RSD	2 7.63 53%		
W-4	N Average RSD	1 6.95 0%		
W-8	N Average RSD	1 7.6 0%	1 0.328 0%	1 1.02 0%
W-9	N Average RSD			1 2.06 0%

Table 1.11. RCRA metals in GAAT sludges that exceed dilution-based RCRA standards

Tank	Statistic	Cr (100 mg/kg)	Hg (4 mg/kg)	Pb (100 mg/kg)
W-3	N Average RSD	3 336.0 34%	3 15.1 53%	
W-4	N Average RSD	4 228.3 29%	4 24.4 112%	
W-5	N Average RSD	3 1273.3 22%	3 103.6 29%	3 283.0 22%
W-6	N Average RSD	3 1363.3 31%	3 78.3 46%	3 3480.0 97%
W-7	N Average RSD	5 198.2 49%	5 150.8 43%	
W-8	N Average RSD	3 258.7 21%	3 184.2 109%	3 1370.0 14%
W-9	N Average RSD	3 119.7 8%	3 66.7 11%	3 496.0 3%
W-10	N Average RSD	3 169.0 27%	3 225.0 51%	3 699.7 32%
TH-4	N Average RSD	3 281.0 29%	3 7.4 15%	

Table 1.12. TCLP (1/g) results for RCRA metals in GAAT sludges

Tank	Cr (5 ppm)	Hg (0.2 ppm)	Pb (5 ppm)
W-3			None Leached
W-4		None Leached	None Leached
W-6		0.206 µg/ml Exceeds Std	None Leached
W-7		1.8 µg/ml Exceeds Std (1)	None Leached
W-10		0.402 µg/ml Exceeds Std	None Leached

(1) Exceeds standard when 20% error is incorporated into results

1.3.8 Concentrations of Process Metals for Tanks

Process metals exhibit a wide range of variability between and within tank groups. Tanks are identified in Table 1.13 for those tanks which have the maximum concentration for each process metal for sludge and supernate in each tank group. For example, W-7 exhibits the maximum concentration of boron (B) in sludge for Tank Group 3. Details are contained in Chap. 9.

Table 1.13. Identification of tanks with maximum values of process metals for tank groups

Tank Group	1	2	2	3	3
Metal	Supernate	Sludge	Supernate	Sludge	Supernate
Al	W-1	W-3	W-3	W-10	W-10
B	W-2	W-5	TH-4	W-7	W-8
Be	NC	W-4	NC	W-8	NC
Ca	W-1	W-6	TH-4	W-10	W-8
Co	NC	W-6	TH-4	W-10	W-9
Cu	W-1	W-6	W-5	W-7	W-9
Fe	W-1	W-6	TH-4	W-7	W-9
K	W-2	W-5	TH-4	W-7	W-9
Mg	W-2	W-6	TH-4	W-8	W-8
Mn	NC	W-5	TH-4	W-7	W-9
Na	W-2	W-6	TH-4	W-7	W-8
Sb	NC	W-5	NC	NC	NC
Si	W-1	W-6	TH-4	NC	NC
Sr	W-1	W-6	TH-4	W-10	W-8
Th	W-11	TH-4	TH-4	W-8	W-9
U	W-11	W-4	TH-4	W-7	W-9
V	NC	NC	NC	W-8	NC
Zn	NC	W-6	W-5	W-10	W-10

NC = Not Calculated

1.3.9 Concentrations of Anions for Tanks

Medians of the concentrations for water soluble anions in supernate for each tank group is presented in Table 1.14. In most cases, Tank Group 3 contains the maximum median values, and Tank Group 1 contains the minimum median values. Although the number of samples is limited, Tank Group 2 exhibits high spatial variability in anion concentration in supernate. This is due to high anion concentrations in TH-4 and W-6. The thick supernate levels in these tanks may also have contributed to these high RSDs. Details are contained in Chap. 10.

Table 1.14. Supernate anion median concentrations (mg/L) for Tank Groups 1, 2, and 3

Anion	Median Tank Group 1	Median Tank Group 2	Median Tank Group 3
Bromide	NC	NC	NC
Chloride	4.5	51.6	306.0
Fluoride	1.7	253.5	61.0
Nitrate	11.9	1,580.0	2,500.0
Phosphate	2.4	566.0	696.0
Sulphate	12.6	676.0	408.0

NC = Not Calculated

Medians of the concentrations for anions in sludge for each tank group is presented in Table 1.15. Excluding TH-4, W-6 represents the maximum anion concentration in Tank Group 2 sludge and drives the group spatial variability. Tank W-7 represents the maximum anion concentration in the Tank Group 3 sludge and drives spatial variability.

Table 1.15. Sludge anion median concentrations (mg/kg) for Tank Groups 2 and 3

Anion	Median Tank Group 2	Median Tank Group 3
Bromide	NC	9.5
Chloride	144	2,360
Fluoride	398	518
Nitrate	1,575	6,270
Phosphate	2,874	3,660
Sulphate	1,720	4,300

NC Not Calculated

1.3.10 Miscellaneous Information

Based on Phase I information, several tanks contain PCBs. These tanks are: W-3, W-4, W-5, W-6, TH-4, W-7, W-8, W-9, and W-10. PCB analysis was not performed on samples in Phase II.

There are a significant number of non-detects for Co-60, Cs-134, Eu-152, Eu-154, Eu-155, and Am-241 in samples from Tank Groups 2 and 3. No statistical tests were performed to examined whether the proportion of non-detects was more than would be expected by chance. However, inclusion of non-detects may serve to reduce the RSD for theses isotopes, which would, in term, lower upper 95%-tile concentration and curie values.

1.4 ORGANIZATION OF REPORT

The organization of this report is presented in Table 1.16. The section, topic, and the scope of the section is provided.

Table 1.16. Organization of report

Section	Topic	Scope
2	Technical Approach	General discussion of technical approach
3	GAAT Volumes	Determine tank volumes
4	Curie Loadings	Determine curie loading for each tank
5	TRU and non-TRU GAAT	Determine tanks that are TRU and non-TRU under DOE Order 5820.2A
6	Risk/Transport Drivers	Describe Risk/Transport drivers for tanks
7	Physical Properties Characterization	Describe Physical Properties of tanks
8	RCRA Metals Characterization	Determine which tanks exceed RCRA metals standards
9	Process Metals Characterization	Describe concentrations of process metals for tanks
10	Anion Characterization	Describe concentrations of Anions for tanks
11	Summary and Conclusions	Provide a summary of evaluation and associated conclusions

Appendix	Topic	Scope
A	DQOs for GAAT Phase II Sampling and Analysis	GAAT Phase II Sampling and Analysis DQOs
B	Sludge Data Base and Summary Statistics	Sludge data base used in evaluation
C	Supernate Data Base and Summary Statistics	Supernate data base used in evaluation
D	Technical Approach and Data Base for Curie Loadings	Approach and data base used to compute curie loading for all tanks
E	Statistical Methods	Discussion of statistical methods used

2. TECHNICAL APPROACH

2.1 INTRODUCTION

The technical approach employed for the evaluation of all sludge and supernate radiological, inorganic, or wet chemistry samples is summarized. Statistical methods are contained in Appendix E.

- Identify evaluation requirements to satisfy DQO questions
- Define data requirements for evaluations to be performed
- Identify measurement and estimation error sources
- Perform exploratory data analysis
- Compute summary statistics for GAAT TS Tank Groups 1, 2, and 3
- Provide graphical portrayals of information
- Determine probability functions that describe tank constituents

Various statistics are computed as part implementing the technical approach. The minimum and the maximum provide a measure of the range of the data. The 25%-tile and the 75%-tile indicate the region in which the central 50% of the data is contained. The median (50%-tile) and the average are measures of central tendency for the data. The RSD (the ratio of the standard deviation to the average) is expressed as a percentage. The RSD provides insight to the variability of the data. Comparisons of the data using parametric and non-parametric approaches is performed as required.

Additionally, probability density functions are determined for selected physical, chemical, or radiological constituents and tank samples. The purpose is to describe, in closed form, the probabilistic behavior of the data. Confidence intervals of the constituent averages can be computed from probability density functions.

2.2 DISCUSSION OF TECHNICAL APPROACH

The following evaluations are needed to satisfy DQO Question 1. "What is the spatial homogeneity or heterogeneity of key chemical and radionuclide concentrations in tanks suspected of significant curie loading?" DQO questions 2, 3, and 4 are not evaluated.

All other evaluations are presented in Table 2.1. For example, one evaluation is to determine the curie loading for each tank. The data requirements include concentrations of H-3, C-14, etc. The curie loading values are determined for sludge and supernate using GAAT Phase I data, GAAT Phase II data, and 1988 data. Note that each evaluation corresponds to a specific section of this report.

Measurement error is attributed to (1) the sample (x,y,z) location in each tank, (2) the sampling method used, (3) the analytical methods used to determine concentrations, and (4) inherent random error in the behavior of the chemical or radionuclide constituents. Total measurement error represents the total precision of the data, and it is expressed either by the RSD or the range (the difference between the maximum and the minimum) of the concentrations.

Estimation error is described by various summary statistics used to describe the data. Parametric estimation methods are the calculation of the mean, the standard deviation, and the RSD. The RSD is defined as the ratio of the standard deviation of a sample data set to the average obtained from the data set. Non-parametric estimation methods are the calculation the median (the 50%-tile) and the range. When appropriate assumptions are met, statistical tests can be employed. These include analysis of variance for parametric statistics and non-parametric tests of the median and the range.

Table 2.1. Evaluations to be performed and associated data requirements

Section	Evaluation	Data Requirements	Sludge	Supernate	Phase I Data	Phase II Data	1988 Data[1]
3	Determine tank volumes	Tank Volumes	x	x	x	x	
4	Determine Curie loading for each tank	Maximum Densities, Tank Volumes, H-3, C-14, Co-60, Cs-134, Cs-137/Ba-137m, Eu-152, Eu-154, Eu-155, Sr-90, Am-241, Cm-244, Th-232, Cf-252, Np-237, U-233, U-234, U-235, U-236, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, Pu-244	x	x	x	x	x
5	Determine tanks that are TRU and non-TRU under DOE Order 5820.2A	Pu-alpha and Np-237, Pu-238, Pu-239, Pu-240, Pu-242, Pu-244, Am-241, Am-242m, Am-243, Cm-243, Cm-246, Cm-247, Cm-248, Bk-247, Cf-249, Cf-251. (U-233 and Cm-244 are also included)	x	x	x	x	
6	Describe Risk/transport drivers for tanks	Sr-90, Cs-137	x	x	x	x	
7	Describe Physical Properties of tanks	Moisture %, Density, Total Carbon, pH	x	x	x	x	
8	Determine which tanks exceed RCRA metals standards	Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Se, Tl	x	x	x	x	
9	Describe concentrations of process metals for tanks	Al, B, Be, Ca, Co, Cu, Fe, K, Mg, Mn, Na, Sb, Si, Sr, Th, U, V, Zn	x	x	x	x	
10	Describe concentrations of Anions for tanks	Br, Cl, F, NO3, PO4, SO4	x	x	x	x	
11	Describe concentrations of miscellaneous chemicals and radioisotopes in tanks	Alkaloids, PCBs, various radioisotopes	x	x	x	x	

[1] 1988 Data is used for curie loading only

Sources for measurement and estimation error are presented in Table 2.2. Included in this table are relevant comments applicable to evaluation of the GAAT data.

Sources of measurement error are "confounded" with each other. This means that it is not statistically possible to determine if the reason for a change in a sample value between Phase I, Phase II, and 1988 sampling is due explicitly to the sample location, the sample method, or the analytical method. Confounding says we cannot "decouple" the combined measurement error effects of the sample location, the sample method, or the analytical method. Two key reasons for confounding are:

- Different sample methods were not used for samples from the same sample location (port, riser, and depth).
- Different analytical methods were not used for samples from the same location.

Cost of sampling and analysis is the key driver. There are three key sources of measurement error (sample location, sample method, and analytical method) associated with samples obtained from either GAAT sludge or supernate. If confounding were desired to be completely eliminated, a minimum of eight samples from the sludge and eight samples from the supernate per tank would have been required. Furthermore, if we wanted to compare Phase I and Phase II data with 1988 data, we would have to replicate the analytical methods used during 1995 and 1988 for each sample collected. This is prohibitive in cost, and, as such, the trade-off between cost and "confounding" occurred.

Table 2.2. Sources for measurement and estimation error

Error Type	Source	Discussion	Comment
Measurement Error Sample (x,y,z) location	Phase I	Selected depths from center riser port	Locations and depths were not the same between Phase I or Phase II or 1988 sampling
	Phase II	Selected depths from multiple riser ports	
	1988 data	Selected depths from center riser port	
Measurement Error Sampling method used	Phase I	Sludge tube	Sampling methods were not the same between Phase I or Phase II or 1988 sampling
	Phase II	Grab sample	
	1988 data	Sludge tube	
Measurement Error Analytical methods	Phase I	Same as Phase II	Analytical methods were similar between Phase I and Phase II but different than 1988 analytical methods
	Phase II	Same as Phase I	
	1988 data	Different than Phase I or II	
Estimation Error Inherent random error	Phase I	Unknown	No significant changes in tank contents expected
	Phase II	Unknown	
	1988 data	Unknown	

3. SLUDGE AND SUPERNATE VOLUMES

Sludge and supernate volumes are provided for all GAAT tanks. Sludge volumes are derived from both the Phase I sampling (Energy Systems 1995) and the Phase II sludge mapping (Bechtel 1995). Liquid volumes are current as of December 1995 (Holder and Emison 1995 Fax). Uncertainties associated with volumes are not considered. All volumes are expected values, and there is no attempt to account for measurement error. These values are presented in Table 3.1. Round off error is present for the percentages of sludge and supernate volume.

Table 3.1. Sludge and supernate volume estimates

Tank	Capacity (gal)	Sludge Volume (gal)	% Sludge Volume	Supernate Volume (gal)	% Supernate Volume	Total Volume (gal)
W-1	4,800	0	0%	2,926	1%	2,926
W-2	4,800	0	0%	1,995	1%	1,995
W-3	42,500	628	1%	15,688	5%	16,316
W-4	42,500	1,313	3%	29,754	9%	31,067
W-5	170,000	3,422	7%	27,964	8%	31,386
W-6	170,000	7,037	14%	41,479	12%	48,516
W-7	170,000	8,812	18%	3,565	1%	12,377
W-8	170,000	10,309	21%	64,581	19%	74,890
W-9	170,000	2,861	6%	45,616	13%	48,477
W-10	170,000	9,298	19%	105,860	31%	115,158
W-11	1,500	0	0%	722	0%	722
TH-4	14,000	5,452	11%	5,410	2%	10,862
	Total	49,132	100%	345,560	100%	394,692

Data sources for sludge and supernate volumes are contained in Table 3.2.

Table 3.2. Data sources for sludge and supernate volumes

Tank	Sludge Volume (gal)	Sampling Period (Data Source)	Supernate Volume (gal)	Sampling Period (Data Source)
W-1	0	Phase I (Energy Systems 1995)	2,926	Phase I (Energy Systems 1995)
W-2	0	Phase I (Energy Systems 1995)	1,995	Phase I (Energy Systems 1995)
W-3	628	Phase II sludge mapping (Bechtel 1995)	15,688	Holder and Emison 1995 Fax
W-4	1,313	Phase II sludge mapping (Bechtel 1995)	29,754	Holder and Emison 1995 Fax
W-5	3,422	Phase II sludge mapping (Bechtel 1995)	27,964	Phase I (Energy Systems 1995)
W-6	7,037	Phase II sludge mapping (Bechtel 1995)	41,479	Phase I (Energy Systems 1995)
W-7	8,812	Phase II sludge mapping (Bechtel 1995)	3,565	Phase I (Energy Systems 1995)
W-8	10,309	Phase II sludge mapping (Bechtel 1995)	64,581	Phase I (Energy Systems 1995)
W-9	2,861	Phase II sludge mapping (Bechtel 1995)	45,616	Phase I (Energy Systems 1995)
W-10	9,298	Phase II sludge mapping (Bechtel 1995)	105,860	Phase I (Energy Systems 1995)
W-11	0	Phase I (Energy Systems 1995)	722	Phase I (Energy Systems 1995)
TH-4	5,452	Phase I (Energy Systems 1995)	5,410	Phase I (Energy Systems 1995)

Tank W-6 has experienced transfer activity since October 1995, and W-8 has experienced transfer activity since September 1995 (Holder and Emison 1996). During September through October 1995, approximately 47,881 gallons of liquid low-level (radioactive) waste (LLLW) was transferred from W-8 to the active LLLW system, and approximately 50,035 gallons of LLLW was transferred from W-6 to the active LLLW system. Since Phase II GAAT sampling was performed prior to the transfers [during the May through August 1995 time frame (U.S. DOE 1995)], there is no reason to suspect that any Phase II samples were biased by transfer and mixing effects of the sludge and the supernate in W-6 or W-8. It is unknown what the transfer and mixing effects are in these two tanks for specific chemicals and radioisotopes. If tanks W-6 or W-8 are re-sampled in similar locations using identical Phase II sampling methods, this comparison can be made.

A comparison of maximum sludge depths and sludge sample depths is provided in Table 3.3. The intent of this comparison is to (1) indicate that refined maximum sludge depth estimates were obtained in Phase II and, hence, affected the volume calculations, and (2) illustrate that some Phase I and Phase II sludge sampling occurred within the 3 standard errors (0.30 ft) of measurement precision for the sludge layer estimates and some did not. Sludge sampling, therefore, was representative sampling for both Phase I and Phase II.

Table 3.3. Sludge depth and sample depths

Tank	Phase I Maximum Sludge Depth (ft)	Phase I Sludge Sample Depth (ft)	Phase II Sludge Net Maximum Depth (ft)	Phase I Sludge Sample Depth (ft)	Difference in Depth of Sludge Sample > 0.30?
W-3	0.37	< 0.37	0.20	~ 0.20	No
W-4	1.30	< 1.00	0.50	~ 0.50	Yes
W-5	0.10	< 0.10	0.40	~ 0.40	No
W-6	0.75	< 0.75	0.75	~ 0.75	No
W-7	0.67	< 0.67	0.67	~ 0.67	No
W-8	0.30	< 0.30	1.00	~ 1.00	Yes
W-9	0.10	< 0.10	0.20	~ 0.20	No
W-10	0.50	< 0.50	1.00	~ 1.00	Yes
TH-4	2.32	< 2.32	Not Sampled	Not Sampled	No Comparison

4. CURIE LOADINGS

4.1 INTRODUCTION

Curie loading for the sludge and the supernates in the tanks is determined. Individual isotope concentrations as reported from GAAT sampling and analysis are examined. Sampling and analysis data in GAAT Phase I (Energy Systems 1995), Phase II (U.S. DOE 1995), and 1988 sampling (U.S. DOE 1993) reports is used. A triangular probability density function is used to model concentrations of isotopes in each tank. The 10%-tile, the median (50%-tile), and the upper 95% confidence limit (the 95%-tile) concentration is computed for each isotope. Sludge and supernate volume and density are used to then compute the curie loading for the sludge and the supernates. Details are contained in Appendix D.

Tanks examined are: W-1, W-2, W-3, W-4, W-5, W-6, W-7, W-8, W-9, W-10, and TH-4. Tank Group 1 (W-1, W-2, W-11), Tank Group 2 (W-3, W-4, W-5, W-6, TH-4), and Tank Group 3 (W-7, W-8, W-9, W-10) represent current operational definitions of tank groups. Tanks W-1A, W-13, W-14, and W-15 are not examined due to lack of Phase I and Phase II data.

Table 4.1 summarize the curie loading for GAAT tanks and tank groups. Both the concentration values and the curie values are presented as the lower 10%-tile , the median (50%-tile), upper 95% tile values for sludge and supernate in the selected tanks. Table 4.2 summarize the relative percentages of the curie loadings by tanks within tank groups for all groups.

Table 4.3 summarizes median curie loading values for GAAT tanks and tank groups. The median curie loading is denoted as Ci(0.50).

Table 4.4 summarizes the upper 95%-tile curie loading values for GAAT tanks and tank groups. The median curie loading is denoted as Ci(0.50).

Appendix D contains (1) the technical approach used to compute curie loadings for sludge and supernate in the GAAT, (2) the curie loadings for all GAAT as based upon the technical approach, and (3) the data base used to compute the curie loadings, referred to as the Curie Loading Data Base. Note that the Curie Loading Data Base is used only for computation of curie loading and should not be compared to the GAAT Phase I and Phase II data base.

4.2 SUMMARY OF RESULTS

The following results are presented for individual tanks and between and within tank groups. Results are presented in terms of the maximum curie values, the relative percentages of the median and upper 95%-tile curie values, skewness of curie values, and actual median and upper 95%-tile curie values.

Maximum of Sludge Curie Loadings. (Table 4.1, Table 4.3, Table 4.4, and Appendix D)

- Tank W-10 exhibits the maximum median and upper 95%-tile sludge curie values in Tank Group 3 (6,356 and 18,764, respectively).

- Tank W-6 exhibits the maximum median and upper 95%-tile sludge curie values in Tank Group 2 (523 and 861, respectively). There is no sludge in tanks in Tank Group 1.

Maximum of Supernate Curie Loadings. (Table 4.1, Table 4.3, Table 4.4, and Appendix D)

- Tank W-8 exhibits the maximum median and upper 95%-tile supernate curie values in Tank Group 3 (2,065 and 2,511, respectively).
- Tank W-6 exhibits the maximum median and upper 95%-tile sludge curie values in Tank Group 2 (364 and 2,178, respectively).
- The maximum median and upper 95%-tile supernate curie values in Tank Group 1 is 0.

Relative Percentage of Median and Upper 95%-tile Total Curie Loadings. (Table 4.2)

- 95% of the total median sludge curies are contained in Tank Group 3.
- 91% of the upper 95%-tile total sludge curies are contained in Tank Group 3.
- 90% of the median supernate curies are contained in Tank Group 3. 70% of the upper 95%-tile supernate curies are contained in Group 3. The remaining 30% of the upper 95%-tile supernate curies are contained in Group 2.

Relative Percentage of Median and Upper 95%-tile Sludge Curie Loadings within Tank Groups. (Table 4.2)

- Tanks W-10, W-8, and W-7 contain 94% and 97% of the median and the upper 95%-tile sludge curies, respectively, in Tank Group 3.
- Tanks W-3 and W-4 contain 8% and 13% of the median and the upper 95%-tile sludge curies, respectively, in Tank Group 2.
- Tanks W-3, W-4, and W-6 contain 95% and 96% of the median and the upper 95%-tile sludge curies, respectively, in Tank Group 2.

Relative Percentage of Median and Upper 95%-tile Supernate Curie Loadings within Tank Groups. (Table 4.2)

- Tanks W-10 and W-8 contain 88% and 90%, respectively, of the median and the upper 95%-tile supernate curies in Tank Group 3.
- Tanks W-10, W-8, and W-7 (or Tanks W-10, W-8, and W-9) contain between 94% and 95% of the median and 95% the upper 95%-tile supernate curies, respectively, in Tank Group 3.
- Tanks W-3 and W-4 contain 3% of the median and 3% of the upper 95%-tile supernate curies, respectively, in Tank Group 2.
- Tanks W-6 contain 94% and 96% of the median and the upper 95%-tile supernate curies, respectively, in Tank Group 2.

Skewness of Sludge Curie Loadings. (Table 4.1 and Appendix D)

- Tank W-10 exhibits the greatest right skewness of sludge curie loading when comparing the median to the upper 95%-tile value. This is due to a high Cs-137 observation (1.1E+07 Bq/g) in the 1988 sludge data set. If this value is removed from the curie calculation, the lower 10%-tile value, the median value, and the upper 95%-tile value change to 3,895, 5,746, and 10,311, respectively.

Skewness of Supernate Curie Loadings. (Table 4.1 and Appendix D)

- Tank W-6 exhibits large right skewness of supernate curie loading when comparing the median to the upper 95%-tile. This is due to high Cs-137 observations (2.0E+04 Bq/g) in the 1988 sludge data set. If this value for W-6 is removed from the curie calculation, the lower 10%-tile value, the median value, and the upper 95%-tile value change to 321, 711, and 2,209 curies, respectively. This tightens the left side of the distribution, increases the median from 364 Ci to 711 Ci, and extends the upper 95%-tile by approximately 1.5%.
- Tank W-8 exhibits large right skewness of supernate curie loading when comparing the median to the upper 95%-tile. This is due to a Phase I Cs-137 sample. No sensitivity was performed by eliminating this value.

Sludge Median Curie Loading Between Tank Groups. (Table 4.1, Table 4.3, and Appendix D)

- There is a consistent ordering for the sludge median curies per tank between the tank groupings as currently defined, namely the median curies per tank in Tank Group 3 is greater than the median curies per tank in Tank Group 2.
- Sludge median curies per tank for Tank Group 3 are greater than Tank Group 2. Sludge median curies per tank for Tank Group 2 are greater than Tank Group 1.
- Tank Group 2 tank W-6 sludge median curies (523 Ci) are only 35% less than the minimum sludge median curies in Tank Group 3 tank W-9 (803 Ci).

Supernate Median Curie Loading Between Tank Groups. (Table 4.1, Table 4.3, and Appendix D)

- The supernate median curies per tank does not follow a consistent ordering between the tank groupings as currently defined, namely the median curies per tank in Tank Group 3 is sometimes greater and sometimes less than the median curies per tank in Tank Group 2.
- Tank Group 2 tank W-6 supernate median curies (364 Ci) contains at least 50% more curies as Tank Group 3 tanks W-7 supernate median curies (238 Ci) and W-9 supernate median curies (212 Ci).

Sludge Median Curie Loading Within Tank Groups. (Table 4.1, Table 4.3, and Appendix D)

- There is a consistent ordering for the sludge median curies per tank within the tank groupings as currently defined, namely the median curies per tank in Tank Group 3 is greater than the median curies per tank in Tank Group 2.
- Tank Group 2 tank W-6 sludge median curies (523 Ci) are 5x greater than the next largest sludge median curies in Tank Group 2 (W-4, 32 Ci).

Supernate Median Curie Loading Within Tank Groups. (Table 4.1, Table 4.3, and Appendix D)

- The supernate median curies per tank does not follow a consistent ordering within the tank groupings as currently defined, namely the median curies per tank in Tank Group 3 is sometimes greater and sometimes less than the median curies per tank in Tank Group 2.
- Tank Group 3 tank W-10 supernate median curies (1,123 Ci) are over 4x greater than the next largest supernate median curies in Tank Group 3 (W-7, 238 Ci).
- Tank Group 2 tank W-6 supernate median curies (364 Ci) are over 25x greater than the next largest supernate median curies in Tank Group 2 (W-4, 13 Ci).

Sludge Upper 95%-tile Curie Loading Between Tank Groups. (Table 4.1, Table 4.4, and Appendix D)

- There is a consistent ordering for the sludge Upper 95%-tile curies per tank between the tank groupings as currently defined, namely the median curies per tank in Tank Group 3 is greater than the median curies per tank in Tank Group 2.
- Sludge Upper 95%-tile curies per tank for Tank Group 3 are greater than Tank Group 2. Sludge Upper 95%-tile curies per tank for Tank Group 2 are greater than Tank Group 1.
- W-6 sludge Upper 95%-tile curies (861 Ci) are only 9% less than the minimum sludge Upper 95%-tile curies in Tank Group 3 (W-9, 950 Ci).

Supernate Upper 95%-tile Curie Loading Between Tank Groups. (Table 4.1, Table 4.4, and Appendix D)

- The supernate Upper 95%-tile curies per tank does not follow a consistent ordering between the tank groupings as currently defined, namely the median curies per tank in Tank Group 3 is sometimes greater and sometime less than the median curies per tank in Tank Group 2.
- Tank Group 2 tank W-6 supernate (2,178 Ci) contains almost 10x more curies as Tank Group 3 tank W-9 supernate (272 Ci).

Sludge Upper 95%-tile Curie Loading Within Tank Groups. (Table 4.1, Table 4.4, and Appendix D)

- There is a consistent ordering for the sludge Upper 95%-tile curies per tank within the tank groupings as currently defined, namely the median curies per tank in Tank Group 3 is greater than the median curies per tank in Tank Group 2.
- W-7 sludge Upper 95%-tile curies (3,461 Ci) are over 3.5x greater than the next largest sludge Upper 95%-tile curies in Tank Group 3 (W-9, 950 Ci).
- W-6 sludge Upper 95%-tile curies (861 Ci) are almost 10x greater than the next largest sludge Upper 95%-tile curies in Tank Group 2 (W-4, 89 Ci).

Supernate Upper 95%-tile Curie Loading Within Tank Groups. (Table 4.1, Table 4.4, and Appendix D)

- The supernate Upper 95%-tile curies per tank does not follow a consistent ordering within the tank groupings as currently defined, namely the median curies per tank in Tank Group 3 is sometimes greater and sometimes less than the median curies per tank in Tank Group 2.
- W-10 supernate Upper 95%-tile curies (2,197 Ci) are 8x greater than the next largest supernate Upper 95%-tile curies in Tank Group 3 (W-9, 272 Ci).
- W-6 supernate Upper 95%-tile curies (2,178 Ci) are over 35x greater than the next largest supernate Upper 95%-tile curies in Tank Group 2 (W-4, 63 Ci).

Table 4.1. Curie loading for GAAT tanks

Tank	Waste Form	Vol (gal)	Max Density (g/cc, g/mL)	Conc (Bq/g, Bq/mL)			Curies (Ci)		
				0.10	0.50	0.95	0.10	0.50	0.95
W-1	Sludge	0	0.000	0.00E+00	0.00E+00	0.00E+00	0	0	0
	Supernate	2,926	1.002	1.94E+02	2.00E+02	2.04E+02	0	0	0
W-2	Sludge	0	0.000	0.00E+00	0.00E+00	0.00E+00	0	0	0
	Supernate	1,995	1.000	2.08E+02	2.12E+02	2.16E+02	0	0	0
W-11	Sludge	0	0.00	0.00E+00	0.00E+00	0.00E+00	0	0	0
	Supernate	722	1.00	1.36E+01	2.28E+01	8.31E+01	0	0	0
Group 1	Sludge	0		0.00E+00	0.00E+00	0.00E+00	0	0	0
	Supernate	5,643		4.16E+02	4.35E+02	5.03E+02	0	0	0
	Total	5,643		4.16E+02	4.35E+02	5.03E+02	0	0	0
W-3	Sludge	628	1.070	1.49E+05	2.36E+05	5.42E+05	10	16	37
	Supernate	15,688	1.006	6.72E+02	9.08E+02	1.25E+03	1	1	2
W-4	Sludge	1,313	1.275	1.10E+05	1.87E+05	5.20E+05	19	32	89
	Supernate	29,754	1.008	2.43E+03	4.19E+03	2.06E+04	7	13	63
W-5	Sludge	3,422	1.165	4.53E+04	5.95E+04	9.74E+04	18	24	40
	Supernate	27,964	1.013	2.14E+03	3.40E+03	4.95E+03	6	10	14
W-6	Sludge	7,037	1.190	4.32E+05	6.11E+05	1.01E+06	370	523	861
	Supernate	41,479	1.020	3.83E+04	8.41E+04	5.03E+05	166	364	2,178
TH-4	Sludge	5,452	1.07	4.05E+03	6.10E+03	9.50E+03	2	4	6
	Supernate	5,410	1.06	1.93E+02	3.13E+02	4.91E+02	0	0	0
Group 2	Sludge	17,852		7.41E+05	1.10E+06	2.17E+06	420	599	1,033
	Supernate	120,295		4.37E+04	9.29E+04	5.30E+05	180	388	2,258
	Total	138,147		7.85E+05	1.19E+06	2.70E+06	601	988	3,291

Table 4.1 cont.

Tank	Waste Form	Vol (gal)	Max Density (g/cc, g/mL)	Conc (Bq/g, Bq/mL)			Curies (Ci)		
				0.10	0.50	0.95	0.10	0.50	0.95
W-7	Sludge	8,812	1.350	1.45E+06	1.95E+06	2.84E+06	1,762	2,367	3,461
	Supernate	3,565	1.020	6.41E+05	6.41E+05	6.41E+05	238	238	238
W-8	Sludge	10,309	1.190	2.36E+06	2.96E+06	3.49E+06	2,963	3,714	4,386
	Supernate	64,581	1.015	2.27E+05	3.08E+05	3.74E+05	1,519	2,065	2,511
W-9	Sludge	2,861	1.250	1.99E+06	2.20E+06	2.60E+06	728	803	950
	Supernate	45,616	1.011	3.47E+04	4.50E+04	5.77E+04	164	212	272
W-10	Sludge	9,298	1.230	3.63E+06	5.59E+06	1.60E+07	4,249	6,536	18,764
	Supernate	105,860	1.013	6.31E+04	1.02E+05	2.00E+05	692	1,123	2,197
Group 3	Sludge	31,280		9.43E+06	1.27E+07	2.50E+07	9,701	13,420	27,562
	Supernate	219,622		9.65E+05	1.10E+06	1.27E+06	2,614	3,639	5,219
	Total	250,902		1.04E+07	1.38E+07	2.62E+07	12,315	17,059	32,780
Total	Sludge	49,132		1.02E+07	1.38E+07	2.71E+07	10,122	14,019	28,595
	Supernate	345,560		1.01E+06	1.19E+06	1.80E+06	2,794	4,027	7,476
	Total	394,692		1.12E+07	1.50E+07	2.90E+07	12,916	18,047	36,071

Table 4.2. Curie loading for GAAT tanks - relative percentages

Tank	Waste Form	Vol (gal)	Max Density (g/cc, g/mL)	Conc (Bq/g, Bq/mL)			Curies (Ci)		
				0.10	0.50	0.95	0.10	0.50	0.95
W-1	Sludge	0%		0%	0%	0%	0%	0%	0%
	Supernate	52%		47%	46%	41%	57%	57%	55%
W-2	Sludge	0%		0%	0%	0%	0%	0%	0%
	Supernate	35%		50%	49%	43%	42%	41%	39%
W-11	Sludge	0%		0%	0%	0%	0%	0%	0%
	Supernate	13%		3%	5%	17%	1%	2%	5%
Group 1	Sludge	0%		0%	0%	0%	0%	0%	0%
	Supernate	2%		0%	0%	0%	0%	0%	0%

Table 4.2 cont.

		Vol (gal)	Max Density (g/cc, g/mL)	Conc (Bq/g, Bq/mL)			Curies (Ci)		
				0.10	0.50	0.95	0.10	0.50	0.95
W-3	Sludge	4%		20%	21%	25%	2%	3%	4%
	Supernate	13%		2%	1%	0%	1%	0%	0%
W-4	Sludge	7%		15%	17%	24%	4%	5%	9%
	Supernate	25%		6%	5%	4%	4%	3%	3%
W-5	Sludge	19%		6%	5%	4%	4%	4%	4%
	Supernate	23%		5%	4%	1%	3%	3%	1%
W-6	Sludge	39%		58%	56%	46%	88%	87%	83%
	Supernate	34%		88%	91%	95%	92%	94%	96%
TH-4	Sludge	31%		1%	1%	0%	1%	1%	1%
	Supernate	4%		0%	0%	0%	0%	0%	0%
Group 2	Sludge	36%		7%	8%	8%	4%	4%	4%
	Supernate	35%		4%	8%	29%	6%	10%	30%
	Total	35%		7%	8%	9%	5%	5%	9%
W-7	Sludge	28%		15%	15%	11%	18%	18%	13%
	Supernate	2%		66%	58%	50%	9%	7%	5%
W-8	Sludge	33%		25%	23%	14%	31%	28%	16%
	Supernate	29%		23%	28%	29%	58%	57%	48%
W-9	Sludge	9%		21%	17%	10%	8%	6%	3%
	Supernate	21%		4%	4%	5%	6%	6%	5%
W-10	Sludge	30%		39%	44%	64%	44%	49%	68%
	Supernate	48%		7%	9%	16%	26%	31%	42%
Group 3	Sludge	64%		93%	92%	92%	96%	96%	96%
	Supernate	64%		96%	92%	71%	94%	90%	70%
	Total	64%		93%	92%	91%	95%	95%	91%
Total	Sludge	100%		100%	100%	100%	100%	100%	100%
	Supernate	100%		100%	100%	100%	100%	100%	100%
	Total	100%		100%	100%	100%	100%	100%	100%

Table 4.3. Median curie loading for all GAAT tanks ordered by tank groups

Sludge Tank	Tank Group	Median Ci(0.50)
W-10	3	6,536
W-8	3	3,714
W-7	3	2,367
W-9	3	803
W-6	2	523
W-4	2	32
W-5	2	24
W-3	2	16
TH-4	2	4
W-1	1	0
W-2	1	0
W-11	1	0

Supernate Tank	Tank Group	Median Ci(0.50)
W-8	3	2,065
W-10	3	1,123
W-6	2	364
W-7	3	238
W-9	3	212
W-4	2	13
W-5	2	10
W-3	2	1
TH-4	2	0
W-1	1	0
W-2	1	0
W-11	1	0

Table 4.4. Upper 95%-tile curie loading for all GAAT tanks ordered by tank groups

Sludge Tank	Tank Group	95%-tile Ci(0.95)
W-10	3	18,764
W-8	3	4,386
W-7	3	3,461
W-9	3	950
W-6	2	861
W-4	2	89
W-5	2	40
W-3	2	37
TH-4	2	6
W-1	1	0
W-2	1	0
W-11	1	0

Supernate Tank	Tank Group	95%-tile Ci(0.95)
W-8	3	2,511
W-10	3	2,197
W-6	2	2,178
W-9	3	272
W-7	3	238
W-4	2	63
W-5	2	14
W-3	2	2
TH-4	2	0
W-1	1	0
W-2	1	0
W-11	1	0

5. TRU IDENTIFICATION

5.1 INTRODUCTION

Tanks are identified as TRU waste and non-TRU under DOE Order 5820.2A. The definition of TRU waste as found in Attachment 2 of the Order states: "Without regard to source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay."

DOE has given the Heads of Field Elements the freedom to further define alpha-emitting wastes and thus their site-specific handling as TRU wastes (ref. DOE order 5820.2A). For ORNL, in addition to the above definition, alpha-emitting isotopes of U, Cm, and Cf (i.e. U-233, Cm-244, or Cf-252) are included in the 100 ηCi/g alpha emitter limit at the time of assay for on-site disposal acceptance and classification.

TRU determination is based upon both individual isotope concentrations and Pu-alpha values as reported from GAAT Sampling and analysis data in GAAT Phase I (Energy Systems 1995) and Phase II (U.S. DOE 1995). Pu-alpha is a rapid estimation technique to determine if a tank is TRU or not. If Pu-alpha indicates a tank is TRU, this will always be confirmed by the isotopics. TRU isotopics (Np-237, Pu-238, Pu-239, Pu-240, Pu-242, Pu-244, Am-241, Am-242m, Am-243, Cm-243, Cm-246, Cm-247, Cm-248, Bk-247, Cf-249, Cf-251, U-233, and Cm-244) are used to affirm TRU identification when TRU values are close to 100 nCi/g.

Sludges in Tank Groups 2 and 3 are examined. Tank Group 2 (W-3, W-4, W-5, W-6, TH-4) and Tank Group 3 (W-7, W-8, W-9, W-10) represent current operational definitions of tank groups.

5.2 SUMMARY OF RESULTS

Table 5.1 summarize the TRU values (based on Pu-alpha values measured on a wet basis) for all tanks by tank groups. The median and the maximum Pu-alpha values are provided for all tanks. When these values result in differing conclusions that a tank is TRU or non-TRU, the maximum TRU value as computed by the TRU isotopics is presented. Note that the TRU conclusion differs for only Tanks W-3 and W-4. (The TRU values are not portrayed in a statistical or probabilistic manner; however, the median and the maximum nCi/g values are presented for comparative purposes to identify whether any difference in values can be attributed to Phase I or Phase II sampling and analysis.) This type of information is contained in the explanation portion of Table 5.1. Note that a "-" indicates no data or explanation is required.

Table 5.1. Identification of TRU or non-TRU sludges in tanks (wet basis)

Tank Group	Tank	TRU	Pu-Alpha (nCi/g) Median	Pu-Alpha (nCi/g) Maximum	TRU Isotopes (nCi/g) Maximum (1)	Explanation	Min % Moisture
2	W-3	Yes	81	132	155	RSD > 80% for isotopics. Maximum in Phase I Samples	57.6
	W-4	Yes	74	324	329	RSD > 100% for isotopics. Phase I samples < 100 nCi/g Phase II samples > 100 nCi/g	63.5
	W-5	No	14	16	-	-	68.3
	W-6	Yes	149	219	-	-	61.5
	TH-4	No	2	2	-	-	34.5
3	W-7	No	59	89	-	-	57.7
	W-8	Yes	219	246	-	-	78.6
	W-9	Yes	324	676	-	-	82.8
	W-10	Yes	297	432	-	-	61.1

(1) These include U-233 and Cm-244 values

5.3 GROUT REQUIREMENTS FOR TRU REDUCTION

Grout requirements for TRU reduction are identified. A deterministic linear model is used to estimate the volume of grout to add to the tanks to reduce the TRU concentration to 100 nCi/g or less.

5.3.1 Approach

A deterministic model is used to compute the volume of grout to add to a tank to reduce the TRU concentration to 100 nCi/g or less:

$$V_g = \left(\frac{C_s}{C_{TRU}} \right) V_s - V_s = \left(\frac{C_s}{C_{TRU}} - 1 \right) V_s$$

where

V_g = Volume of grout to add [gal]
V_s = Volume of waste in a tank [gal]
C_s = Concentration of waste in a tank [nCi/g)]
C_{TRU} = TRU threshold (equal to 100nCi/g)

The value $[(C_s / C_{TRU}) - 1]$ represents the marginal contribution of the concentration of waste in a tank normalized by the TRU criteria. If the value is less than or equal to 0, namely a tank in which $C_s \leq 100$nCi/g, then the volume of grout to add is zero since the concentration of waste in a tank meets the minimum TRU criteria. If the value is greater than 0, the tank volume is weighted by this amount to prescribe the amount of grout to add to the tank to reduce the concentration of waste so that it meets the minimum TRU criteria.

This approach does not consider (1) differences in density between the sludge and the grout, and (2) any process specific requirements that would affect the grout volumes required. As such, the model provides an envelope for consideration of the volume of grout required to reduce TRU to less than 100 nCi/, and refinements should be pursued.

5.3.2 Results

Tables 5.2 and 5.3 present the expected volume of grout to add to tanks in Tank Group 2 and 3, respectively, to reduce TRU to less than 100 nCi/g. For information purposes, the total volume and the volume of sludge in each tank is provided.

Two measurement bases are provided: wet and dry. Each basis assumes the minimum moisture content for each tank. The transformation is:

$$C_{Dry} = \left(\frac{1}{1 - W_{Wet}} \right) C_{Wet}$$

where W_{Wet} represents the wet moisture content (%) and C represents the concentration (nCi/g).

The volume of grout to add (measured in gallons) is then computed for each basis for the median and the maximum Pu-alpha concentration (measured in nCi/g). This information provides an envelope for consideration of the volume of grout required to reduce TRU to less than 100 nCi/g.

For example, under a wet basis, W-7 is not considered a TRU tank, but using a dry basis, it is. If the dry basis reflects TRU reality, then the volume of grout to add to W-7 to reduce the concentration to less than 100 nCi/g is between 3,575 gal and 9,768 gal. Note that these values are expected values and do not incorporate the underlying variability (RSD) of the Pu-alpha concentrations. This means that two standard deviations could be as large as, say, 2 x 9,768 x RSD(%).

Table 5.2. Expected volume of grout to add to tanks in Tank Group 2 to reduce TRU < 100 nCi/g

Tank	W-3	W-4	W-5	W-6	TH-4
Tank Volume (gal)	42,500	42,500	170,000	170,000	14,000
V(Sludge) (gal)	628	1,313	3,422	7,037	5,452
WET BASIS					
MINIMUM % Water	57.6	63.5	68.3	61.5	34.5
MEDIAN C(Sludge) (nCi/g)	81	74	14	149	2
V(Grout to Add) (gal)	No Add	No Add	No Add	3,423	No Add
MAXIMUM C(Sludge) (nCi/g)	132	324	16	219	2
V(Grout to Add) (gal)	204	2,945	No Add	8,368	No Add
DRY BASIS					
MINIMUM % Water	42.4	36.5	31.7	38.5	65.5
MEDIAN C(Sludge) (nCi/g)	191	204	43	396	3
V(Grout to Add) (gal)	573	1,366	No Add	20,857	No Add
MAXIMUM C(Sludge) (nCi/g)	312	889	49	584	3
V(Grout to Add) (gal)	1,333	10,354	No Add	34,044	No Add

Table 5.3. Expected volume of grout to add to tanks in Tank Group 3 to reduce TRU < 100 nCi/g

Tank	W-7	W-8	W-9	W-10
Tank Volume (gal)	170,000	170,000	170,000	170,000
V(Sludge) (gal)	8,812	10,309	2,861	9,298
WET BASIS				
MINIMUM % Water	57.7	78.6	82.8	61.1
MEDIAN C(Sludge) (nCi/g)	59	219	324	297
V(Grout to Add) (gal)	No Add	12,259	6,418	18,345
MAXIMUM C(Sludge) (nCi/g)	89	246	676	432
V(Grout to Add) (gal)	No Add	15,046	16,470	30,910
DRY BASIS				
MINIMUM % Water	42.3	21.4	17.2	38.9
MEDIAN C(Sludge) (nCi/g)	141	1,023	1,886	764
V(Grout to Add) (gal)	3,575	95,151	51,086	61,763
MAXIMUM C(Sludge) (nCi/g)	211	1,149	3,928	1,112
V(Grout to Add) (gal)	9,768	108,170	109,529	94,063

6. BETA-GAMMA RISK/TRANSPORT DRIVERS

6.1 INTRODUCTION

Beta/gamma emitters, particularly Sr-90 and Cs-137, are considered significant variables in the transport and human health and environmental risk modeling for the GAAT. The statistical behavior of average concentration values for Sr-90 and Cs-137 in sludge are discussed in this section. Closed form statistical representations of Sr-90 and Cs-137 concentrations can also support effectiveness evaluation of GAAT sludge removal systems.

Concentration values for beta/gamma emitters are based upon values as reported from GAAT Phase I (Energy Systems 1995) and Phase II (U.S. DOE 1995) sampling and analysis data. Only sludges in Tank Groups 2 and 3 are examined. Tank Group 2 (W-3, W-4, W-5, W-6, TH-4) and Tank Group 3 (W-7, W-8, W-9, W-10) represent current operational definitions of tank groups.

6.2 SUMMARY OF RESULTS

6.2.1 Sr-90 and Cs-137 Average Concentrations Fit to an Exponential Probability Distribution

Sr-90 and Cs-137 concentrations account for 19% to 65% of all gross beta values for Tank Group 2, and the same isotopes account for 50% to 85% of all gross beta values for Tank Group 3. When TH-4 is omitted from Tank Group 2, Sr-90 and Cs-137 concentrations account for 25% to 65% of all gross beta values.

However, Sr-90 and Cs-137 account for over 80% of all curie values for each tank in either Tank Group 2 or Tank Group 3. This clearly implies that Sr-90 and Cs-137 are key risk drivers in beta-gamma emitters.

Summary statistics for Sr-90 and Cs-137 concentrations for individual tanks in Tank Groups 2 and 3 are presented in Table 6.1. The same data is sorted by either Sr-90 or Cs-137 concentrations as indicated in Tables 6.2 and 6.3, respectively. A graphical portrayal of the average Sr-90 and Cs-137 concentrations for each tank is presented in the stacked bar chart in Fig. 6.1. The way to read this figure is, for example, the average concentration of Cs-137 in W-10 sludge is 1.15E+06 Bq/g, and the total average concentration of Sr-90 and Cs-137 in W-10 sludge is 4.52E+06 Bq/g. The average concentration of Sr-90 in W-10 sludge is the difference, namely, 3.37E+06 Bq/g.

Using this information, several observations of the average concentrations and the spatial homogeneity or heterogeneity of the concentrations are made:

- Tanks W-8, W-9, and W-10 indicate the largest average concentration of Sr-90 in sludge (> 1.73E+06 Bq/g)
- Tanks W-7 and W-10 indicate the largest average concentration of Cs-137 in sludge (> 1.15E+06 Bq/g)
- Tanks W-3 and W-4 exhibit the most heterogeneity for Sr-90 average concentration in sludge (RSD ~ 100%).

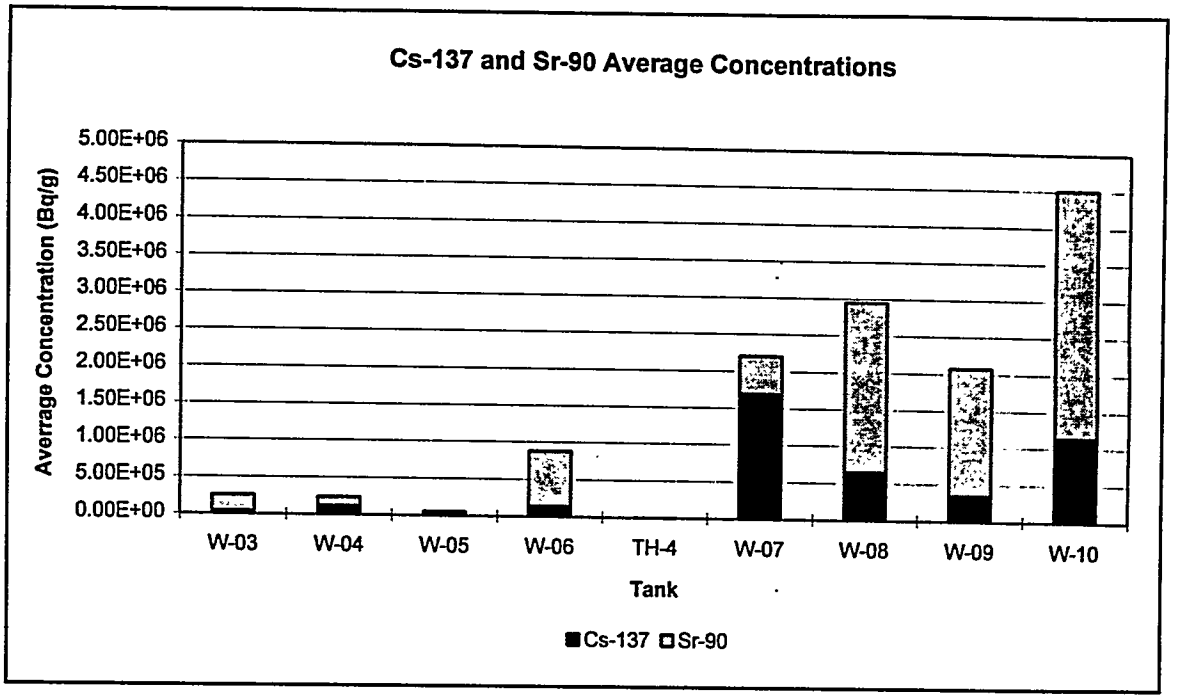

Fig. 6.1. Cs-137 and Sr-90 concentrations for sludge.

- Tank W-4 exhibits the most heterogeneity for Cs-137 average concentration in sludge (RSD > 100%).
- Tanks W-8 and W-9 exhibit the most homogeneity for Sr-90 average concentration in sludge (RSD < 25%).
- Tanks W-3, W-5, W-8, W-9, and TH-4 exhibit the most homogeneity for Cs-137 average concentration in sludge (RSD < 25%).

Table 6.1. Summary statistics for Sr-90 and Cs-137 concentrations in sludge

Tank	Tank		Sr-90 (Bq/g)		Cs-137 (Bq/g)	
ID	Group	N	Average	RSD	Average -	RSD
W-3	2	3	2.13E+05	150%	4.53E+04	5%
W-4	2	4	1.22E+05	93%	1.21E+05	123%
W-5	2	3	3.97E+04	86%	1.93E+04	23%
W-6	2	3	7.47E+05	65%	1.40E+05	33%
TH-4	2	3	1.80E+03	53%	6.40E+02	3%
W-7	3	7	5.08E+05	79%	1.70E+06	47%
W-8	3	3	2.30E+06	24%	6.53E+05	20%
W-9	3	3	1.73E+06	3%	3.50E+05	10%
W-10	3	3	3.37E+06	35%	1.15E+06	42%

Table 6.2. Summary statistics for Cs-137 and Sr-90 concentrations in sludge sorted by Cs-137 concentration

Tank	Tank		Sr-90 (Bq/g)		Cs-137 (Bq/g)	
ID	Group	N	Average	RSD	Average	RSD
TH-4	2	3	1.80E+03	53%	6.40E+02	3%
W-5	2	3	3.97E+04	86%	1.93E+04	23%
W-3	2	3	2.13E+05	150%	4.53E+04	5%
W-4	2	4	1.22E+05	93%	1.21E+05	123%
W-6	2	3	7.47E+05	65%	1.40E+05	33%
W-9	3	3	1.73E+06	3%	3.50E+05	10%
W-8	3	3	2.30E+06	24%	6.53E+05	20%
W-10	3	3	3.37E+06	35%	1.15E+06	42%
W-7	3	7	5.08E+05	79%	1.70E+06	47%

Table 6.3. Summary statistics for Cs-137 and Sr-90 concentrations in sludge sorted by Sr-90 concentration

Tank	Tank		Sr-90 (Bq/g)		Cs-137 (Bq/g)	
ID	Group	N	Average	RSD	Average	RSD
TH-4	2	3	1.80E+03	53%	6.40E+02	3%
W-5	2	3	3.97E+04	86%	1.93E+04	23%
W-4	2	4	1.22E+05	93%	1.21E+05	123%
W-3	2	3	2.13E+05	150%	4.53E+04	5%
W-7	3	7	5.08E+05	79%	1.70E+06	47%
W-6	2	3	7.47E+05	65%	1.40E+05	33%
W-9	2	3	1.73E+06	3%	3.50E+05	10%
W-8	2	3	2.30E+06	24%	6.53E+05	20%
W-10	2	3	3.37E+06	35%	1.15E+06	42%

Statistical Goodness of Fit Tests were performed on the combined concentrations for each tank group. The concentration values for tanks W-3, W-4, W-5, W-6, and TH-4 were combined for Tank Group 2. The concentration values for tanks W-7, W-8, W-9, W-10 were combined for Tank Group 3. The rationale for this is to quantify the similarity or differences in the current tank group categories, since there is insufficient data for individual tanks to make a meaningful assessment of the underlying probability functions that describe the individual tanks.

The result of the statistical Goodness of Fit Test is that each of the Sr-90 and Cs-137 average concentrations in each tank group follow an exponential probability density function with at least a 99% probability of having chosen the correct probability distribution. Both the χ^2 and the

Kolmorgrov-Smirnov Goodness of Fit tests were used to determine this finding. The results are illustrated in Table 6.4. A significance test of the difference of the averages of the two groups was not performed.

Figs. 6.2 and 6.3 portray the Exponential Cumulative Distribution Function (CDF) for Sr-90 and Cs-137 based upon the computed parameters of Table 6.4. For example, read Fig. 6.2 as "there is a 25% chance that the average concentration in of Sr-90 in sludges in Tank Group 3 is 1.4E+05 Bg/g or less," or "If all sludges from all tanks in Tank Group 2 (excluding TH-4) were combined, we can be 100% confident that the average concentration of the Sr-90 concentrations in the sludge would be less than 1.2E+05 Bq/g."

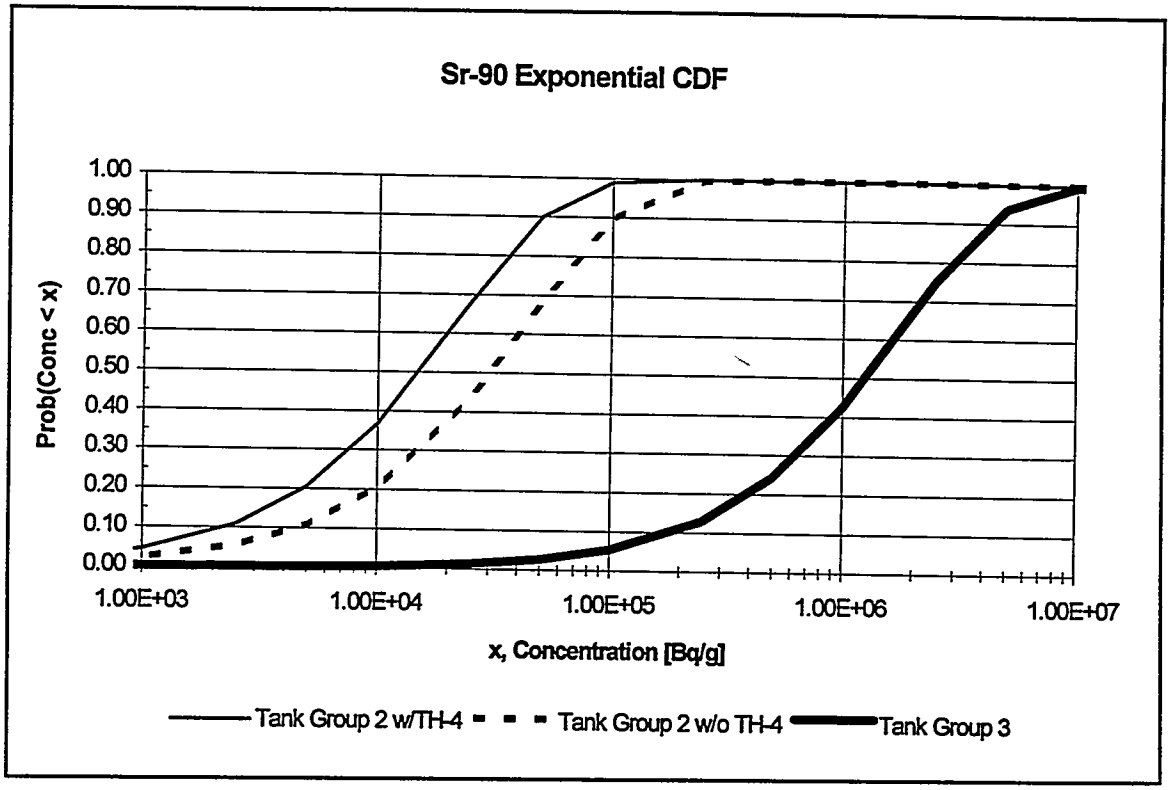

Fig. 6.2. Sr-90 sludge concentration exponential cumulative distribution function.

Since the Sr-90 and Cs-137 average concentrations in Tank Groups 2 and 3 sludge follow an exponential probability density function, descriptions and inferences regarding the Sr-90 and Cs-137 average concentration in these tanks is now both greatly simplified and statistically rigorous.

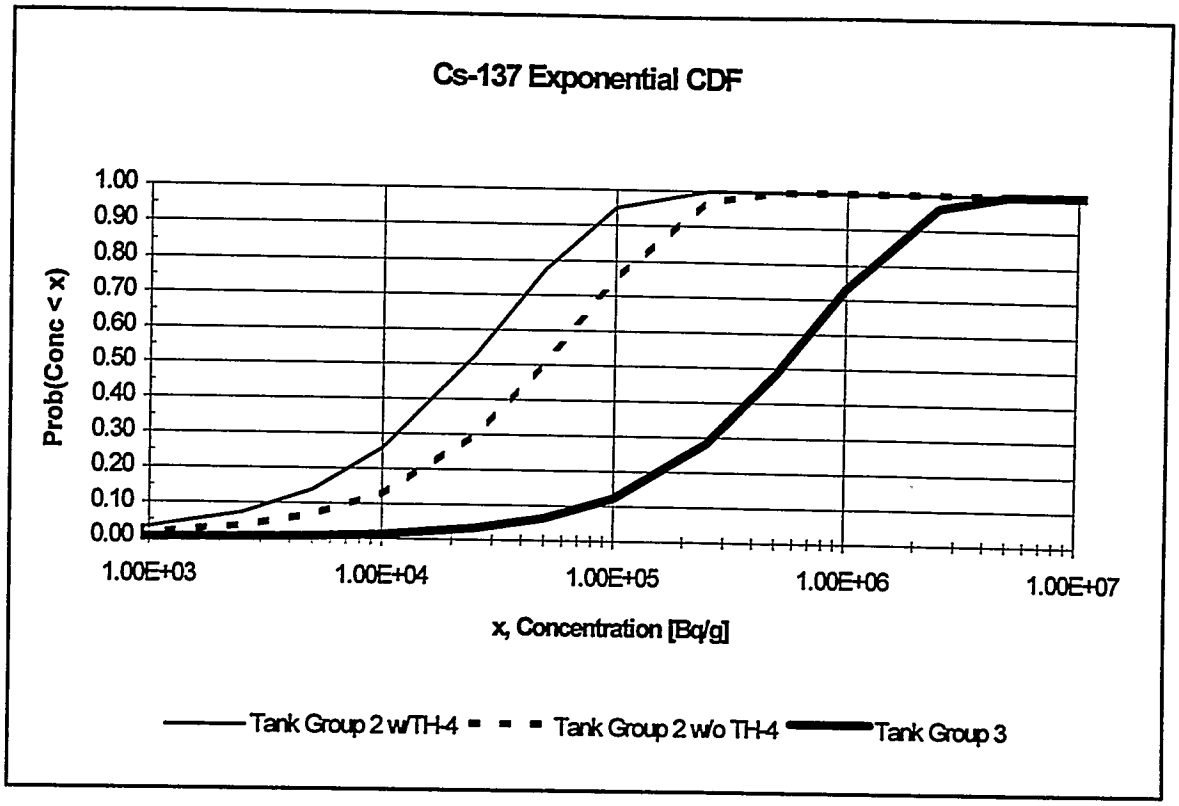

Fig. 6.3. Cs-137 sludge concentration exponential cumulative distribution function.

- The average Sr-90 concentration in sludge for Tank Group 2 (2.18E+04 Bq/g) is approximately 2 orders of magnitude less than the average Sr-90 concentration in sludge for Tank Group 3 (1.80E+06 Bq/g) when an exponential probability distribution is used to describe average Sr-90 concentration.
- The average Sr-90 concentration in sludge for Tank Group 2 when TH-4 Sr-90 concentrations are not included (4.38E+04 Bq/g) is approximately 2 orders of magnitude less than the average Sr-90 concentration in sludge for Tank Group 3 (1.80E+06 Bq/g) when an exponential probability distribution is used to describe average Sr-90 concentration.
- The average Cs-137 concentration in sludge for Tank Group 2 (3.35+04 Bq/g) is approximately 1 order of magnitude less than the average Cs-137 concentration in sludge for Tank Group 3 (7.60E+05 Bq/g) when an exponential probability distribution is used to describe average Cs-137 concentration.
- The average Cs-137 concentration in sludge for Tank Group 2 when TH-4 Cs-137 concentrations are not included (7.14E+04 Bq/g) is approximately 1 order of magnitude less than the average Cs-137 concentration in sludge for Tank Group 3 (7.60E+05 Bq/g) when an exponential probability distribution is used to describe average Cs-137 concentration.

Table 6.4. Exponential distribution summary statistics

Tank Group	Parameter μ Sr-90 (Bq/g)	Confidence that Sr-90 Sample Data Fits an Exponential Probability Distribution	Parameter μ Cs-137 (Bq/g)	Confidence that Cs-137 Sample Data Fits an Exponential Probability Distribution
Tank Group 2	2.18E+04	> 99%	3.35E+04	> 99%
Tank Group excluding TH-4	4.38E+04	> 99%	7.14E+04	> 99%
Tank Group 3	1.80E+06	> 99%	7.60E+05	> 99%

For reference purposes, the general form of this exponential probability density function, f(x), and the Exponential Cumulative Distribution Function, F(x), is presented. Using this notation, x represents the concentration value for either Sr-90 or Cs-137, X represents the random variable Sr-90 or Cs-137, Pr(X=x) means the probability that the average concentration of Sr-90 or Cs-137 will be equal to a specific value x, and $Pr(X \leq x)$ means the probability that the average concentration of Sr-90 or Cs-137 will be less than or equal to a specific value x:

$$Pr(X=x)=f(x)=\frac{1}{\mu}e^{\frac{-x}{\mu}} \text{ for } x>0$$

$$Pr(X\leq x)=F(x)=1-e^{\frac{-x}{\mu}} \text{ for } x>0$$

Note that μ is the parameter as described in Table 6.4 for the distribution function. This parameter is estimated as the arithmetic average of the concentrations. Upper confidence limits are easily computed for the isotopes is a closed form, namely:

$$x_p = -\mu \ln(1-p)$$

where $0 < 1\text{-}p < 1$ is the desired confidence value (e.g. 95%).

Upper confidence bounds for average Sr-90 and Cs-137 concentrations within tank groups as fit to an exponential probability function can be easily expressed. If the value of the parameter is 1.80E+06 Bq/g for Sr-90 in Tank Group 3, then the upper 95% confidence value for the average concentration of Sr-90 is 5.39E+06 Bq/g. This is computed as 5.39E+06 = -1.80E+06 * ln(1-0.95).

Table 6.4. Upper 95%-tile values using exponential distribution

Tank Group	Parameter μ Sr-90 (Bq/g)	Upper 95%-tile Value (Bq/g)	Parameter μ Cs-137 (Bq/g)	Upper 95%-tile Value (Bq/g)
Tank Group 2	2.18E+04	6.53E+04	3.35E+04	1.00E+05
Tank Group excluding TH-4	4.38E+04	1.31E+05	7.14E+04	2.14E+05
Tank Group 3	1.80E+06	5.39E+06	7.60E+05	2.28E+06

6.2.2 Sr-90 and Cs-137 Average Concentrations Fit to an Alternative Probability Distribution

Sr-90 and Cs-137 average concentrations in sludge can also be fit to a triangular probability distribution with 99% statistical confidence for Tank Group 3 and for Tank Group 2 excluding TH-4. The hypothesis is rejected that the Sr-90 and Cs-137 average concentrations follow a triangular distribution when TH-4 is included in Tank Group 2. (This means that the Sr-90 and Cs-137 average concentrations in Tank Group 2 including TH-4 do not follow a triangular distribution.) A summary of the triangular distribution statistics and upper 95%-tile values are presented in Tables 6.5 and 6.6 for Sr-90 and Cs-137 average concentrations in sludge, respectively.

The operational significance of these results is:

- Tank Group 2 including TH-4:
  - Only the exponential distribution should be used for Sr-90 average concentrations and upper 95%-tile values.
  - Only the exponential distribution should be used for Cs-137 average concentrations and upper 95%-tile values.
- Tank Group 2 excluding TH-4:
  - Either the exponential distribution or the triangular distribution can be used for Sr-90 average concentrations and upper 95%-tile values.
  - Either the exponential distribution or the triangular distribution can be used for Cs-137 average concentrations and upper 95%-tile values.
- Tank Group 3:
  - Either the exponential distribution or the triangular distribution can be used for Sr-90 average concentrations and upper 95%-tile values.
  - Either the exponential distribution or the triangular distribution can be used for Cs-137 average concentrations and upper 95%-tile values.

Table 6.5. Triangular distribution summary statistics for Sr-90 and comparison of upper 95%-tile values

Tank Group	Parameters Min, Most Likely, Max for Sr-90 (Bq/g)	Confidence that Sr-90 Sample Data Fits an Triangular Probability Distribution	Upper 95%-tile Sr-90 Concentration (Bq/g)	Ratio of Exponential Upper 95%-tile Sr-90 Concentration to Triangular Upper 95%-tile Sr-90 Concentration (Bq/g)
Tank Group 2	0.00E+00 8.02E+03 9.50E+05	None	N/A	N/A
Tank Group excluding TH-4	0.00E+00 1.18E+04 9.50E+05	> 99%	7.39E+05	0.2
Tank Group 3	0.00E+00 1.66E+06 4.70E+06	> 99%	3.85E+06	1.4

Table 6.6. Triangular distribution summary statistics for Cs-137 and comparison to upper 95%-tile values

Tank Group	Parameters Min, Most Likely, Max for Cs-137 (Bq/g)	Confidence that Cs-137 Sample Data Fits an Triangular Probability Distribution	Upper 95%-tile Cs-137 Concentration (Bq/g)	Ratio of Exponential Upper 95%-tile Cs-137 Concentration to Triangular Upper 95%-tile Cs-137 Concentration (Bq/g)
Tank Group 2	0.00E+00 3.76E+02 3.40E+05	None	N/A	N/A
Tank Group excluding TH-4	0.00E+00 1.49E+04 3.40E+05	> 99%	2.66E+05	0.8
Tank Group 3	0.00E+00 2.03E+05 3.10E+06	> 99%	2.43E+06	0.9

The statistical significance of these results are as follows:

- Tank Group 2 excluding TH-4:
  - The most likely value for the Sr-90 exponential distribution (4.38E+04 Bq/g) is relatively close to the most likely value for the Sr-90 triangular distribution (1.18E+04 Bq/g). Both values fall within the minimum RSD that would be expected for either probability distribution, namely an RSD equal to 100% for the exponential distribution.
  - The upper 95%-tile for Sr-90 average concentration computed by the exponential distribution (1.31E+05 Bq/g) is approximately 20% the upper 95%-tile for Sr-90 average concentration computed by the triangular distribution (7.39E+05) Bq/g.

- The most likely value for the Cs-137 exponential distribution (7.14E+04 Bq/g) is relatively close to the most likely value for the Cs-137 triangular distribution (1.49E+04 Bq/g). Both values fall within the minimum RSD that would be expected for either probability distribution, namely an RSD equal to 100% for the exponential distribution.
- The upper 95%-tile for Cs-137 average concentration computed by the exponential distribution (2.14E+04 Bq/g) is approximately 80% the upper 95%-tile for Cs-137 average concentration computed by the triangular distribution (2.66E+05) Bq/g.

• Tank Group 3:

- The most likely value for the Sr-90 exponential distribution (1.80E+06 Bq/g) is 1.1x the most likely value for the Sr-90 triangular distribution (1.66E+06 Bq/g). Both values fall within the minimum RSD that would be expected for either probability distribution, namely an RSD equal to 100% for the exponential distribution.
- The upper 95%-tile for Sr-90 average concentration computed by the exponential distribution (5.39E+06 Bq/g) is approximately 140% the upper 95%-tile for Sr-90 average concentration computed by the triangular distribution (3.85E+06) Bq/g.
- The most likely value for the Cs-137 exponential distribution (7.60E+05 Bq/g) is 3.7x the most likely value for the Cs-137 triangular distribution (2.03+05 Bq/g). Both values fall within the minimum RSD that would be expected for either probability distribution, namely an RSD equal to 100% for the exponential distribution.
- The upper 95%-tile for Cs-137 average concentration computed by the exponential distribution (2.28E+06 Bq/g) is approximately 95% the upper 95%-tile for Cs-137 average concentration computed by the triangular distribution (2.43E+06) Bq/g.

7. PHYSICAL PROPERTIES

7.1 INTRODUCTION

Physical properties are described based on GAAT sampling and analysis data for Phase I (Energy Systems 1995) and Phase II (U.S. DOE 1995). Supernate physical properties examined are TSS, TDS, density, pH, and TOC. Sludge physical properties examined are % moisture, density, TOC, and pH. Knowledge of physical properties can support GAAT system design and operational remedial actions that comply with waste acceptance criteria at proposed storage and disposal facilities

Physical properties statistics for supernate and sludge for Tank Groups. Tank Group 1 (W-1, W-2, W-11), Tank Group 2 (W-3, W-4, W-5, W-6, TH-4), and Tank Group 3 (W-7, W-8, W-9, W-10) represent current operational definitions of Tank Groups. Supernate and sludge samples are pooled for the Tank Groups. These values are used to compute the minimum, median, maximum, average, and RSD for each physical property for the Tank Group.

Physical properties statistics for supernate and sludge for individual tanks. Supernate and sludge samples from each tank are used to compute the minimum, the 25%-tile, the median, the 75%-tile, the maximum, the average, and the RSD for each physical property for individual tanks. The minimum and the maximum provide a measure of the range of the physical property data. The 25%-tile and the 75%-tile indicate the region in which the central 50% of the reported physical property data is contained. The median and the average are measures of central tendency for the physical property data. The RSD (the ratio of the standard deviation to the average) is expressed as a percentage. The RSD provides insight to the variability of the physical property data.

7.2 PHYSICAL PROPERTIES IN SUPERNATES

Summary statistics of the physical properties in supernate for each tank group is presented in Tables 7.1 through 7.3.

In most cases, Tank Groups 2 and 3 contain the maximum median values, and Tank Group 1 contains the minimum median values. TSS and TDS in Tank Group 2 exhibit high spatial variability, which is due to high values in TH-4 and W-6.

A summary of the concentrations for individual physical properties in supernate for Tank Groups is presented. Samples which contain the largest and smallest median concentrations are indicated. The RSD is also provided.

TSS — The largest median concentration is in Tank Group 2 (1.8 mg/mL), and the smallest median concentration is in Tank Group 3 (0.7 mg/mL). TH-4 and W-4 contain the maximum values, and W-6 contains the minimum value. Spatial variability in Tank Group 2 is greater than 100%.

TDS — The largest median concentration is in Tank Group 3 (11.0 mg/mL), and the smallest median concentration is in Tank Group 1 (0.2 mg/mL). TH-4 and W-8 contain the

maximum values, and W-11 contains the minimum value. Spatial variability in Tank Group 2 is greater than 100%.

Density — The largest median concentration is in Tank Group 2 (1.02 g/mL), and the smallest median concentration is in Tank Group 1 (1.00 g/mL). TH-4 and W-6 contain the maximum values, and W-11 contains the minimum value. Spatial variability is 2% or less for all groups.

TOC — The largest median concentration is in Tank Group 3 (89.0 mg/L), and the smallest median concentration is in Tank Group 1 (7.5 mg/L). W-3 contains the maximum values, and W-1 contains the minimum value. Spatial variability ranges from 66% to 85%.

pH — The largest median concentration is in Tank Group 3 (9.85), and the smallest median concentration is in Tank Group 1 (8.30). W-3 contains the maximum value, and W-1 contains the minimum value. Spatial variability ranges from 2% to 14%.

Table 7.1. Summary of physical properties for Tank Group 1 for GAAT supernate

Tank Group 1	N	Min	Median	Max	Range	Avg	RSD
TSS	4	0.8	0.9	0.9	0.1	0.8	7%
TDS	4	0.2	0.2	0.5	0.4	0.3	74%
Density	4	0.99	1.00	1.00	0.01	1.00	0%
TOC	2	4.0	7.5	11.0	7.0	7.5	66%
pH	4	8.27	8.30	8.68	0.41	8.39	2%

NC = Not Calculated

Table 7.2. Summary of physical properties for Tank Group 2 for GAAT supernate

Tank Group 2	N	Min	Median	Max	Range	Avg	RSD
TSS	8	0.0	1.8	14.2	14.2	3.8	126%
TDS	8	1.3	9.6	79.1	77.8	20.4	129%
Density	8	1.0	1.02	1.06	0.05	1.01	2%
TOC	7	4.0	77.0	197.0	193.0	91.6	78%
pH	8	7.50	9.60	10.82	3.32	9.23	14%

NC = Not Calculated

Table 7.3. Summary of physical properties for Tank Group 3 for GAAT supernate

Tank Group 3	N	Min	Median	Max	Range	Avg	RSD
TSS	3	0.4	0.7	1.2	0.8	0.7	56%
TDS	3	10.7	11.0	15.2	4.5	12.3	21%
Density	3	1.01	1.01	1.02	0.0	1.01	0%
TOC	3	2.0	89.0	107.0	105.0	66.0	85%
pH	3	9.29	9.85	9.92	0.63	9.69	4%

NC = Not Calculated

7.3 PHYSICAL PROPERTIES IN SLUDGES

Sludge samples from each tank are used to compute the minimum, the 25%-tile, the median, the 75%-tile, the maximum, the average, and the RSD for each physical property for individual tanks in Tank Group 2 and 3, Tables 7.4 through 7.13, respectively.

Table 7.4. Physical properties in sludge for Tank W-3

W-3 Tank Group 2	N.	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
% Moisture	3	57.6	72.75	87.9	88.25	88.6	78.0	23%
Bulk density	1	NC	NC	1.07	NC	NC	1.1	NC
TOC	3	4240	4360	4480	4890	5300	4673.3	12%
pH	1	NC	NC	10.5	NC	NC	10.5	NC

NC = Not Calculated

Table 7.5. Physical properties in sludge for Tank W-4

W-4 Tank Group 2	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
% Moisture	4	63.5	69.2	73.85	78.3	83.4	73.65	11%
Bulk density	2	1.2	1.2375	1.275	1.3125	1.35	1.275	8%
TOC	3	200	326.5	453	791.5	1130	594.3	81%
pH	1	NC	NC	10.6	NC	NC	10.6	NC

NC = Not Calculated

Table 7.6. Physical properties in sludge for Tank W-5

W-5 Tank Group 2	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
% Moisture	3	68.3	70.15	72	75	78	72.8	7%
Bulk density	2	1.07	1.1175	1.165	1.2125	1.26	1.2	12%
TOC	3	627	663.5	700	773.5	847	724.7	15%
pH	0	NC	NC	NC	NC	NC	NC	NC

NC = Not Calculated

Table 7.7. Physical properties in sludge for Tank W-6

W-6 Tank Group 2	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
% Moisture	3	62.5	64.05	65.6	69.2	72.8	67.0	8%
Bulk density	3	1.17	1.18	1.19	1.325	1.46	1.3	13%
TOC	3	2400	2855	3310	7505	11700	5803.3	88%
pH	1	NC	NC	11.1	NC	NC	11.1	NC

NC = Not Calculated

Table 7.8. Physical properties in sludge for Tank TH-4

TH-4 Tank Group 2	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
% Moisture	3	34.5	49.8	65.1	65.15	65.2	54.9	32%
Bulk density	2	1.3	1.3175	1.335	1.3525	1.37	1.3	4%
TOC	2	5100	5900	6700	7500	8300	6700.0	34%
pH	2	9.0	9.0	9.0	9.0	9.0	9.0	0%

NC = Not Calculated

Table 7.9. Physical properties in sludge for Tank W-7

W-7 Tank Group 3	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
% Moisture	5	57.7	65.9	67.9	70.4	74.7	67.32	9%
Bulk density	4	1.21	1.225	1.35	1.495	1.57	1.37	13%
TOC	4	796	1174	1300	1410	1740	1284	30%
pH	2	10.2	10.2175	10.235	10.2525	10.27	10.235	0%

NC = Not Calculated

Table 7.10. Physical properties in sludge layer for Tank W-7

W-7 Tank Group 3	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
% Moisture	2	58.7	59.55	60.4	61.25	62.1	60.4	4%
Bulk density	2	1.18	1.2475	1.315	1.3825	1.45	1.315	15%
TOC	2	866	1029.5	1193	1356.5	1520	1193	39%
pH	0	NC	NC	NC	NC	NC	NC	NC

NC = Not Calculated

Table 7.11. Physical properties in sludge for Tank W-8

W-8 Tank Group 3	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
% Moisture	3	78.6	81	83.4	83.45	83.5	81.8	3%
Bulk density	3	1.08	1.135	1.19	1.215	1.24	1.2	7%
TOC	3	5290	5855	6420	7410	8400	6703.3	23%
pH	1	NC	NC	9	NC	NC	9	NC

NC = Not Calculated

Table 7.12. Physical properties in sludge for Tank W-9

W-9 Tank Group 3	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
% Moisture	3	82.8	84.7	86.6	86.65	86.7	85.37	3%
Bulk density	3	1.1	1.175	1.25	1.265	1.28	1.21	8%
TOC	3	2120	2510	2900	2915	2930	2650	17%
pH	1	NC	NC	10	NC	NC	10	NC

NC = Not Calculated

Table 7.13. Physical properties in sludge for Tank W-10

W-10 Tank Group 3	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
% Moisture	3	61.1	66.95	72.8	74.95	77.1	70.3	12%
Bulk density	3	1.13	1.18	1.23	1.24	1.25	1.2	5%
TOC	3	2640	3755	4870	4885	4900	4136.7	31%
pH	1	NC	NC	11	NC	NC	10.6	NC

NC = Not Calculated

Median values for physical properties for sludge for individual tanks in tank groups are presented in Tables 7.14 and 7.15. The TOC RSD in Tank Group 2 is the largest RSD at 97%. This is due to high physical property concentrations in TH-4 and W-6. All other RSDs for Tank Group 2 and 3 are less than 75%.

Table 7.14. Sludge median values for physical properties for Tank Group 2

Tank Group 2	W3	W-4	W-5	W-6	TH-4	Min	Max
% Moisture	87.9	73.85	72	65.6	65.1	65.1	87.9
Bulk density	1.07	1.275	1.165	1.19	1.335	1.07	1.335
TOC	4480	453	700	3310	6700	453	6700
pH	10.5	10.6	NC	11.1	8.995	8.995	11.1

NC = Not Calculated

Table 7.15. Sludge median values for physical properties for Tank Group 3

Tank Group 3	W-7	W-7 Layer	W-8	W-9	W-10	Min	Max
% Moisture	67.9	60.4	83.4	86.6	72.8	60.4	86.6
Bulk density	1.35	1.315	1.19	1.25	1.23	1.19	1.35
TOC	1300	1193	6420	2900	4870	1193	6420
pH	10.235	NC	9.1	9.9	10.6	9.1	10.6

NC = Not Calculated

Summary statistics of the physical properties in sludge tank groups are presented in Tables 7.16 and 7.17. A discussion of the concentrations for individual physical properties in supernate for Tank Groups is presented. Samples which contain the largest and smallest median concentrations are indicated. The RSD is also provided.

% Moisture — The larger median concentration is in Tank Group 3 (72%), and the smaller median concentration is in Tank Group 2 (69.7%). W-3 contains the maximum value, and W-7 sludge layers contains the minimum value. Spatial variability between Tank Groups ranges from 14% to 19%.

Density — The larger median concentration is in Tank Group 3 (1.24 g/mL), and the smaller median concentration is in Tank Group 2 (1.23 g/mL). W-7 contain the maximum values, and W-3 contains the minimum value. Spatial variability is less than 12% for all groups.

TOC — The larger median concentration is in Tank Group 2 (2,855 mg/kg), and the smaller median concentration is in Tank Group 3 (2,380 mg/kg). TH-4 contains the maximum values, and W-4 contains the minimum value. Spatial variability ranges from 75% to 95%.

pH — The larger median concentration is in Tank Group 2 (10.50), and the smaller median concentration is in Tank Group 3 (9.90). W-6 contains the maximum value, and TH-4 contains the minimum value. Spatial variability ranges from 6% to 10%.

Table 7.16. Summary statistics for physical properties for Tank Group 2

Tank Group 2	N	Min	Median	Max	Range	Avg	RSD
% Moisture	16	34.5	69.7	88.6	54.1	69.5	19%
Density	10	1.07	1.23	1.46	0.39	1.24	10%
TOC	14	200.0	2,855.0	11,700.0	11,500.0	3,484.8	97%
pH	5	8.99	10.50	11.10	2.11	10.04	10%

NC = Not Calculated

Table 7.17. Summary statistics for physical properties for Tank Group 3

Tank Group 3	N	Min	Median	Max	Range	Avg	RSD
% Moisture	15	57.7	72.8	86.7	29.0	72.9	14%
Density	14	1.08	1.24	1.57	0.49	1.26	11%
TOC	14	796.0	2,380.0	8,400.0	7,604.0	3,080.1	75%
pH	5	9.10	9.90	10.60	1.50	10.01	6%

NC = Not Calculated

8. RCRA METALS

Concentrations of RCRA metals are described in several ways using GAAT Sampling and analysis data in GAAT Phase I (Energy Systems 1995) and Phase II (U.S. DOE 1995).

- Concentration statistics for supernate and sludge for individual tanks. Supernate and sludge samples from each tank are used to compute the minimum, the 25%-tile, the median, the 75%-tile, the maximum, the average, and the RSD for each RCRA metal concentration for individual tanks. The minimum and the maximum provide a measure of the range of the concentration data. The 25%-tile and the 75%-tile indicate the region in which the central 50% of the reported concentration data is contained. The median and the average are measures of central tendency for the concentration data. The RSD (the ratio of the standard deviation to the average) provides insight to the variability of the concentration data.
- Concentration statistics for supernate and sludge for tank groups. Tank Group 1 (W-1, W-2, W-11), Tank Group 2 (W-3, W-4, W-5, W-6, TH-4), and Tank Group 3 (W-7, W-8, W-9, W-10) represent current operational definitions of tank groups. Supernate and sludge samples are pooled for the tank groups. These concentrations are used to compute the minimum, median, maximum, average, and RSD for each RCRA metal for tank group.
- Maximum supernate and sludge concentrations for tanks within each tank group. The maximum sludge and supernate concentrations of each RCRA metal for each tank group are used to identify which tanks within a tank group exhibit the largest concentration.
- Maximum concentrations sorted by individual tanks within tank groups for supernate or sludge. Sorts of the maximum concentrations for the tank groups are performed to easily display which individual tanks within the tank group exhibit the largest concentrations in the supernate and the sludge.

8.1 RCRA METALS IN SUPERNATES

8.1.1 RCRA Concentrations in Supernate that Exceed RCRA Standards

Samples in which RCRA metals for GAAT supernates exceed dilution-based and TCLP RCRA criteria occur in some GAAT tanks. These values are derived obtained from Phase I sampling. These are presented in Table 8.1. The entries identify the number of samples upon which the statistics are based, the average, and the RSD (i.e., the ratio of the standard deviation to the average expressed as a percentage). When there are two observations, the median and the average are equal.

Table 8.1. RCRA metals in GAAT supernates that exceed dilution-based RCRA standards

Tank	Statistic	Cr (5 mg/L)	Hg (0.2 mg/L)	Tl (0.9 mg/L)
W-3	N Average RSD	2 7.63 53%		
W-4	N Average RSD	1 6.95 0%		
W-8	N Average RSD	1 7.6 0%	1 0.328 0%	1 1.02 0%
W-9	N Average RSD			1 2.06 0%

A summary of the concentrations for individual metals is presented. Samples which contain the largest and smallest median concentrations are indicated. The RSD is also provided.

Ag The largest median concentration in supernate occurs in samples from W-4 (1.07 mg/L). The tank has only one observation, so an RSD is not computed. The smallest median concentration in supernate occurs in samples from W-3 (0.1445 mg/L). The RSD is 51%.

As The largest median concentration in supernate occurs in samples from W-6 (0.032 mg/L). The tank has only one observation, so an RSD is not computed. The smallest median concentration in supernate occurs in samples from W-10 (0.008 mg/L). The tank has only one observation, so an RSD is not computed.

Ba The largest median concentration in supernate occurs in samples from W-4 (0.165 mg/L). The tank has only one observation, so an RSD is not computed. The smallest median concentration in supernate occurs in samples from W-6 (0.005 mg/L). The tank has only one observation, so an RSD is not computed.

Cd All concentrations are reported as less than detection limits.

Cr The largest median concentration in supernate occurs in samples from W-3 and W-8 (7.625 mg/L and 7.6 mg/L, respectively). The RSD for W-3 is 53%, and W-8 has only one observation, so an RSD is not computed. The smallest median concentration in supernate occurs in samples from W-11 (0.013 mg/L). The RSD is 10%.

Hg The largest median concentration in supernate occurs in samples from W-8 (0.328 mg/L). There is only one observation, so an RSD is not computed. The smallest median concentration in supernate occurs in samples from W-2 (0.003 mg/L). There is only one observation, so an RSD is not computed.

Ni The largest median concentration in supernate occurs in samples from TH-4 (0.58 mg/L). The RSD is 58%. The smallest median concentration in supernate occurs in samples from W-2 (0.012 mg/L). There is only one observation, so an RSD is not computed.

Pb The largest median concentration in supernate occurs in samples from W-9 (1.03 mg/L). There is only one observation, so an RSD is not computed. The smallest median concentration in supernate occurs in samples from W-2 (0.0066 mg/L). There is only one observation, so an RSD is not computed.

Se The largest median concentration in supernate occurs in samples from W-4 (0.0128 mg/L). There is only one observation, so an RSD is not computed. The smallest median concentration in supernate occurs in samples from W-3 (0.0098 mg/L). The RSD is 3%.

Tl The largest median concentration in supernate occurs in samples from W-9 (2.06 mg/L). There is only one observation, so an RSD is not computed. The smallest median concentration in supernate occurs in samples from W-6 (0.554 mg/L). There is only one observation, so an RSD is not computed.

8.1.2 RCRA Concentration Statistics for Supernate for Tank Groups

Concentration statistics for supernate for individual tanks in tank groups are presented in Tables 8.2–8.4. Statistics presented are the minimum, the 25%-tile, the median, the 75%-tile, the maximum, the average, and the RSD for each RCRA metal concentration for individual tanks. Concentration statistics for supernate for Tank Groups are presented in Tables 9.5 through 9.7.

Table 8.2. Summary of RCRA metals for tanks in Tank Group 1 for GAAT supernates

Tank Group 1	W-1		W-2		W-11		
RCRA Metals (mg/L)	N	Median	N	Median	N	Median	RSD
Ag	0	NC	0	NC	0	NC	NC
As	0	NC	0	NC	0	NC	NC
Ba	1	0.0704	1	0.057	2	0.0243	4%
Cd	0	NC	0	NC	0	NC	NC
Cr	0	NC	0	NC	2	0.013	10%
Hg	1	0.0072	1	0.003	2	0.0038	47%
Ni	0	NC	1	0.012	0	NC	NC
Pb	0	NC	1	0.0066	0	NC	NC
Se	0	NC	0	NC	0	NC	NC
Tl	0	NC	0	NC	0	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.3. Summary of RCRA metals for tanks in Tank Group 2 for GAAT supernates

Tank Group 2	W-3			W-4			W-5			W-6			TH-4		
RCRA Metals (mg/L)	N	Median	RSD	N	Median	RSD	N	Median	RSD	N	Median	RSD	N	Median	RSD
Ag	2	0.1445	51%	1	1.07	NC	0	NC	NC	0	NC	NC	0	NC	NC
As	0	NC	NC	0	NC	NC	0	NC	NC	1	0.032	NC	0	NC	NC
Ba	2	0.017	42%	1	0.165	NC	1	0.017	NC	1	0.005	NC	2	0.0519	5%
Cd	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC	0	NC	NC
Cr	2	7.625	53%	1	6.95	NC	1	0.621	NC	2	2.5652	138 %	2	2.075	68%
Hg	2	0.0201	95%	1	0.0036	NC	1	0.0263	NC	2	0.0119	104 %	2	0.0057	31%
Ni	2	0.0765	36%	1	0.233	NC	1	0.105	NC	1	0.152	NC	2	0.58	34%
Pb	0	NC	NC	1	0.0558	NC	0	NC	NC	0	NC	NC	0	NC	NC
Se	2	0.0098	3%	1	0.0128	NC	0	NC	NC	0	NC	NC	0	NC	NC
Tl	0	NC	NC	0	NC	NC	0	NC	NC	1	0.554	NC	0	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.4. Summary of RCRA metals for tanks in Tank Group 3 for GAAT supernates

Tank Group 3	W-8			W-9			W-10		
RCRA Metals (mg/L)	N	Median	RSD	N	Median	RSD	N	Median	RSD
Ag	0	NC	NC	0	NC	NC	0	NC	NC
As	0	NC	NC	0	NC	NC	1	0.008	NC
Ba	1	0.0628	NC	1	0.118	NC	1	0.0215	NC
Cd	0	NC	NC	0	NC	NC	0	NC	NC
Cr	1	7.6	NC	1	4.84	NC	1	3.86	NC
Hg	1	0.328	NC	1	0.16	NC	1	0.116	NC
Ni	1	0.27	NC	1	0.289	NC	1	0.0609	NC
Pb	1	0.472	NC	1	1.03	NC	0	NC	NC
Se	0	NC	NC	0	NC	NC	0	NC	NC
Tl	1	1.02	NC	1	2.06	NC	0	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.5. RCRA metal concentration statistics (mg/L) for Tank Group 1, supernate

Tank Group	1								
Supernate	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Ag	0	NC	NC	NC	NC	NC	NC	NC	NC
As	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	4	0.0704	W-1	0.0236	W-11	0.041	0.0468	0.04	53%
Cd	0	NC	NC	NC	NC	NC	NC	NC	NC
Cr	2	0.0139	W-11	0.012	W-11	0.01295	0.0019	0.01	10%
Hg	4	0.0072	W-1	0.0025	W-11	0.004	0.0047	0.00	48%
Ni	1	0.012	W-2	0.012	W-2	0.012	0	0.01	NC
Pb	1	0.0066	W-2	0.0066	W-2	0.0066	0	0.01	NC
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	0	NC	NC	NC	NC	NC	NC	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.6. RCRA metal concentration statistics (mg/L) for Tank Group 2, supernate

Tank Group	2								
Supernate	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Ag	3	1.07	W-4	0.092	W-3	0.197	0.978	0.45	119%
As	1	0.032	W-6	0.032	W-6	0.032	0	0.03	NC
Ba	7	0.165	W-4	0.005	W-6	0.022	0.16	0.05	120%
Cd	0	NC	NC	NC	NC	NC	NC	NC	NC
Cr	8	10.5	W-3	0.0703	W-6	3.915	10.4297	- 4.01	89%
Hg	8	0.0336	W-3	0.0031	W-6	0.00675	0.0305	0.01	91%
Ni	7	0.721	TH-4	0.057	W-3	0.152	0.664	0.26	94%
Pb	1	0.0558	W-4	0.0558	W-4	0.0558	0	0.06	NC
Se	3	0.0128	W-4	0.0096	W-3	0.01	0.0032	0.01	16%
Tl	1	0.554	W-6	0.554	W-6	0.554	0	0.55	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.7. RCRA metal concentration statistics (mg/L) for Tank Group 3, supernate

Tank Group	3								
Supernate	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Ag	0	NC	NC	NC	NC	NC	NC	NC	NC
As	1	0.008	W-10	0.008	W-10	0.008	0	0.01	NC
Ba	3	0.118	W-9	0.0215	W-10	0.0628	0.0965	0.07	72%
Cd	0	NC	NC	NC	NC	NC	NC	NC	NC
Cr	3	7.6	W-8	3.86	W-10	4.84	3.74	5.43	36%
Hg	3	0.328	W-8	0.116	W-10	0.16	0.212	0.20	56%
Ni	3	0.289	W-9	0.0609	W-10	0.27	0.2281	0.21	61%
Pb	2	1.03	W-9	0.472	W-8	0.751	0.558	0.75	53%
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	2	2.06	W-9	1.02	W-8	1.54	1.04	1.54	48%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

8.13 Maximum Supernate Concentrations by Tanks Within Each Tank Group

The tanks that exhibit the maximum supernate RCRA metal concentrations for each tank group are identified in Table 8.8. Tanks that exhibit the maximum sludge concentrations are also identified for comparison purposes. As an example, Tanks W-11, W-3, and W-8 exhibit the maximum concentration for Cr in supernate for tank groups 1, 2, and 3, respectively.

Table 8.8. Identification of tank ID maximum values of RCRA metals for tank groups

Tank Group	1	2	2	3	3
Metal	Supernate	Sludge	Supernate	Sludge	Supernate
Ag	NC	W-4	W-4	W-10	NC
As	NC	TH-4	W-6	NC	W-10
Ba	W-1	W-6	W-4	W-7	W-9
Cd	NC	W-6	NC	W-10	NC
Cr	W-11	W-5	W-3	W-7	W-8
Hg	W-1	W-6	W-3	W-8	W-8
Ni	W-2	W-6	TH-4	W-10	W-9
Pb	W-2	NC	W-4	W-8	W-9
Se	NC	NC	W-4	NC	NC
Tl	NC	W-6	W-6	NC	W-9

NC = Not Calculated

8.14 Maximum Supernate RCRA Concentrations by Tanks Sorted by Tank Groups

Tanks that exhibit the maximum supernate RCRA metal concentrations are ordered for each tank group and presented in Tables 8.9, 8.10, and 8.11 for Tank Groups 1, 2, and 3, respectively. Tanks that exhibit the maximum sludge concentrations are also identified for comparison purposes. For example, Tank W-1 exhibits the maximum supernate RCRA metal concentrations for Ba and Hg. As a second example, Tank W-3 exhibits the maximum supernate RCRA metal concentrations for Cr and Hg. Similarly, Tank W-8 exhibits the maximum supernate RCRA metal concentrations for Cr and Hg.

Table 8.9. Identification of tank ID maximum values of RCRA metals for tank groups sorted by Tank Group 1 supernate

Tank Group	1
Metal	Supernate
Ba	W-1
Hg	W-1
Ni	W-2
Pb	W-2
Cr	W-11
Ag	NC
As	NC
Cd	NC
Se	NC
Tl	NC

NC = Not Calculated

Table 8.10. Identification of tank ID maximum values of RCRA metals for tank groups sorted by Tank Group 2 supernate

Tank Group	2
Metal	Supernate
Ni	TH-4
Cr	W-3
Hg	W-3
Ag	W-4
Ba	W-4
Pb	W-4
Se	W-4
As	W-6
Tl	W-6
Cd	NC

NC = Not Calculated

Table 8.11. Identification of tank maximum values of RCRA metals for tank groups sorted by Tank Group 3 supernate

Tank Group	3
Metal	Supernate
Cr	W-8
Hg	W-8
Ba	W-9
Ni	W-9
Pb	W-9
Tl	W-9
As	W-10
Ag	NC
Cd	NC
Se	NC

NC = Not Calculated

8.2 RCRA METALS IN SLUDGES

8.2.1 RCRA Concentrations in Sludge That Exceed RCRA Standards

Some GAAT supernate and sludge samples exceed RCRA criteria. The samples are derived obtained from Phase I and Phase II sampling. RCRA metals are Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Se, and Tl . RCRA metals that exceed RCRA standards for supernate are presented in Table 8.12. Table 8.13 presents information regarding sludge concentrations based upon the application of U.S. Environmental Protection Agency TOX.

In Tables 8.12 and 8.13, the criteria are contained in the table header for each RCRA metal. The tabular entries identify the number of samples upon which the statistics are based, the average, and the RSD. When there are two observations, the median and the average are equal. Blank entries indicate the RCRA metal criteria was not exceeded in the tank. Details are contained in Chap. 8.

Tables 8.14–8.22 present the results from TCLP criteria and the subsequent 20:1 dilution of metal contaminants in the leachate performed on the sludge metals (Giaquinto, Keller, and Mills 1996). Blank entries indicate the RCRA metal criteria was not exceeded in the tank.

Table 8.12. RCRA metals (mg/kg) in GAAT sludges that exceed RCRA standards

Tank	Statistic	Cr (100 mg/kg)	Hg (4 mg/kg)	Pb (100 mg/kg)
W-3	N	3	3	
	Average	336.0	15.1	
	RSD	34%	53%	
W-4	N	4	4	
	Average	228.3	24.4	
	RSD	29%	112%	
W-5	N	3	3	3
	Average	1273.3	103.6	283.0
	RSD	22%	29%	22%
W-6	N	3	3	3
	Average	1363.3	78.3	3480.0
	RSD	31%	46%	97%
W-7	N	5	5	
	Average	198.2	150.8	
	RSD	49%	43%	
W-8	N	3	3	3
	Average	258.7	184.2	1370.0
	RSD	21%	109%	14%
W-9	N	3	3	3
	Average	119.7	66.7	496.0
	RSD	8%	11%	3%
W-10	N	3	3	3
	Average	169.0	225.0	699.7
	RSD	27%	51%	32%
TH-4	N	3	3	
	Average	281.0	7.4	
	RSD	29%	15%	

Table 8.13. TCLP (1/g) results for RCRA metals in GAAT sludges

Tank	Cr (5 ppm)	Hg (0.2 ppm)	Pb (5 ppm)
W-3			None Leached
W-4		None Leached	None Leached
W-6		0.206 µg/ml Exceeds Std	None Leached
W-7		1.8 µg/ml Exceeds Std (1)	None Leached
W-10		0.402 µg/ml Exceeds Std	None Leached

A summary of the concentrations for individual metals is presented. Samples which contain the largest and smallest median concentrations are indicated. The RSD is also provided.

Ag The largest median concentration in sludge occurs in samples from W-4 (24.7 mg/kg). The RSD is 9%. The smallest median concentration in sludge occurs in samples from W-10 (5.8 mg/kg). The RSD is 58%.

As The largest median concentration in sludge occurs in samples from TH-4 (4.2 mg/kg). The RSD is 7%. The smallest median concentration in sludge occurs in samples from W-5 (0.7 mg/kg). The RSD is 1%.

Ba The largest median concentration in sludge occurs in samples from W-6 (210.0 mg/kg). The RSD is 34%. The smallest median concentration in sludge occurs in samples from W-3 (5.4 mg/kg). The RSD is 53%.

Cd The largest median concentration in sludge occurs in samples from W-6 (6.8 mg/kg). The RSD is 24%. The smallest median concentration in sludge occurs in samples from W-9 (3.1 mg/kg). The RSD is 13%.

Cr The largest median concentration in sludge occurs in samples from W-6 and W-5 (1390 mg/kg and 1220 mg/kg, respectively). The RSDs are 31% and 22%, respectfully. The smallest median concentration in sludge occurs in samples from W-9 (115 mg/kg). The RSD is 8%.

Hg The largest median concentration in sludge occurs in samples from W-10 (288 mg/kg). The RSD is 51%. The smallest median concentration in sludge occurs in samples from TH-4 (7.4 mg/kg). The RSD is 15%. Tanks W-4 and W-8 exhibit the largest heterogeneity (RSD > 100%).

Ni The largest median concentration in sludge occurs in samples from W-6 and w-8 (138 mg/kg and 130 mg/kg respectively). The RSDs are 37% and 17%, respectively. The smallest median concentration in sludge occurs in samples from W-3 (5.7 mg/kg). The RSD is 3%.

Pb The largest median concentration in sludge occurs in samples from W-6 and W-8 (2110 mg/kg and 1440 mg/kg, respectively). The RSDs are 97% and 14% respectively. The smallest median concentration in sludge occurs in samples from W-4 (16.4 mg/kg). The RSD is 6%.

Se All concentrations are reported as less than detection limits.

Tl All concentrations except W-6 (36.1 mg/kg) are reported as less than detection limits.

Table 8.14. Statistical summary of RCRA metals (mg/kg) in GAAT sludges for W-3

Metal	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
Ag	2	22.7	23.3	23.9	24.5	25.1	23.9	7%	2.4
As	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	3	2.9	4.2	5.4	7.2	9.0	5.8	53%	6.1
Cd	1	NC	NC	1.3	NC	NC	1.3	NC	1.3
Cr	3	252.0	270.0	288.0	378.0	468.0	336.0	34%	216.0
Hg	3	6.4	11.6	16.7	19.5	22.3	15.1	53%	15.9
Ni	3	5.5	5.6	5.7	5.7	5.8	5.7	3%	0.3
Pb	1	NC	NC	9.9	NC	NC	9.9	NC	9.9
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	0	NC	NC	NC	NC	NC	NC	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.15. Statistical summary of RCRA metals (mg/kg) in GAAT sludges for W-4

Metal	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
Ag	2	23.1	23.9	24.7	25.5	26.3	24.7	9%	3.2
As	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	4	5.5	5.6	6.1	9.4	18	8.9	68%	12.5
Cd	3	2.0	3.4	4.8	5.2	5.55	4.1	46%	3.6
Cr	4	158.0	198.5	219.5	249.3	316	228.3	29%	158.0
Hg	4	3.4	5.2	15.8	35.1	62.6	24.4	112%	59.2
Ni	4	5.9	6.4	10.4	14.5	15.2	10.5	47%	9.3
Pb	2	15.6	16.0	16.4	16.7	17.1	16.4	6%	1.5
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	0	NC	NC	NC	NC	NC	NC	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.16. Statistical summary of RCRA metals (mg/kg) in GAAT sludges for W-5

Metal	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
Ag	0	NC	NC	NC	NC	NC	NC	NC	NC
As	2	0.7	0.7	0.7	0.7	0.706	0.7	1%	0.0
Ba	3	39.7	50.3	60.9	78.1	95.3	65.3	43%	55.6
Cd	2	2.4	3.1	3.9	4.6	5.37	3.9	55%	3.0
Cr	3	1020.0	1120.0	1220.0	1400.0	1580	1273.3	22%	560.0
Hg	3	71.8	89.4	107.0	119.5	132	103.6	29%	60.2
Ni	3	86.9	91.6	96.3	112.7	129	104.1	21%	42.1
Pb	3	213.0	258.0	303.0	318.0	333	283.0	22%	120.0
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	0	NC	NC	NC	NC	NC	NC	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.17. Statistical summary of RCRA metals (mg/kg) in GAAT sludges for W-6

Metal	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
Ag	2	8.6	8.8	8.9	9.1	9.21	8.9	5%	0.6
As	2	0.7	1.1	1.5	1.8	2.22	1.5	74%	1.5
Ba	3	107.0	158.5	210.0	210.0	210	175.7	34%	103.0
Cd	3	5.0	5.9	6.8	7.4	8.13	6.6	24%	3.2
Cr	3	930.0	1160.0	1390.0	1580.0	1770	1363.3	31%	840.0
Hg	3	40.2	61.5	82.8	97.4	112	78.3	46%	71.8
Ni	3	102.0	120.0	138.0	175.0	212	150.7	37%	110.0
Pb	3	1010.0	1560.0	2110.0	4715.0	7320	3480.0	97%	6310.0
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	1	NC	NC	36.1	NC	NC	36.1	NC	36.1

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.18. Statistical summary of RCRA metals (mg/kg) in GAAT sludges for W-7

Metal	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
Ag	1	NC	NC	4.1	NC	NC	4.1	NC	4.1
As	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	5	16.7	23.9	54.7	79.9	231	81.2	108%	214.3
Cd	0	NC	NC	NC	NC	NC	NC	NC	NC
Cr	5	115.0	132.0	143.0	264.0	337	198.2	49%	222.0
Hg	5	104.0	111.0	137.0	138.0	264	150.8	43%	160.0
Ni	5	7.4	19.6	37.1	43.5	54.7	32.5	58%	47.4
Pb	3	18.7	29.0	39.2	50.9	62.6	40.2	55%	43.9
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	0	NC	NC	NC	NC	NC	NC	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.19. Statistical summary of RCRA metals (mg/kg) in GAAT sludges for W-8

Metal	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
Ag	0	NC	NC	NC	NC	NC	NC	NC	NC
As	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	3	25.4	35.7	45.9	49.0	52	41.1	34%	26.6
Cd	3	3.8	4.2	4.7	5.0	5.22	4.6	16%	1.4
Cr	3	206.0	231.0	256.0	285.0	314	258.7	21%	108.0
Hg	3	55.4	68.4	81.3	248.7	416	184.2	109%	360.6
Ni	3	95.6	112.8	130.0	131.5	133	119.5	17%	37.4
Pb	3	1150.0	1295.0	1440.0	1480.0	1520	1370.0	14%	370.0
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	0	NC	NC	NC	NC	NC	NC	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.20. Statistical summary of RCRA metals (mg/kg) in GAAT sludges for W-9

Metal	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
Ag	0	NC	NC	NC	NC	NC	NC	NC	NC
As	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	3	89.6	94.5	99.3	106.7	114	101.0	12%	24.4
Cd	3	2.7	2.9	3.1	3.3	3.49	3.1	13%	0.8
Cr	3	113.0	114.0	115.0	123.0	131	119.7	8%	18.0
Hg	3	62.1	62.4	62.7	69.0	75.3	66.7	11%	13.2
Ni	3	71.8	72.4	73.0	73.2	73.3	72.7	1%	1.5
Pb	3	487.0	487.5	488.0	500.5	513	496.0	3%	26.0
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	0	NC	NC	NC	NC	NC	NC	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.21. Statistical summary of RCRA metals (mg/kg) in GAAT sludges for W-10

Metal	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
Ag	3	2.1	4.0	5.8	7.1	8.4	5.4	58%	6.3
As	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	3	75.3	79.5	83.7	196.9	310	156.3	85%	234.7
Cd	3	2.7	3.7	4.7	5.1	5.44	4.3	33%	2.7
Cr	3	122.0	146.5	171.0	192.5	214	169.0	27%	92.0
Hg	3	93.1	190.6	288.0	291.0	294	225.0	51%	200.9
Ni	3	71.2	77.8	84.3	158.7	233	129.5	69%	-161.8
Pb	3	473.0	589.5	706.0	813.0	920	699.7	32%	447.0
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	0	NC	NC	NC	NC	NC	NC	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.22. Statistical summary of RCRA metals (mg/kg) in GAAT sludges for TH-4

Metal	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
Ag	0	NC	NC	NC	NC	NC	NC	NC	NC
As	3	3.7	3.9	4.2	4.2	4.19	4.0	7%	0.5
Ba	3	8.9	9.3	9.7	12.1	14.5	11.0	27%	5.6
Cd	1	NC	NC	1.8	NC	NC	1.8	NC	1.8
Cr	3	191.0	245.5	300.0	326.0	352	281.0	29%	161.0
Hg	3	6.4	6.9	7.4	8.0	8.56	7.4	15%	2.2
Ni	3	36.7	38.7	40.7	46.8	52.8	43.4	19%	16.1
Pb	0	NC	NC	NC	NC	NC	NC	NC	NC
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	0	NC	NC	NC	NC	NC	NC	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

8.2.2 RCRA Concentration Statistics for Sludge for Tank Groups

RCRA concentration statistics for sludge for Tank Groups 2 and 3 are presented in Tables 8.23 and 8.24.

An Analysis of Variance was performed to compare average sludge concentrations given the associated RSDs between Tank Groups 2 and 3 for selected RCRA metals (Cd, Cr, and Hg). The results indicate that there is no statistically significant difference (probability greater than 95%) between the average concentrations for Cd between Tank Groups 2 and 3.

There is a statistically significant difference (probability greater than 95%) between the average concentrations for Cr and Hg in sludges between Tank Groups 2 and 3. The average concentration for Cr in sludges in Tank Group 2 (667.13 mg/kg) is statistically greater (probability greater than 95%) than the average concentration for Cr in sludges in Tank Group 3 (271.94 mg/kg). The average concentration for Hg in sludges in Tank Group 3 (152.68 mg/kg) is statistically greater (probability greater than 95%) than the average concentration for Hg in sludges in Tank Group 2 (44.45 mg/kg).

Table 8.23. RCRA metal concentration statistics (mg/kg) for Tank Group 2, sludge

Tank Group	2								
Sludge	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Ag	6	26.3	W-4	8.6	W-6	22.9	17.7	19.17	42%
As	7	4.19	TH-4	0.695	W-6	2.22	3.495	2.34	71%
Ba	16	210	W-6	2.94	W-3	12.11	207.06	50.57	139%
Cd	10	8.13	W-6	1.3	W-3	4.895	6.83	4.31	54%
Cr	16	1770	W-6	158	W-4	334	1612	667.13	84%
Hg	16	132	W-5	3.41	W-4	24.1	128.59	44.45	99%
Ni	16	212	W-6	5.5	W-3	38.7	206.5	59.58	104%
Pb	9	7320	W-6	9.9	W-3	303	7310.1	1259.07	188%
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	1	36.1	W-6	36.1	W-6	36.1	0	36.10	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 8.24. RCRA metal concentration statistics (mg/kg) for Tank Group 3, sludge

Tank Group	3								
Sludge	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Ag	4	8.4	W-10	2.09	W-10	4.94	6.31	5.09	53%
As	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	16	318	W-7	16.7	W-7	77.6	301.3	105.03	91%
Cd	9	5.44	W-10	2.7	W-9	3.78	2.74	3.98	27%
Cr	16	1550	W-7	113	W-9	169.5	1437	271.94	128%
Hg	16	416	W-8	55.4	W-8	116	360.6	152.68	69%
Ni	16	233	W-10	7.35	W-7	72.4	225.65	82.38	74%
Pb	14	1520	W-8	15	W-7	487.5	1505	567.04	92%
Se	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	0	NC	NC	NC	NC	NC	NC	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

8.2.3 Maximum Sludge Concentrations by Tanks Within Each Tank Group

The tanks that exhibit the maximum sludge metal concentrations for each tank group are identified in Table 8.25. Tanks that exhibit the maximum supernate concentrations are also

identified for comparison purposes. As an example, Tanks W-1, W-3, and W-10 exhibit the maximum concentration for Al in supernate for tank groups 1, 2, and 3.

Table 8.25. Identification of tank ID maximum values of RCRA metals for tank groups

Tank Group	1	2	2	3	3
Metal	Supernate	Sludge	Supernate	Sludge	Supernate
Ag	NC	W-4	W-4	W-10	NC
As	NC	TH-4	W-6	NC	W-10
Ba	W-1	W-6	W-4	W-7	W-9
Cd	NC	W-6	NC	W-10	NC
Cr	W-11	W-5	W-3	W-7	W-8
Hg	W-1	W-6	W-3	W-8	W-8
Ni	W-2	W-6	TH-4	W-10	W-9
Pb	W-2	NC	W-4	W-8	W-9
Se	NC	NC	W-4	NC	NC
Tl	NC	W-6	W-6	NC	W-9

NC = Not Calculated

8.2.4 Maximum RCRA Concentrations by Tanks Sorted by Tank Groups

Tanks that exhibit the maximum sludge RCRA metal concentrations are ordered for each tank group and presented in Tables 8.26 and 8.27 for Tank Groups 2 and 3, respectively. Tanks that exhibit the maximum supernate concentrations are also identified for comparison purposes. As a first example, Tank W-6 exhibits the maximum sludge RCRA metal concentrations for Ba, Cd, Hg, Ni, and Tl. As a second example, Tank W-10 exhibits the maximum sludge metal concentrations for Ag, Cd, and Ni.

Table 8.26. Identification of tank ID maximum values of RCRA metals for tank groups sorted by Tank Group 2 sludge

Tank Group	2
Metal	Sludge
As	TH-4
Ag	W-4
Cr	W-5
Ba	W-6
Cd	W-6
Hg	W-6
Ni	W-6
Tl	W-6
Pb	NC
Se	NC

NC = Not Calculated

Table 8.27. Identification of tank ID maximum values of RCRA metals for tank groups sorted by Tank Group 3 sludge

Tank Group	3
Metal	Sludge
Ba	W-7
Cr	W-7
Hg	W-8
Pb	W-8
Ag	W-10
Cd	W-10
Ni	W-10
As	NC
Se	NC
Tl	NC

NC = Not Calculated

9. PROCESS METALS

Process metals include: Al, B, Be, Ca, Co, Cu, Fe, K, Mg, Mn, Na, Sb, Si, Sr, Th, U, V, Zn. Concentrations of process metals are described to support potential GAAT system design and operational remedial actions that comply with waste acceptance criteria at proposed storage and disposal facilities. A substantial amount of information is presented in this section, and the reader may rapidly refer to individual subsections to obtain information of interest.

- Concentration statistics for supernate and sludge for individual tanks. Supernate (Sect. 10.1.1) and sludge (Sect. 10.2.1) samples from each tank are used to compute the minimum, the 25%-tile, the median, the 75%-tile, the maximum, the average, and the RSD for each process metal concentration for individual tanks. The minimum and the maximum provide a measure of the range of the concentration data. The 25%-tile and the 75%-tile indicate the region in which the central 50% of the reported concentration data is contained. The median and the average are measures of central tendency for the concentration data. The RSD (the ratio of the standard deviation to the average) is expressed as a percentage. The RSD provides insight to the variability of the concentration data.
- Concentration statistics for supernate and sludge for tank groups. Tank Group 1 (W-1, W-2, W-11), Tank Group 2 (W-3, W-4, W-5, W-6, TH-4), and Tank Group 3 (W-7, W-8, W-9, W-10) represent current operational definitions of tank groups. Supernate samples (Sects. 10.1.1 and 10.1.2) are pooled for the tank groups, and the same is accomplished for sludge samples (Sects. 10.2.1 and 10.2.2) for the tank groups. These concentrations are used to compute the minimum, median, maximum, average, and RSD for each process metal for tank group.
- Maximum supernate and sludge concentrations for tanks within each tank group. The maximum supernate (Sect. 10.1.3) and sludge (Sect. 10.2.3) concentrations of each process metal for each tank group are used to identify which tanks within a tank group exhibit the largest concentration.
- Maximum concentrations sorted by individual tanks within tank groups for supernate or sludge. Sorts of the maximum concentrations for the tank groups are performed to easily display which individual tanks within the tank group exhibit the largest concentrations in the supernate (Sect. 10.1.4) and the sludge (Sect. 10.2.4).

9.1 PROCESS METALS IN SUPERNATES

9.1.1 Concentration Statistics for Supernate for Individual Tanks

Concentration statistics for process metals in supernate for individual tanks are presented in Tables 9.1 through 9.3. Given the paucity of observations (N=2 or less for any tank), statistics presented include only the median and the RSD for each process metal concentration for individual tanks. The following observations are provided for median concentrations and, where applicable, for the spatial variability of the concentrations.

Median Concentrations. Medians for supernate concentrations indicate that value such that 50% of the concentrations occur either above or below the median value. For two observations, the median and the average are equivalent. RSDs that exceed 100% indicate large spatial

variability. RSDs that are less than 25% to 50% indicate small spatial variability. The maximum number of samples used to compute the RSD is 2.

Al The largest median concentration of metals in supernate occur in samples from W-3 and W-6 (5.14 mg/L and 2.55 mg/L, respectively). Both RSDs are greater than 100%. The smallest median concentration of metals in supernate occurs in samples from W-2 and W-11 (0.0242 mg/L and 0.026 mg/L, respectively). Both tanks have only one observation, so an RSD is not computed.

B The largest median concentration of metals in supernate occur in samples from TH-4 and W-8 (1.018 mg/L and 0.713 mg/L, respectively). The RSD for TH-4 is 20%. The RSD is not computed for the single observation in W-8. The smallest median concentration of metals in supernate occurs in samples from W-1 and W-11 (0.033 mg/L and 0203 mg/L, respectively). There is one observation from W-1 and W-11, and the RSD is not computed.

Be All concentrations are reported as less than detection limits.

Ca The largest median concentration of metals in supernate occur in the samples from TH-4, W-4, and W-1 (263 mg/L, 47.1 mg/L, and 42.5 mg/L, respectively). The RSD for TH-4 is 8%. There is one observation for W-4 and W-1. The smallest median concentration of metals in supernate occurs in samples from W-6 and W-5 (11.835 mg/L and 6.84 mg/L, respectively). The RSD for W-6 is 95%. There is one observation from W-5, and the RSD is not computed.

Co The largest median concentration of metals in supernate occur in the samples from W-9 and W-4 (0.215 mg/L and 0.19 mg/L, respectively). There is one observation for W-9 and W-4. The smallest median concentration of metals in supernate occurs in samples from W-3 and W-10 (0.0285 mg/L and 0.0116 mg/L, respectively). There is one observation from W-3 and W-10, and the RSD is not computed.

Cu The largest median concentration of metals in supernate occur in the samples from W-9 and W-8 (0.694 mg/L and 0.586 mg/L, respectively). There is one observation for W-9 and W-8. The smallest median concentration of metals in supernate occurs in samples from W-2 and W-11 (0.005 mg/L and 0.003 mg/L, respectively). There is one observation from W-2 and W-11, and the RSD is not computed.

Fe The largest median concentration of metals in supernate occur in the samples from TH-4 and W-4 (0.5165 mg/L and 0.448 mg/L, respectively). The RSD for TH-4 is 5%. There is one observation for W-4. The smallest median concentration of metals in supernate occurs in samples from W-10 and W-11 (0.0296 mg/L and 0.0135 mg/L, respectively). There is one observation from W-10, and the RSD is not computed. The RSD for W-11 is 47%.

K The largest median concentration of metals in supernate occur in samples from TH-4 and W-2 (8.255 mg/L and 7.85 mg/L, respectively). There is one observation per tank, and RSDs are not computed. The smallest median concentration of metals in supernate occurs in samples from W-1 and W-11 (15.4 mg/L and 7.665 mg/L, respectively). There is one observation from W-1, and the RSD for W-11 is 1%.

Mg The largest median concentration of metals in supernate occur in samples from W-9 and W-10 (896 mg/L and 819 mg/L, respectively). The RSDs are less than 5%. The smallest median concentration of metals in supernate occurs in samples from W-5 and W-6

(1.98 mg/L and 1.336 mg/L, respectively). There is one observation from W-5, and the RSD for W-6 is 77%.

Mn The largest median concentration of metals in supernate occur in the samples from TH-4 and W-4 (0.398 mg/L and 0.173 mg/L, respectively). The RSD for TH-4 is 1%. There is one observation for W-4. The smallest median concentration of metals in supernate occurs in samples from W-5 and W-10 (0.008 mg/L and 0.007 mg/L, respectively). There is one observation from W-5 and W-10, and the RSD is not computed.

Na The largest median concentration of metals in supernate occur in the samples from TH-4, W-8, and W-5 (14,500 mg/L, 4,370 mg/L, and 4,250 mg/L, respectively). The RSD for TH-4 is 42%. There is one observation for W-8 and W-5. The smallest median concentration of metals in supernate occurs in samples from W-1 and W-11 (6.56 mg/L and 5.345 mg/L, respectively). The RSD for W-11 is 4%. There is one observation from W-1, and the RSD is not computed.

Sb All concentrations are reported as less than detection limits.

Sl The largest median concentration of metals in supernate occur in the samples from TH-4 and W-1 (6.785 mg/L and 5.54 mg/L, respectively). The RSD for TH-4 is 9%. There is one observation for W-1. The smallest median concentration of metals in supernate occurs in samples from W-4 and W-11 (2.36 mg/L and 2.245 mg/L, respectively). The RSD for W-11 is 0%. There is one observation from W-4, and the RSD is not computed.

Sr The largest median concentration of metals in supernate occur in the samples from TH-4 and W-4 (0.3745 mg/L and 0.262 mg/L, respectively). The RSD for TH-4 is 3%. There is one observation for W-4. The smallest median concentration of metals in supernate occurs in samples from W-3 and W-5 (0.0315 mg/L and 0.0084 mg/L, respectively). There is one observation from W-3 and W-5, and the RSD is not computed.

Th The largest median concentration of metals in supernate occur in the samples from TH-4 and W-4 (130.9 mg/L and 39.6 mg/L, respectively). The RSD for TH-4 is 81%. There is one observation for W-4. The smallest median concentration of metals in supernate occurs in samples from W-11 and W-5 (0.101 mg/L and 0.097 mg/L, respectively). There is one observation from W-11 and W-5, and the RSD is not computed.

U The largest median concentration of metals in supernate occur in the samples from TH-4, W-4, and W-9 (7,865 mg/L, 1,540 mg/L, and 1,520 mg/L, respectively). The RSD for TH-4 is 76%. There is one observation for W-4 and W-9. The smallest median concentration of metals in supernate occurs in samples from W-11 and W-2 (1.65 mg/L and 0.1 mg/L, respectively). The RSD for W-11 is 23%. There is one observation from W-2, and the RSD is not computed.

V All concentrations are reported as less than detection limits.

Zn The largest median concentration of metals in supernate occur in the samples from W-10 (0.368 mg/L). There is one observation for W-10. The smallest median concentration of metals in supernate occurs in samples from W-8 (0.0349 mg/L). There is one observation from W-8, and the RSD is not computed.

Table 9.1. Process metal concentration statistics for Tanks W-1, W-2, and W-11 supernate (mg/L)

Tank	W-1		W-2		W-11		
Process Metal	N	Median	N	Median	N	Median	RSD
Al	1	0.247	1	0.0242	1	0.026	NC
B	1	0.033	1	0.04	1	0.0203	NC
Be	0	NC	0	NC	0	NC	NC
Ca	1	42.5	1	28.2	2	23.65	1%
Co	0	NC	0	NC	0	NC	NC
Cu	1	0.0061	1	0.005	1	0.003	NC
Fe	1	0.187	1	0.037	2	0.0135	47%
K	1	15.4	1	38.8	2	7.665	1%
Mg	1	5.94	1	7.85	2	3.83	1%
Mn	0	NC	0	NC	0	NC	NC
Na	1	6.56	1	51.9	2	5.345	4%
Sb	0	NC	0	NC	0	NC	NC
Sl	1	5.54	1	3.86	2	2.245	0%
Sr	1	0.117	1	0.0953	2	0.0788	1%
Th	0	NC	0	NC	1	0.101	NC
U	0	NC	1	0.1	2	1.65	23%
V	0	NC	0	NC	0	NC	NC
Zn	0	NC	0	NC	0	NC	NC

Table 9.2. Process metal concentration statistics for Tanks W-3, W-4, W-5, W-6, and TH-4 supernate (mg/L)

Tank	W-3			W-4		W-5		W-6			TH-4		
Process Metal	N	Median	RSD	N	Median	N	Median	N	Median	RSD	N	Median	RSD
Al	2	5.143	117%	1	2.3	0	NC	2	2.5445	139%	2	1.5625	98%
B	2	0.195	15%	1	0.092	1	0.0531	2	0.1036	103%	2	1.018	20%
Be	0	NC	NC	0	NC	0	NC	0	NC	NC	0	NC	NC
Ca	2	15.45	40%	1	47.1	1	6.84	2	11.835	95%	2	263	8%
Co	2	0.0285	62%	1	0.19	1	0.0341	0	NC	NC	2	0.164	38%
Cu	0	NC	NC	0	NC	1	0.1	2	0.017	117%	2	0.0638	36%
Fe	2	0.2275	62%	1	0.448	1	0.0349	1	0.05	NC	2	0.5165	5%
K	2	19.75	8%	1	21.3	1	76.3	2	86.65	105%	2	260.5	37%
Mg	2	2.196	90%	0	NC	1	1.98	2	1.3355	77%	2	8.255	4%
Mn	2	0.0249	51%	1	0.173	1	0.008	0	NC	NC	2	0.3975	1%
Na	2	1705	54%	1	2200	1	4250	2	3400.5	126%	2	14500	42%
Sb	0	NC	NC	0	NC	0	NC	0	NC	NC	0	NC	NC
Sl	2	5.08	5%	1	2.36	0	NC	0	NC	NC	2	6.785	9%
Sr	2	0.0315	11%	1	0.262	1	0.0084	2	0.0328	111%	2	0.3745	3%
Th	2	5.31	53%	1	39.6	1	0.097	1	0.904	NC	2	130.9	81%
U	2	205.5	54%	1	1540	1	81.9	2	19.72	126%	2	7865	76%
V	0	NC	NC	0	NC	0	NC	0	NC	NC	0	NC	NC
Zn	0	NC	NC	0	NC	1	0.0534	0	NC	NC	0	NC	NC

Table 9.3. Process metal concentration statistics for Tanks W-8, W-9, and W-10 supernate (mg/L)

Tank	W-8		W-9		W-10	
Process Metal	N	Median	N	Median	N	Median
Al	0	NC	0	NC	1	0.968
B	1	0.713	1	0.347	1	0.323
Be	0	NC	0	NC	0	NC
Ca	1	29.8	1	22.1	1	16.8
Co	1	0.138	1	0.215	1	0.0116
Cu	1	0.586	1	0.694	1	0.0961
Fe	1	0.141	1	0.307	1	0.0296
K	1	627	1	896	1	819
Mg	1	5.39	1	3.97	1	2.81
Mn	1	0.0766	1	0.161	1	0.007
Na	1	4370	1	2640	1	2800
Sb	0	NC	0	NC	0	NC
Sl	0	NO	0	NO	0	NC
Sr	1	0.086	1	0.064	1	0.0514
Th	1	0.809	1	1.56	0	NC
U	1	746	1	1520	1	78.5
V	0	NC	0	NC	0	NC
Zn	1	0.0349	1	0.0529	1	0.388

9.1.2 Concentration Statistics for Supernate for Tank Groups

Concentration statistics for supernate for Tank Groups 1, 2, and 3 are presented in Tables 9.4–9.7. The following observations are made for each tank group.

Tank Group 1 Supernate RSDs.

RSD > 100%	Al, Fe, Na
50% < RSD < 100%	K, U
50% < RSD	B, Ca, Cu, Mg, Si, Sr
RSD Not Computed	Be, Co, Mn, Sb, Th, V, Zn

Tank Group 2 Supernate RSDs. High RSD (> 100%) is due to samples from TH-4 supernate.

RSD > 100%	Al, B, Ca, K, Mn, Na, Sr, Th, U
50% < RSD < 100%	Co, Cu, Fe, Mg,

50% < RSD Si
RSD Not Computed Be, Sb, V, Zn

Tank Group 3 Supernate RSDs.

RSD > 100% Al
50% < RSD < 100% Co, Cu, Fe, Mn, U
50% < RSD B, Ca, K, Mg, Na, Sr, Th
RSD Not Computed Al, Be, Sb, Si, V

Table 9.4. Process metal concentration statistics for all tank groups, supernate (mg/L)

Metal	Group	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Al	1	3	0.247	W-1	0.0242	W-2	0.026	0.2228	0.10	129%
	2	7	9.4	W-3	0.0489	W-6	2.3	9.3511	2.97	111%
	3	1	0.968	W-10	0.968	W-10	0.968	0	0.97	NC
B	1	3	0.04	W-2	0.0203	W-11	0.033	0.0197	0.03	32%
	2	8	1.16	TH-4	0.0281	W-6	0.177	1.1319	0.35	123%
	3	3	0.713	W-8	0.323	W-10	0.347	0.39	0.46	47%
Be	1	0	NC	NC	NC	NC	NC	NC	NC	NC
	2	0	NC	NC	NC	NC	NC	NC	NC	NC
	3	0	NC	NC	NC	NC	NC	NC	NC	NC
Ca	1	4	42.5	W-1	23.5	W-11	26	19	29.50	30%
	2	8	277	TH-4	3.87	W-6	19.8	273.13	79.31	144%
	3	3	29.8	W-8	16.8	W-10	22.1	13	22.90	29%
Co	1	0	NC	NC	NC	NC	NC	NC	NC	NC
	2	6	0.208	TH-4	0.016	W-3	0.0805	0.192	0.10	82%
	3	3	0.215	W-9	0.0116	W-10	0.138	0.2034	0.12	84%
Cu	1	3	0.0061	W-1	0.003	W-11	0.005	0.0031	0.00	33%
	2	5	0.1	W-5	0.0029	W-6	0.0475	0.0971	0.05	74%
	3	3	0.694	W-9	0.0961	W-10	0.586	0.5979	0.46	69%
Fe	1	4	0.187	W-1	0.009	W-11	0.0275	0.178	0.06	133%
	2	7	0.535	TH-4	0.0349	W-5	0.327	0.5001	0.29	75%
	3	3	0.307	W-9	0.0296	W-10	0.141	0.2774	0.16	88%
K	1	4	38.8	W-2	7.63	W-11	11.55	31.17	17.38	85%
	2	8	329	TH-4	18.7	W-3	49.3	310.3	103.93	109%
	3	3	896	W-9	627	W-8	819	269	780.67	18%
Mg	1	4	7.85	W-2	3.8	W-11	4.9	4.05	5.36	36%

Table 9.4 cont.

Metal	Group	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
	2	7	8.5	TH-4	0.611	W-6	2.06	7.889	3.65	90%
	3	3	5.39	W-8	2.81	W-10	3.97	2.58	4.06	32%
Mn	1	0	NC	NC	NC	NC	NC	NC	NC	NC
	2	6	0.4	TH-4	0.008	W-5	0.1034	0.392	0.17	108%
	3	3	0.161	W-9	0.007	W-10	0.0766	0.154	0.08	95%
Na	1	4	51.9	W-2	5.18	W-11	6.035	46.72	17.29	134%
	2	8	18800	TH-4	361	W-6	3305	18439	5707.63	108%
	3	3	4370	W-8	2640	W-9	2800	1730	3270.00	29%
Sb	1	0	NC	NC	NC	NC	NC	NC	NC	NC
	2	0	NC	NC	NC	NC	NC	NC	NC	NC
	3	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	1	4	5.54	W-1	2.24	W-11	3.055	3.3	3.47	45%
	2	5	7.21	TH-4	2.36	W-4	5.26	4.85	5.22	35%
	3	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr	1	4	0.117	W-1	0.078	W-11	0.0874	0.039	0.09	20%
	2	8	0.383	TH-4	0.0071	W-6	0.0462	0.3759	0.14	115%
	3	3	0.086	W-8	0.0514	W-10	0.064	0.0346	0.07	26%
Th	1	1	0.101	W-11	0.101	W-11	0.101	0	0.10	NC
	2	7	206	TH-4	0.097	W-5	7.31	205.903	44.72	166%
	3	2	1.56	W-9	0.809	W-8	1.1845	0.751	1.18	45%
U	1	3	1.92	W-11	0.1	W-2	1.38	1.82	1.13	82%
	2	8	12100	TH-4	2.14	TH-4	205.5	12097.9	2225.29	188%
	3	3	1520	W-9	78.5	W-10	746	1441.5	781.50	92%
V	1	0	NC	NC	NC	NC	NC	NC	NC	NC
	2	0	NC	NC	NC	NC	NC	NC	NC	NC
	3	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	1	0	NC	NC	NC	NC	NC	NC	NC	NC
	2	1	0.0534	W-5	0.0534	W-5	0.0534	0	0.05	NC
	3	3	0.388	W-10	0.0349	W-8	0.0529	0.3531	0.16	125%

Table 9.5. Process metal concentration statistics for Tank Group 1, supernate (mg/L)

Tank Group	1								
Supernate	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Al	3	0.247	W-1	0.0242	W-2	0.026	0.2228	0.10	129%
B	3	0.04	W-2	0.0203	W-11	0.033	0.0197	0.03	32%
Be	0	NC	NC	NC	NC	NC	NC	NC	NC
Ca	4	42.5	W-1	23.5	W-11	26	19	29.50	30%
Co	0	NC	NC	NC	NC	NC	NC	NC	NC
Cu	3	0.0061	W-1	0.003	W-11	0.005	0.0031	0.00	33%
Fe	4	0.187	W-1	0.009	W-11	0.0275	0.178	0.06	133%
K	4	38.8	W-2	7.63	W-11	11.55	31.17	17.38	85%
Mg	4	7.85	W-2	3.8	W-11	4.9	4.05	5.36	36%
Mn	0	NC	NC	NC	NC	NC	NC	NC	NC
Na	4	51.9	W-2	5.18	W-11	6.035	46.72	17.29	134%
Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	4	5.54	W-1	2.24	W-11	3.055	3.3	3.47	45%
Sr	4	0.117	W-1	0.078	W-11	0.0874	0.039	0.09	20%
Th	1	0.101	W-11	0.101	W-11	0.101	0	0.10	NC
U	3	1.92	W-11	0.1	W-2	1.38	1.82	1.13	82%
V	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	0	NC	NC	NC	NC	NC	NC	NC	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.6. Process metal concentration statistics for Tank Group 2, supernate (mg/L)

Tank Group	2								
Supernate	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Al	7	9.4	W-3	0.0489	W-6	2.3	9.3511	2.97	111%
B	8	1.16	TH-4	0.0281	W-6	0.177	1.1319	0.35	123%
Be	0	NC	NC	NC	NC	NC	NC	NC	NC
Ca	8	277	TH-4	3.87	W-6	19.8	273.13	79.31	144%
Co	6	0.208	TH-4	0.016	W-3	0.0805	0.192	0.10	82%
Cu	5	0.1	W-5	0.0029	W-6	0.0475	0.0971	0.05	74%
Fe	7	0.535	TH-4	0.0349	W-5	0.327	0.5001	0.29	75%
K	8	329	TH-4	18.7	W-3	49.3	310.3	103.93	109%
Mg	7	8.5	TH-4	0.611	W-6	2.06	7.889	3.65	90%
Mn	6	0.4	TH-4	0.008	W-5	0.1034	0.392	0.17	108%
Na	8	18800	TH-4	361	W-6	3305	18439	5707.63	108%
Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	5	7.21	TH-4	2.36	W-4	5.26	4.85	5.22	35%
Sr	8	0.383	TH-4	0.0071	W-6	0.0462	0.3759	0.14	115%
Th	7	206	TH-4	0.097	W-5	7.31	205.903	44.72	166%
U	8	12100	TH-4	2.14	TH-4	205.5	12097.9	2225.29	188%
V	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	1	0.0534	W-5	0.0534	W-5	0.0534	0	0.05	NC

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.7. Process metal concentration statistics for Tank Group 3, supernate (mg/L)

Tank Group	3								
Supernate	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Al	1	0.968	W-10	0.968	W-10	0.968	0	0.97	NC
B	3	0.713	W-8	0.323	W-10	0.347	0.39	0.46	47%
Be	0	NC	NC	NC	NC	NC	NC	NC	NC
Ca	3	29.8	W-8	16.8	W-10	22.1	13	22.90	29%
Co	3	0.215	W-9	0.0116	W-10	0.138	0.2034	0.12	84%
Cu	3	0.694	W-9	0.0961	W-10	0.586	0.5979	0.46	69%
Fe	3	0.307	W-9	0.0296	W-10	0.141	0.2774	0.16	88%
K	3	896	W-9	627	W-8	819	269	780.67	18%
Mg	3	5.39	W-8	2.81	W-10	3.97	2.58	4.06	32%
Mn	3	0.161	W-9	0.007	W-10	0.0766	0.154	0.08	95%
Na	3	4370	W-8	2640	W-9	2800	1730	3270.00	29%
Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr	3	0.086	W-8	0.0514	W-10	0.064	0.0346	0.07	26%
Th	2	1.56	W-9	0.809	W-8	1.1845	0.751	1.18	45%
U	3	1520	W-9	78.5	W-10	746	1441.5	781.50	92%
V	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	3	0.388	W-10	0.0349	W-8	0.0529	0.3531	0.16	125%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

9.1.3 Maximum Supernate Concentrations by Tanks Within Each Tank Group

The tanks that exhibit the maximum supernate metal concentrations for each tank group are identified in Table 9.8. Tanks that exhibit the maximum sludge concentrations are also identified for comparison purposes. As an example, Tanks W-1, W-3, and W-10 exhibit the maximum concentration for Al in supernate for tank groups 1, 2, and 3.

Table 9.8. Identification of tanks with maximum values of process metals for tank groups

Tank Group	1	2	2	3	3
Metal	Supernate	Sludge	Supernate	Sludge	Supernate
Al	W-1	W-3	W-3	W-10	W-10
B	W-2	W-5	TH-4	W-7	W-8
Be	NC	W-4	NC	W-8	NC
Ca	W-1	W-6	TH-4	W-10	W-8
Co	NC	W-6	TH-4	W-10	W-9
Cu	W-1	W-6	W-5	W-7	W-9
Fe	W-1	W-6	TH-4	W-7	W-9
K	W-2	W-5	TH-4	W-7	W-9
Mg	W-2	W-6	TH-4	W-8	W-8
Mn	NC	W-5	TH-4	W-7	W-9
Na	W-2	W-6	TH-4	W-7	W-8
Sb	NC	W-5	NC	NC	NC
Si	W-1	W-6	TH-4	NC	NC
Sr	W-1	W-6	TH-4	W-10	W-8
Th	W-11	TH-4	TH-4	W-8	W-9
U	W-11	W-4	TH-4	W-7	W-9
V	NC	NC	NC	W-8	NC
Zn	NC	W-6	W-5	W-10	W-10

NC = Not Calculated

9.1.4 Maximum Supernate Concentrations by Tanks Sorted by Tank Groups

Tanks that exhibit the maximum supernate metal concentrations are ordered for each tank group and presented in Tables 9.9, 9.10, and 9.11 for Tank Groups 1, 2, and 3, respectively. Tanks that exhibit the maximum sludge concentrations are also identified for comparison purposes. As a first example, Tank W-1 exhibits the maximum supernate metal concentrations for Al, Ca, Cu, Fe, Si, and Sr. As a second example, Tank W-3 exhibits the maximum supernate metal concentrations for Al. As a third example, Tank W-8 exhibits the maximum supernate metal concentrations for B, Ca, Mg, Na, and Sr.

Table 9.10. Identification of tanks with maximum values of process metals for tank groups sorted by tank group 2 supernate

Tank Group	2
Metal	Supernate
B	TH-4
Ca	TH-4
Co	TH-4
Fe	TH-4
K	TH-4
Mg	TH-4
Mn	TH-4
Na	TH-4
Si	TH-4
Sr	TH-4
Th	TH-4
U	TH-4
Al	W-3
Cu	W-5
Zn	W-5
Be	NC
Sb	NC
V	NC

NC = Not Calculated

Table 9.9. Identification of Tanks with maximum values of process metals for tank groups sorted by Tank Group 1 supernate

Tank Group	1
Metal	Supernate
Al	W-1
Ca	W-1
Cu	W-1
Fe	W-1
Si	W-1
Sr	W-1
B	W-2
K	W-2
Mg	W-2
Na	W-2
Th	W-11
U	W-11
Be	NC
Co	NC
Mn	NC
Sb	NC
V	NC
Zn	NC

NC = Not Calculated

Table 9.11. Identification of tank maximum values of process metals for tank groups sorted by Tank Group 3 supernate

Tank Group	3
Metal	Supernate
B	W-8
Ca	W-8
Mg	W-8
Na	W-8
Sr	W-8
Co	W-9
Cu	W-9
Fe	W-9
K	W-9
Mn	W-9
Th	W-9
U	W-9
Al	W-10
Zn	W-10
Be	NC
Sb	NC
Si	NC
V	NC

NC = Not Calculated

9.2 PROCESS METALS IN SLUDGES

9.2.1 Concentration Statistics for Sludge for Individual Tanks

Concentration statistics for sludge for individual tanks are presented in Tables 9.12–9.22. Statistics presented are the minimum, the 25%-tile, the median, the 75%-tile, the maximum, the average, and the RSD for each process metal concentration for individual tanks. The following observations are provided for median concentrations and for the spatial variability of the concentrations.

Median Concentrations. The median concentration is that value such that 50% of the concentrations occur either above or below the median value. The median is always less than the average for concentrations that are highly skewed to the right. Concentrations that are highly skewed to the right occur when the difference between the median (or the average) concentration and the maximum concentration is large. Concentrations that are highly skewed will exhibit a

large (> 100%) RSD. Concentrations that are not highly skewed to the right occur when the difference between the median (or the average) concentration and the maximum concentration is small. Concentrations that are not highly skewed will exhibit a small (< 25% to 50%) RSD.

Al The largest median concentration of metals in sludges occur in samples from W-10, W-5, and W-6 (30,200 mg/kg, 15,700 mg/kg, and 10,900 mg/kg, respectively). All RSDs are less than 35%. The smallest median concentration of metals in sludges occur in samples from W-3 and W-7 Chips (913 mg/kg and 594 mg/kg, respectively). All RSDs are greater than 100%.

B The largest median concentration of metals in sludges occur in samples from W-7 Layer, W-7, W-5 (38.60 mg/kg, 24.20 mg/kg, and 16.30 mg/kg, respectively). RSDs are 85%, 16%, and 118%, respectively. The smallest median concentration of metals in sludges occur in samples from W-10 and W-3 (3.50 mg/kg and 3.12 mg/kg, respectively). RSDs are 63% and 8%, respectively.

Be The largest median concentration of metals in sludges occur in samples from W-4 and W-8 (11.08 mg/kg and 9.71 mg/kg, respectively). RSDs are less than 60%. The smallest median concentration of metals in sludges occur in samples from W-7, TH-4, and W-5 (2.19 mg/kg, 3.12 mg/kg, and 0.67 mg/kg, respectively). RSDs are 40% and 43%, respectively, for W-7 and TH-4. The RSD was not computed for the one observation for W-5.

Ca The largest median concentration of metals in sludges occur in samples from W-6, W-5, and W-10 (29,800 mg/kg, 11,300 mg/kg, and 8,810 mg/kg, respectively). All RSDs are less than 45%. The smallest median concentration of metals in sludges occur in samples from W-7 Layer and W-7 Chips (702 mg/kg and 314 mg/kg, respectively). All RSDs are greater than 65%.

Co The largest median concentration of metals in sludges occur in samples from W-6, W-4, and W-10 (7.35 mg/kg, 5.20 mg/kg, and 4.50 mg/kg, respectively). RSDs are 87%. and 12% for W-6 and W-4. The RSD was not computed for the one observation for W-10. The smallest median concentration of metals in sludges occur in samples from W-9 and W-8, and W-7 Chips (2.90 mg/kg, 2.70 mg/kg, and 2.67 mg/kg, respectively). All RSDs are less than 30%. The RSD was not computed for the one observation for the W-7 Chips.

Cu The largest median concentration of metals in sludges occur in samples from W-7, W-10, and W-8 (98.0 mg/kg, 75.0 mg/kg, and 62.2 mg/kg, respectively). All RSDs are less than 20%. The smallest median concentration of metals in sludges occur in samples from W-4 and TH-4 (22.7 mg/kg and 16.4 mg/kg, respectively). RSDs are 82% and 21%, respectively.

Fe The largest median concentration of metals in sludges occur in samples from W-5, W-6, and W-7 Layer (19,200 mg/kg, 14,200 mg/kg, and 10,544 mg/kg, respectively). RSDs for W-5 and W-6 are less than 20%. W-7 Layer RSD is 131%. The smallest median concentration of metals in sludges occur in samples from W-7 Chips and W-3 (332 mg/kg and 245 mg/kg, respectively). W-7 Chips RSD is 39% and W-3 RSD is 139%.

K The largest median concentration of metals in sludges occur in samples from W-7 Chips, W-7, and W-7 Layer (10,015 mg/kg, 9,170 mg/kg, and 8,175 mg/kg, respectively). All RSDs are less than 35%. The smallest median concentration of metals in sludges occur

in samples from W-3 and W-4 (334 mg/kg and 275 mg/kg, respectively). All RSDs are less than 35%.

Mg The largest median concentration of metals in sludges occurs in samples from W-8 (5,520 mg/kg). The RSD is less than 45%. The smallest median concentration of metals in sludges occur in samples from W-4 and W-7 Layer (179 mg/kg and 149 mg/kg, respectively). The RSDs are 97% and 51%, respectively.

Mn The largest median concentration of metals in sludges occur in samples from W-6 and W-5 (801 mg/kg and 433 mg/kg, respectively). All RSDs are less than 70%. The smallest median concentration of metals in sludges occur in samples from W-4 and W-7 Chips (26.8 mg/kg and 23.7 mg/kg, respectively). All RSDs are less than 45%.

Na The largest median concentration of metals in sludges occur in samples from W-7 Layer, W-7 Chips, and W-7 Chips (67,400 mg/kg, 57,800 mg/kg, and 43,200 mg/kg, respectively). All RSDs are less than 20%. The smallest median concentration of metals in sludges occur in samples from W-3 and W-9 (9,540 mg/kg and 6,310 mg/kg, respectively). All RSDs are less than 40%.

Sb All samples were reported as less than detection limits.

Si The largest median concentration of metals in sludges occur in samples from W-6 and W-3 (3,360 mg/kg and 509 mg/kg, respectively). Only one observation was reported for both tanks. The smallest median concentration of metals in sludges occur in samples from W-4 and TH-4 (234 mg/kg and 198 mg/kg, respectively). All RSDs are less than 26%.

Sr The largest median concentration of metals in sludges occur in samples from W-6, W-10, and W-8 (64.6 mg/kg, 63.9 mg/kg, and 50.2 mg/kg, respectively). All RSDs are less than 35%. The smallest median concentration of metals in sludges occur in samples from W-7 Layer and W-7 Chips (8.6 mg/kg and 3.1 mg/kg, respectively). All RSDs are less than 75%.

Th The largest median concentration of metals in sludges occur in samples from TH-4 and W-8 (115,000 mg/kg and 14,300 mg/kg, respectively). All RSDs are less than 50%. The smallest median concentration of metals in sludges occur in samples from W-6 and W-5 (679 mg/kg and 319 mg/kg, respectively). The RSD for W-6 is 89% and for W-5 is 161%.

U The largest median concentration of metals in sludges occur in samples from W-7 Chips, W-7 Layer, and W-7 (217,000 mg/kg, 121,050 mg/kg, and 117,950 mg/kg, respectively). All RSDs are less than 75%. The smallest median concentration of metals in sludges occur in samples from W-5 (927 mg/kg). The RSD is 163%.

V The median concentration of metals in sludges occur in samples from W-7 Chips , W-7, and W-7 Layer (2.6 mg/kg, 2.1 mg/kg, and 1.5 mg/kg, respectively). All RSDs are less than 25%.

Zn The largest median concentration of metals in sludges occur in samples from W-6, W-10, and W-8 (157 mg/kg, 110 mg/kg, and 95.6 mg/kg, respectively). W-6 RSDs is 70% and the other RSDs are less than 15%. The smallest median concentration of metals in sludges occur in samples from W-3, W-4, and W-7 Chips (10.7 mg/kg, 10.1 mg/kg, and 8.2 mg/kg, respectively). The RSD for W-3 is 100%, and the other RSDs are less than 20%.

Spatial Variability. RSDs for concentrations for metals for each tank that exceed 100% indicate large spatial variability. RSDs for concentrations for metals for each tank that are less

than 25% to 50% indicate small spatial variability. The maximum number of samples used to compute the RSD is 5, and the minimum number of samples used to compute the RSD is 2.

Al The greatest spatial variability of metals in sludges occur in samples from W-3 and W-7 Chips (165% and 137%, respectively). The least spatial variability of metals in sludges occur in samples from Tanks W-6, W-10, W-9, W-8 (11% to 3%).

B The greatest spatial variability of metals in sludges occur in samples from W-5 (118%). The least spatial variability of metals in sludges occur in samples from Tanks W-7, W-3, W-4, W-9, and W-7 Chips (16% to 1%).

Be No samples exhibit spatial variability of metals in sludges greater than 100%. The least spatial variability of metals in sludges occur in samples from Tanks W-9 (22%).

Ca No samples exhibit spatial variability of metals in sludges greater than 100%. The least spatial variability of metals in sludges occur in samples from Tanks W-8, W-6, TH-4, W-7 Chips, and W-9 (12% to 3%).

Co No samples exhibit spatial variability of metals in sludges greater than 100%. The least spatial variability of metals in sludges occur in samples from Tanks W-8, W-3, and W-4 (13% to 12%).

Cu No samples exhibit spatial variability of metals in sludges greater than 100%. The least spatial variability of metals in sludges occur in samples from Tanks W-5, W-7 Layer, TH-4, W-8, W-7, W-10, and W-9 (22% to 4%).

Fe The greatest spatial variability of metals in sludges occur in samples from W-3 and W-7 Layer (139% to 131%). The least spatial variability of metals in sludges occur in samples from Tanks W-6, W-5, TH-4, and W-9 (20% to 6%).

K No samples exhibit spatial variability of metals in sludges greater than 100%. The least spatial variability of metals in sludges occur in samples from Tanks W-5, W-7, W-10, W-7 Chips, W-3, and W-8 (24% to 5%).

Mg The greatest spatial variability of metals in sludges occur in samples from W-5, W-6, and W-4 (155% to 97%). The least spatial variability of metals in sludges occur in samples from Tanks W-7 Chips and W-9 (24% to 17%).

Mn The greatest spatial variability of metals in sludges occur in samples from W-7 Layer (121%). The least spatial variability of metals in sludges occur in samples from Tanks W-7 Chips, W-8, TH-4, and W-9 (25% to 3%).

Na No samples exhibit spatial variability of metals in sludges greater than 100%. The least spatial variability of metals in sludges occur in samples from Tanks W-7, W-10, W-9, W-6, TH-4, W-7 Chips, and W-7 Layer (20% to 3%).

Si No samples exhibit spatial variability of metals in sludges greater than 100%. The least spatial variability of metals in sludges occur in samples from Tanks W-4 and TH-4 (26% to 23%). Si was analyzed only in Phase I, and it was reviewed as an estimated detect and as a matrix spike.

Sr No samples exhibit spatial variability of metals in sludges greater than 100%. The least spatial variability of metals in sludges occur in samples from Tanks W-8, W-5, W-6, and W-9 (22% to 5%).

Th The greatest spatial variability of metals in sludges occur in samples from W-5 (161%). The least spatial variability of metals in sludges occur in samples from Tanks W-4, W-8, W-7, W-9, and W-7 Chips (26% to 1%).

U The greatest spatial variability of metals in sludges occur in samples from W-5 and W-6 (163 to 115%%). There is a tight cluster of variability for samples from W-4, W-10, W-7 Layer, W-3, TH-4, W-9, and W-7 (72% to 53%). The least spatial variability of metals in sludges occur in samples from Tanks W-8 and W-7 Chips (8% to 3%).

V No samples exhibit spatial variability of metals in sludges greater than 100%. The least spatial variability of metals in sludges occur in samples from Tanks W-7, W-7 Chips, and W-7 Layer (25% to 0%).

Zn The greatest spatial variability of metals in sludges occur in samples from W-3 (100%). The least spatial variability of metals in sludges occur in samples from Tanks W-4, W-5, W-9, W-8, W-10, and W-7 Chips (19% to 1%).

Table 9.12. Process metal concentration statistics for sludge for Tank W-3 (mg/kg)

Tank	Metal	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Range	Average	RSD (%)
W-3	Al	3	733	823	913	26,007	51,100	50,367	17,582	165%
W-3	B	2	2.94	3.03	3.12	3.21	3.30	0.36	3.12	8%
W-3	Be	0	NC	NC	NC	NC	NC	NC	NC	NC
W-3	Ca	3	7,160	7,640	8,120	10,760	13,400	6,240	9,560	35%
W-3	Co	2	3.20	3.36	3.51	3.67	3.82	0.62	3.51	12%
W-3	Cu	3	17.5	22.4	27.2	29.8	32.3	14.8	25.7	29%
W-3	Fe	3	195	220	245	1,568	2,890	2,695	1,110	139%
W-3	K	3	298	316	334	358	381	83	338	12%
W-3	Mg	3	303	440	577	726	874	571	585	49%
W-3	Mn	3	26.4	35.3	44.1	85.6	127.0	100.6	65.8	82%
W-3	Na	3	8,380	8,960	9,540	13,220	16,900	8,520	11,607	40%
W-3	Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
W-3	Si	1	NC	NC	509	NC	NC	509	509	NC
W-3	Sr	3	17.5	19.4	21.2	26.5	31.8	14.3	23.5	32%
W-3	Th	2	1,320	1,530	1,740	1,950	2,160	840	1,740	34%
W-3	U	3	42,300	45,100	47,900	87,950	128,000	85,700	72,733	66%
W-3	V	0	NC	NC	NC	NC	NC	NC	NC	NC
W-3	Zn	2	3.1	6.9	10.7	14.4	18.2	15.1	10.7	100%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.13. Process metal concentration statistics for sludge for Tank W-4 (mg/kg)

Tank	Metal	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Range	Average	RSD (%)
W-4	Al	4	815	2,116	5,015	7,648	8,150	7,335	4,749	76%
W-4	B	2	4.86	5.01	5.15	5.30	5.44	0.58	5.15	8%
W-4	Be	2	7	8.81	11.08	13.34	15.60	9.05	11.08	58%
W-4	Ca	4	620	667	1,172	1,755	2,040	1,420	1,251	57%
W-4	Co	2	4.76	4.98	5.20	5.42	5.64	0.88	5.20	12%
W-4	Cu	4	6.0	6.8	22.7	38.6	39.6	33.6	22.8	82%
W-4	Fe	4	294	703	930	1,190	1,700	1,406	963	60%
W-4	K	4	219	243	275	339	459	240	307	35%
W-4	Mg	4	48	62	179	353	538	490	236	97%
W-4	Mn	4	18.0	23.2	26.8	33.3	47.2	29.2	29.7	42%
W-4	Na	4	10,900	11,500	18,350	26,300	30,200	19,300	19,450	50%
W-4	Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
W-4	Si	2	190	212	234	255	277	87	234	26%
W-4	Sr	4	3.2	3.3	9.9	17.9	22.2	19.0	11.3	84%
W-4	Th	2	3,050	3,395	3,740	4,085	4,430	1,380	3,740	26%
W-4	U	4	43,100	48,200	117,950	192,250	211,000	167,900	122,500	72%
W-4	V	0	NC	NC	NC	NC	NC	NC	NC	NC
W-4	Zn	4	7.9	9.4	10.1	10.9	12.6	4.7	10.2	19%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.14. Process metal concentration statistics for sludge for Tank W-5 (mg/kg)

Tank	Metal	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Range	Average	RSD (%)
W-5	Al	3	10,400	13,050	15,700	18,450	21,200	10,800	15,767	34%
W-5	B	3	11.80	14.05	16.30	60.15	104.00	92.20	44.03	118%
W-5	Be	1	NC	NC	0.67	NC	NC	0.67	0.67	NC
W-5	Ca	3	9,000	10,150	11,300	15,600	19,900	10,900	13,400	43%
W-5	Co	0	NC	NC	NC	NC	NC	NC	NC	NC
W-5	Cu	3	26.5	28.6	30.7	35.6	40.5	14.0	32.6	22%
W-5	Fe	3	14,400	16,800	19,200	19,300	19,400	5,000	17,667	16%
W-5	K	3	310	373	436	473	509	199	418	24%
W-5	Mg	3	284	380	476	5,288	10,100	9,816	3,620	155%

Table 9.14 cont.

W-5	Mn	3	276.0	354.5	433.0	481.5	530.0	254.0	413.0	31%
W-5	Na	3	21,100	26,000	30,900	41,800	52,700	31,600	34,900	46%
W-5	Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
W-5	Si	0	NC	NC	NC	NC	NC	NC	NC	NC
W-5	Sr	3	24.5	28.8	33.1	33.5	33.9	9.4	30.5	17%
W-5	Th	3	95	207	319	4,345	8,370	8,275	2,928	161%
W-5	U	3	895	911	927	23,214	45,500	44,605	15,774	163%
W-5	V	0	NC	NC	NC	NC	NC	NC	NC	NC
W-5	Zn	3	26.0	26.6	27.1	31.2	35.2	9.2	29.4	17%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.15. Process metal concentration statistics for sludge for Tank W-6 (mg/kg)

Tank	Metal	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Range	Average	RSD (%)
W-6	Al	3	9,630	10,265	10,900	11,500	12,100	2,470	10,877	11%
W-6	B	3	6.36	8.12	9.87	12.09	14.30	7.94	10.18	39%
W-6	Be	0	NC	NC	NC	NC	NC	NC	NC	NC
W-6	Ca	3	25,800	27,800	29,800	30,700	31,600	5,800	29,067	10%
W-6	Co	3	4.89	6.12	7.35	15.78	24.20	19.31	12.15	87%
W-6	Cu	3	31.2	36.4	41.5	50.2	58.8	27.6	43.8	32%
W-6	Fe	3	9,950	12,075	14,200	14,450	14,700	4,750	12,950	20%
W-6	K	3	595	680	764	942	1,120	525	826	32%
W-6	Mg	3	91	418	746	2,143	3,540	3,449	1,459	126%
W-6	Mn	3	341.0	571.0	801.0	1,155.5	1,510.0	1,169.0	884.0	67%
W-6	Na	3	35,800	39,100	42,400	43,150	43,900	8,100	40,700	11%
W-6	Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
W-6	Si	1	NC	NC	3,360	NC	NC	3,360	3,360	NC
W-6	Sr	3	54.5	59.6	64.6	64.9	65.1	10.6	61.4	10%
W-6	Th	3	86	383	679	1,000	1,320	1,234	695	89%
W-6	U	3	8,860	13,380	17,900	54,500	91,100	82,240	39,287	115%
W-6	V	0	NC	NC	NC	NC	NC	NC	NC	NC
W-6	Zn	3	89.9	123.5	157.0	259.5	362.0	272.1	203.0	70%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.16. Process metal concentration statistics for sludge for Tank W-7 (mg/kg)

Tank	Metal	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Range	Average	RSD (%)
W-7	Al	5	3,160	4,130	5,130	5,970	6,580	3,420	4,994	28%
W-7	B	5	19.90	21.50	24.20	24.30	30.10	10.20	24.00	16%
W-7	Be	3	1	1.59	2.19	2.26	2.32	1.33	1.83	40%
W-7	Ca	5	477	791	1,300	1,440	2,600	2,123	1,322	62%
W-7	Co	0	NC	NC	NC	NC	NC	NC	NC	NC
W-7	Cu	5	78.4	80.0	98.0	100.0	115.0	36.6	94.3	16%
W-7	Fe	5	715	887	4,670	5,250	6,570	5,855	3,618	74%
W-7	K	5	8,310	8,330	9,170	10,900	13,000	4,690	9,942	20%
W-7	Mg	5	145	267	273	299	409	264	279	34%
W-7	Mn	5	20.5	34.8	83.4	110.0	116.0	95.5	72.9	60%
W-7	Na	5	41,100	42,900	43,200	54,400	63,500	22,400	49,020	20%
W-7	Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
W-7	Si	0	NC	NC	NC	NC	NC	NC	NC	NC
W-7	Sr	5	3.8	7.7	11.4	12.6	16.1	12.3	10.3	46%
W-7	Th	5	3,180	3,920	4,180	4,490	4,710	1,530	4,096	14%
W-7	U	5	63,500	73,400	84,600	86,800	195,000	131,500	100,660	53%
W-7	V	2	1.7	1.9	2.1	2.3	2.5	0.7	2.1	25%
W-7	Zn	5	22.1	31.1	31.8	33.4	49.7	27.6	33.6	30%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.17. Process metal concentration statistics for sludge for Tank W-7 Chips (mg/kg)

Tank	Metal	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Range	Average	RSD (%)
W-7 Chip	Al	2	18	306	594	882	1,170	1,153	594	137%
W-7 Chip	B	2	13.40	13.45	13.50	13.55	13.60	0.20	13.50	1%
W-7 Chip	Be	0	NC	NC	NC	NC	NC	NC	NC	NC
W-7 Chip	Ca	2	301	307	314	320	326	25	314	6%
W-7 Chip	Co	1	NC	NC	2.67	NC	NC	2.67	2.67	NC
W-7 Chip	Cu	2	30.8	35.4	40.1	44.7	49.3	18.5	40.1	33%
W-7 Chip	Fe	2	240	286	332	377	423	183	332	39%
W-7 Chip	K	2	8,930	9,473	10,015	10,558	11,100	2,170	10,015	15%
W-7 Chip	Mg	2	176	194	212	229	247	71	212	24%
W-7 Chip	Mn	2	19.5	21.6	23.7	25.8	27.9	8.4	23.7	25%
W-7 Chip	Na	2	56,100	56,950	57,800	58,650	59,500	3,400	57,800	4%
W-7 Chip	Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
W-7 Chip	Si	0	NC	NC	NC	NC	NC	NC	NC	NC
W-7 Chip	Sr	2	2.4	2.8	3.1	3.5	3.8	1.4	3.1	31%
W-7 Chip	Th	2	5,060	5,085	5,110	5,135	5,160	100	5,110	1%
W-7 Chip	U	2	212,000	214,500	217,000	219,500	222,000	10,000	217,000	3%
W-7 Chip	V	2	2.3	2.4	2.6	2.8	2.9	0.6	2.6	17%
W-7 Chip	Zn	2	8.1	8.1	8.2	8.2	8.3	0.2	8.2	1%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.18. Process metal concentration statistics for sludge for Tank W-7 Layers (mg/kg)

Tank	Metal	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Range	Average	RSD (%)
W-7 Layer	Al	2	1,190	2,058	2,925	3,793	4,660	3,470	2,925	84%
W-7 Layer	B	2	15.30	26.95	38.60	50.25	61.90	46.60	38.60	85%
W-7 Layer	Be	0	NC	NC	NC	NC	NC	NC	NC	NC
W-7 Layer	Ca	2	384	543	702	861	1,020	636	702	64%
W-7 Layer	Co	0	NC	NC	NC	NC	NC	NC	NC	NC
W-7 Layer	Cu	2	43.8	47.8	51.8	55.8	59.8	16.0	51.8	22%
W-7 Layer	Fe	2	787	5,665	10,544	15,422	20,300	19,513	10,544	131%
W-7 Layer	K	2	6,150	7,163	8,175	9,188	10,200	4,050	8,175	35%
W-7 Layer	Mg	2	95	122	149	176	203	108	149	51%
W-7 Layer	Mn	2	36.6	147.2	257.8	368.4	479.0	442.4	257.8	121%
W-7 Layer	Na	2	66,100	66,750	67,400	68,050	68,700	2,600	67,400	3%
W-7 Layer	Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
W-7 Layer	Si	0	NC	NC	NC	NC	NC	NC	NC	NC
W-7 Layer	Sr	2	4.2	6.4	8.6	10.8	13.0	8.8	8.6	72%
W-7 Layer	Th	2	1,510	2,193	2,875	3,558	4,240	2,730	2,875	67%
W-7 Layer	U	2	63,100	92,075	121,050	150,025	179,000	115,900	121,050	68%
W-7 Layer	V	2	1.5	1.5	1.5	1.5	1.5	0.0	1.5	0%
W-7 Layer	Zn	2	18.5	21.1	23.7	26.2	28.8	10.3	23.7	31%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.19. Process metal concentration statistics for sludge for Tank W-8 (mg/kg)

Tank	Metal	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Range	Average	RSD (%)
W-8	Al	3	9,800	9,840	9,880	10,090	10,300	500	9,993	3%
W-8	B	3	10.60	11.85	13.10	23.80	34.50	23.90	19.40	68%
W-8	Be	3	9	9.19	9.71	12.16	14.60	5.93	10.99	29%
W-8	Ca	3	7,230	7,540	7,850	8,495	9,140	1,910	8,073	12%
W-8	Co	2	2.45	2.58	2.70	2.83	2.95	0.50	2.70	13%
W-8	Cu	3	44.0	53.1	62.2	62.4	62.6	18.6	56.3	19%
W-8	Fe	3	4,100	5,010	5,920	7,580	9,240	5,140	6,420	41%
W-8	K	3	1,370	1,395	1,420	1,460	1,500	130	1,430	5%
W-8	Mg	3	5,460	5,490	5,520	8,310	11,100	5,640	7,360	44%
W-8	Mn	3	98.5	120.3	142.0	152.5	163.0	64.5	134.5	24%
W-8	Na	3	5,070	7,400	9,730	9,915	10,100	5,030	8,300	34%
W-8	Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
W-8	Si	0	NC	NC	NC	NC	NC	NC	NC	NC
W-8	Sr	3	35.4	42.8	50.2	52.8	55.4	20.0	47.0	22%
W-8	Th	3	9,750	12,025	14,300	15,350	16,400	6,650	13,483	25%
W-8	U	3	5,070	5,380	5,690	5,810	5,930	860	5,563	8%
W-8	V	1	NC	NC	4.6	NC	NC	4.6	4.6	NC
W-8	Zn	3	78.5	87.1	95.6	97.8	100.0	21.5	91.4	12%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.20. Process metal concentration statistics for sludge for Tank W-9 (mg/kg)

Tank	Metal	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Range	Average	RSD (%)
W-9	Al	3	8,540	8,695	8,850	9,000	9,150	610	8,847	3%
W-9	B	3	6.16	6.46	6.76	6.92	7.07	0.91	6.66	7%
W-9	Be	3	5	6.09	7.26	7.40	7.53	2.62	6.57	22%
W-9	Ca	3	6,010	6,050	6,090	6,220	6,350	340	6,150	3%
W-9	Co	3	1.72	2.31	2.90	3.00	3.10	1.38	2.57	29%
W-9	Cu	3	46.1	47.4	48.6	49.5	50.4	4.3	48.4	4%
W-9	Fe	3	3,040	3,105	3,170	3,290	3,410	370	3,207	6%
W-9	K	3	2,430	2,475	2,520	3,265	4,010	1,580	2,987	30%
W-9	Mg	3	613	728	843	844	845	232	767	17%
W-9	Mn	3	143.0	143.5	144.0	148.0	152.0	9.0	146.3	3%
W-9	Na	3	5,660	5,985	6,310	6,680	7,050	1,390	6,340	11%
W-9	Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
W-9	Si	0	NC	NC	NC	NC	NC	NC	NC	NC
W-9	Sr	3	37.4	38.4	39.3	40.5	41.6	4.2	39.4	5%
W-9	Th	3	5,780	5,825	5,870	6,065	6,260	480	5,970	4%
W-9	U	3	11,900	12,950	14,000	22,800	31,600	19,700	19,167	56%
W-9	V	0	NC	NC	NC	NC	NC	NC	NC	NC
W-9	Zn	3	50.1	50.6	51.0	59.0	67.0	16.9	56.0	17%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.21. Process metal concentration statistics for sludge for Tank W-10 (mg/kg)

Tank	Metal	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Range	Average	RSD (%)
W-10	Al	3	29,000	29,600	30,200	32,100	34,000	5,000	31,067	8%
W-10	B	3	3.47	3.49	3.50	6.46	9.41	5.94	5.46	63%
W-10	Be	3	4	5.56	7.22	8.81	10.40	6.50	7.17	45%
W-10	Ca	3	5,960	7,385	8,810	11,355	13,900	7,940	9,557	42%
W-10	Co	1	NC	NC	4.50	NC	NC	4.50	4.50	NC
W-10	Cu	3	71.4	73.2	75.0	80.9	86.8	15.4	77.7	10%
W-10	Fe	3	4,010	6,205	8,400	9,650	10,900	6,890	7,770	45%
W-10	K	3	2,650	2,945	3,240	3,550	3,860	1,210	3,250	19%
W-10	Mg	3	592	660	728	1,454	2,180	1,588	1,167	75%
W-10	Mn	3	152.0	166.0	180.0	225.0	270.0	118.0	200.7	31%
W-10	Na	3	12,100	12,200	12,300	13,500	14,700	2,600	13,033	11%
W-10	Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
W-10	Si	0	NC	NC	NC	NC	NC	NC	NC	NC
W-10	Sr	3	34.0	49.0	63.9	65.1	66.2	32.2	54.7	33%
W-10	Th	3	4,180	5,215	6,250	8,325	10,400	6,220	6,943	46%
W-10	U	3	4,350	7,475	10,600	15,550	20,500	16,150	11,817	69%
W-10	V	0	NC	NC	NC	NC	NC	NC	NC	NC
W-10	Zn	3	102.0	106.0	110.0	116.5	123.0	21.0	111.7	9%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.22. Process metal concentration statistics for sludge for tank TH-4 (mg/kg)

Tank	Metal	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Range	Average	RSD (%)
TH-4	Al	3	1,350	2,500	3,650	3,780	3,910	2,560	2,970	47%
TH-4	B	2	2.98	3.48	3.98	4.47	4.97	1.99	3.98	35%
TH-4	Be	3	1	1.40	1.83	2.16	2.49	1.52	1.77	43%
TH-4	Ca	3	1,390	1,470	1,550	1,585	1,620	230	1,520	8%
TH-4	Co	0	NC	NC	NC	NC	NC	NC	NC	NC
TH-4	Cu	3	15.8	16.1	16.4	19.6	22.7	6.9	18.3	21%
TH-4	Fe	3	3,190	3,350	3,510	3,620	3,730	540	3,477	8%
TH-4	K	3	587	729	871	946	1,020	433	826	27%
TH-4	Mg	3	193	200	206	382	557	364	319	65%
TH-4	Mn	3	27.1	31.0	34.8	36.4	37.9	10.8	33.3	17%
TH-4	Na	3	27,500	28,600	29,700	30,250	30,800	3,300	29,333	6%
TH-4	Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
TH-4	Si	3	188	193	198	240	282	94	223	23%
TH-4	Sr	3	9.1	9.6	10.1	12.8	15.4	6.3	11.5	29%
TH-4	Th	3	110,000	112,500	115,000	176,000	237,000	127,000	154,000	47%
TH-4	U	3	24,300	24,500	24,700	46,050	67,400	43,100	38,800	64%
TH-4	V	0	NC	NC	NC	NC	NC	NC	NC	NC
TH-4	Zn	3	17.8	18.3	18.8	37.0	55.1	37.3	30.6	70%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

9.2.2 Concentration Statistics for Sludge for Tank Groups

Concentration statistics for sludge for Tank Groups 2 and 3 are presented in Tables 9.23–19.25.

An Analysis of Variance was performed to compare average sludge concentrations given the associated RSDs between Tank Groups 2 and 3 for selected metals (Al, Ca, Cu, Fe, K, Mg, Mn, Na, Sr, and U). The results indicate that there is no statistically significant difference between the average concentrations for Al, Fe, Mg, Mn, Na, Sr, and U between Tank Groups 2 and 3.

There is a statistically significant difference between the average concentrations for Ca, Cu, and K between Tank Groups 2 and 3. The average concentration for Ca in Tank Group 2 is statistically smaller than the average concentration for Ca in Tank Group 3. The average concentration for Cu in Tank Group 2 is statistically greater than the average concentration for Cu in Tank Group 3. The average concentration for K in Tank Group 2 is statistically smaller than the average concentration for K in Tank Group 3.

Table 9.23. Process metal concentration statistics for all tank groups, sludge (mg/kg)

Metal	Group	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Al	2	16	51100	W-3	733	W-3	7815	50367	10036.31	124%
	3	16	34000	W-10	1190	W-7	8695	32810	11283.75	90%
B	2	12	104	W-5	2.94	W-3	5.9	101.06	15.59	181%
	3	16	61.9	W-7	3.47	W-10	14.2	58.43	18.24	83%
Be	2	6	15.6	W-4	0.665	W-5	2.16	14.935	4.69	123%
	3	12	14.6	W-8	0.99	W-7	7.24	13.61	6.64	60%
Ca	2	16	31600	W-6	620	W-4	7640	30980	10352.69	104%
	3	16	13900	W-10	384	W-7	5985	13516	4959.50	80%
Co	2	7	24.2	W-6	3.2	W-3	4.89	21	7.69	96%
	3	6	4.5	W-10	1.72	W-9	2.925	2.78	2.94	31%
Cu	2	16	58.8	W-6	6.03	W-4	28.95	52.77	28.26	49%
	3	16	115	W-7	43.8	W-7	67	71.2	70.13	31%
Fe	2	16	19400	W-5	195	W-3	3350	19205	6841.44	105%
	3	16	20300	W-7	715	W-7	4385	19585	5710.56	86%
K	2	16	1120	W-6	219	W-4	447.5	901	528.31	53%
	3	16	13000	W-7	1370	W-8	3935	11630	5566.25	69%
Mg	2	16	10100	W-5	47.8	W-4	389.5	10052.2	1180.62	213%
	3	16	11100	W-8	95	W-7	602.5	11005	1848.25	163%
Mn	2	16	1510	W-6	18	W-4	45.65	1492	269.19	150%
	3	16	479	W-7	20.5	W-7	142.5	458.5	145.30	75%
Na	2	16	52700	W-5	8380	W-3	28600	44320	26713.75	49%
	3	16	68700	W-7	5070	W-8	13500	63630	28932.50	84%
Sb	2	0	NC	NC	NC	NC	NC	NC	NC	NC
	3	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	2	7	3360	W-6	188	TH-4	277	3172	714.86	164%
	3	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr	2	16	65.1	W-6	3.22	W-4	21.7	61.88	26.63	74%
	3	16	66.2	W-10	3.8	W-7	34.7	62.4	30.76	69%
Th	2	13	237000	TH-4	86.2	W-6	2160	236914	37217.60	196%
	3	16	16400	W-8	1510	W-7	5245	14890	6588.75	62%
U	2	16	211000	W-4	895	W-5	44300	210105	61861.38	102%
	3	16	195000	W-7	4350	W-10	26050	190650	53440.00	113%

Table 9.23 cont.

Metal	Group	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
V	2	0	NC	NC	NC	NC	NC	NC	NC	NC
	3	5	4.63	W-8	1.47	W-7	1.74	3.16	2.36	57%
Zn	2	15	362	W-6	3.1	W-3	18.8	358.9	56.73	165%
	3	16	123	W-10	18.5	W-7	50.55	104.5	62.04	56%

Table 9.24. Process metal concentration statistics for Tank Group 2, sludge (mg/kg)

Tank Group	2								
Sludge	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Al	16	51100	W-3	733	W-3	7815	50367	10036.31	124%
B	12	104	W-5	2.94	W-3	5.9	101.06	15.59	181%
Be	6	15.6	W-4	0.665	W-5	2.16	14.935	4.69	123%
Ca	16	31600	W-6	620	W-4	7640	30980	10352.69	104%
Co	7	24.2	W-6	3.2	W-3	4.89	21	7.69	96%
Cu	16	58.8	W-6	6.03	W-4	28.95	52.77	28.26	49%
Fe	16	19400	W-5	195	W-3	3350	19205	6841.44	105%
K	16	1120	W-6	219	W-4	447.5	901	528.31	53%
Mg	16	10100	W-5	47.8	W-4	389.5	10052.2	1180.62	213%
Mn	16	1510	W-6	18	W-4	45.65	1492	269.19	150%
Na	16	52700	W-5	8380	W-3	28600	44320	26713.75	49%
Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	7	3360	W-6	188	TH-4	277	3172	714.86	164%
Sr	16	65.1	W-6	3.22	W-4	21.7	61.88	26.63	74%
Th	13	237000	TH-4	86.2	W-6	2160	236914	37217.60	196%
U	16	211000	W-4	895	W-5	44300	210105	61861.38	102%
V	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	15	362	W-6	3.1	W-3	18.8	358.9	56.73	165%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

Table 9.25. Process metal concentration statistics for Tank Group 3, sludge (mg/kg)

Tank Group	3								
Sludge	N	Max	Tank	Min	Tank	Median	Range	Average	RSD
Al	16	34000	W-10	1190	W-7	8695	32810	11283.75	90%
B	16	61.9	W-7	3.47	W-10	14.2	58.43	18.24	83%
Be	12	14.6	W-8	0.99	W-7	7.24	13.61	6.64	60%
Ca	16	13900	W-10	384	W-7	5985	13516	4959.50	80%
Co	6	4.5	W-10	1.72	W-9	2.925	2.78	2.94	31%
Cu	16	115	W-7	43.8	W-7	67	71.2	70.13	31%
Fe	16	20300	W-7	715	W-7	4385	19585	5710.56	86%
K	16	13000	W-7	1370	W-8	3935	11630	5566.25	69%
Mg	16	11100	W-8	95	W-7	602.5	11005	1848.25	163%
Mn	16	479	W-7	20.5	W-7	142.5	458.5	145.30	75%
Na	16	68700	W-7	5070	W-8	13500	63630	28932.50	84%
Sb	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr	16	66.2	W-10	3.8	W-7	34.7	62.4	30.76	69%
Th	16	16400	W-8	1510	W-7	5245	14890	6588.75	62%
U	16	195000	W-7	4350	W-10	26050	190650	53440.00	113%
V	5	4.63	W-8	1.47	W-7	1.74	3.16	2.36	57%
Zn	16	123	W-10	18.5	W-7	50.55	104.5	62.04	56%

N = Number of Samples
RSD = Relative Standard Deviation
NC = Not Calculated

9.2.3 Maximum Sludge Concentrations by Tanks Within Each Tank Group

The tanks that exhibit the maximum sludge metal concentrations for each tank group are identified in Table 9.26. Tanks that exhibit the maximum supernate concentrations are also identified for comparison purposes. As an example, Tanks W-6 and W-10 exhibit the maximum sludge metal concentrations for Ca, Co, Sr, and Zn in tank groups 2 and 3.

Table 9.26. Identification of tanks with maximum values of process metals for tank groups

Tank Group	1	2	2	3	3
Metal	Supernate	Sludge	Supernate	Sludge	Supernate
Al	W-1	W-3	W-3	W-10	W-10
B	W-2	W-5	TH-4	W-7	W-8
Be	NC	W-4	NC	W-8	NC
Ca	W-1	W-6	TH-4	W-10	W-8
Co	NC	W-6	TH-4	W-10	W-9
Cu	W-1	W-6	W-5	W-7	W-9
Fe	W-1	W-6	TH-4	W-7	W-9
K	W-2	W-5	TH-4	W-7	W-9
Mg	W-2	W-6	TH-4	W-8	W-8
Mn	NC	W-5	TH-4	W-7	W-9
Na	W-2	W-6	TH-4	W-7	W-8
Sb	NC	W-5	NC	NC	NC
Si	W-1	W-6	TH-4	NC	NC
Sr	W-1	W-6	TH-4	W-10	W-8
Th	W-11	TH-4	TH-4	W-8	W-9
U	W-11	W-4	TH-4	W-7	W-9
V	NC	NC	NC	W-8	NC
Zn	NC	W-6	W-5	W-10	W-10

NC = Not Calculated

9.2.4 Maximum Sludge Concentrations by Tanks Sorted by Tank Groups

Tanks that exhibit the maximum sludge metal concentrations are ordered for each tank group and presented in Tables 9.27 and 9.28 for Tank Groups 2 and 3, respectively. Tanks that exhibit the maximum sludge concentrations are also identified for comparison purposes. As a first example, Tank W-6 in Tank Group 2 exhibits the maximum sludge metal concentrations for Ca, Co, Cu, Fe. Mg, Na, Si, Sr, and Zn. As a second example, Tank W-7 in Tank Group 3 exhibits the maximum sludge metal concentrations for B, Cu, Fe, K, Mn, Na, and U. There are no reported concentrations for sludge in Tank Group 1.

Table 9.27. Identification of tanks with maximum values of process metals for tank groups sorted by Tank Group 2, sludge

Tank Group	2
Metal	Sludge
Th	TH-4
Al	W-3
Be	W-4
U	W-4
B	W-5
K	W-5
Mn	W-5
Sb	W-5
Ca	W-6
Co	W-6
Cu	W-6
Fe	W-6
Mg	W-6
Na	W-6
Si	W-6
Sr	W-6
Zn	W-6
V	NC

NC = Not Calculated

Table 9.28. Identification of tanks with maximum values of process metals for tank groups sorted by Tank Group 3, sludge

Tank Group	3
Metal	Sludge
B	W-7
Cu	W-7
Fe	W-7
K	W-7
Mn	W-7
Na	W-7
U	W-7
Be	W-8
Mg	W-8
Th	W-8
V	W-8
Al	W-10
Ca	W-10
Co	W-10
Sr	W-10
Zn	W-10
Sb	NC
Si	NC

NC = Not Calculated

10. ANIONS

10.1 INTRODUCTION

Concentrations of water soluble anions (Chloride, Bromide, Fluoride, Nitrate, Phosphate, Sulphate) are described in several ways using GAAT Sampling and analysis data from GAAT Phase I (Energy Systems 1995) and Phase II (U.S. DOE 1995). Knowledge of anions can support GAAT system design and operational remedial actions that comply with waste acceptance criteria at proposed storage and disposal facilities.

Anion statistics for supernate and sludge for Tank Groups. Tank Group 1 (W-1, W-2, W-11), Tank Group 2 (W-3, W-4, W-5, W-6, TH-4), and Tank Group 3 (W-7, W-8, W-9, W-10) represent current operational definitions of Tank Groups. Supernate and sludge samples are pooled for the Tank Groups. These values are used to compute the minimum, median, maximum, average, and RSD for each anion for the Tank Group.

Anion statistics for supernate and sludge for individual tanks. Supernate and sludge samples from each tank are used to compute the minimum, the 25%-tile, the median, the 75%-tile, the maximum, the average, and the RSD for each anion for individual tanks. The minimum and the maximum provide a measure of the range of the anion data. The 25%-tile and the 75%-tile indicate the region in which the central 50% of the reported anion data is contained. The median and the average are measures of central tendency for the anion data. The RSD (the ratio of the standard deviation to the average) is expressed as a percentage. The RSD provides insight to the variability of the anion data.

10.2 ANIONS IN SUPERNATES

Summary statistics of the concentrations for anions in supernate for each tank group are presented in Tables 10.1 through 10.3. In most cases, Tank Group 3 contains the maximum median values, and Tank Group 1 contains the minimum median values. Although the number of samples is limited, Tank Group 2 clearly exhibits high spatial variability in anion concentration in supernate. This is due to high anion concentrations in TH-4 and W-6. The thick supernate levels in these tanks may also have contributed to these high RSDs.

Table 10.1. Summary of anion concentrations (mg/L) for Tank Group 1 for GAAT supernate

Tank Group 1	N	Min	X(0.25)	Median	X(0.75)	Max	Range	Avg	RSD
Bromide	0	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	4	2.9	3.1	4.5	6.1	6.9	4.0	4.7	43%
Fluoride	4	0.3	0.4	1.7	3.9	6.4	6.1	2.5	114%
Nitrate	4	4.0	7.0	11.9	16.8	19.6	15.6	11.9	60%
Phosphate	1	2.4	2.4	2.4	2.4	2.4	0	2.4	NC
Sulphate	4	12.4	12.6	12.6	13.0	14.0	1.6	12.9	6%

NC = Not Calculated

Table 10.2. Summary of anion concentrations (mg/L) for Tank Group 2 for GAAT supernate

Tank Group 2	N	Min	X(0.25)	Median	X(0.75)	Max	Range	Avg	RSD
Bromide	0	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	8	7.2	17.4	51.6	90.3	151.0	143.8	60.7	87%
Fluoride	4	12.9	40.0	253.5	545.5	808.0	795.1	332.0	113%
Nitrate	7	2.1	809.5	1,580.0	12,280.0	24,100.0	24,097.9	7,408.7	132%
Phosphate	6	15.0	143.3	566.0	890.8	2,273.0	2,258.0	736.9	114%
Sulphate	8	51.0	314.3	676.0	2,902.5	10,900.0	10,849.0	2,660.0	150%

NC = Not Calculated

Table 10.3. Summary of anion concentrations (mg/L) for Tank Group 3 for GAAT supernate

Tank Group 3	N	Min	X(0.25)	Median	X(0.75)	Max	Range	Avg	RSD
Bromide	0	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	3	133.0	219.5	306.0	314.0	322.0	189.0	253.7	41%
Fluoride	3	55.0	58.0	61.0	100.5	140.0	85.0	85.3	56%
Nitrate	3	868.0	1,684.0	2,500.0	3,320.0	4,140.0	3,272.0	2,502.7	65%
Phosphate	2	82.0	389.0	696.0	1,003.0	1,310.0	1,228.0	696.0	125%
Sulphate	3	401.0	404.5	408.0	1,089.0	1,770.0	1,369.0	859.7	92%

NC = Not Calculated

A summary of the concentrations for individual anions in supernate for Tank Groups is presented. Samples which contain the largest and smallest median concentrations are indicated. The RSD is also provided.

Bromide All samples were non-detects.

Chloride The largest median concentration is in Tank Group 3 (306.0 mg/L), and the smallest median concentration is in Tank Group 1 (4.5 mg/L). W-10 contains the maximum value, and W-11 contains the minimum value. Spatial variability between Tank Groups ranges from 41% to 87%

Fluoride The largest median concentration is in Tank Group 2 (253.5 mg/L), and the smallest median concentration is in Tank Group 1 (1.7 mg/L). W-6 contains the maximum value, and W-11 contains the minimum value. Tank Groups 1 and 2 exhibit spatial variability greater than 100%.

Nitrate The largest median concentration is in Tank Group 3 (2,500.0 mg/L), and the smallest median concentration is in Tank Group 1 (11.9 mg/L). W-6 and TH-4 contain the maximum values, and W-3 contains the minimum value. Tank Group 2 exhibits spatial variability greater than 100%.

Phosphate The largest median concentration is in Tank Group 3 (696.0 mg/L), and the smallest median concentration is in Tank Group 1 (2.4 mg/L). W-10 contains the maximum value, and W-2 contains the minimum value. Tank Groups 2 and 3 exhibit spatial variability greater than 100%.

Sulphate The largest median concentration is in Tank Group 3 (676.0 mg/L), and the smallest median concentration is in Tank Group 1 (12.6 mg/L). TH-4, W-6, and W-8 contain the maximum values, and W-11 contains the minimum value. Tank Group 2 exhibits spatial variability greater than 100%.

10.3 ANIONS IN SLUDGES

Sludge samples from each tank are used to compute the minimum, the 25%-tile, the median, the 75%-tile, the maximum, the average, and the RSD for each anion for individual tanks in Tank Groups 2 and 3. These are presented in Tables 10.4 through 10.13.

Table 10.4. Anion concentrations (mg/kg) in sludge for Tank W-3

W-3 Tank Group 2	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
Bromide	0	NC	NC	NC	NC	NC	NC	NC
Chloride	0	NC	NC	NC	NC	NC	NC	NC
Fluoride	3	17.5	19.2	20.9	22.3	23.7	20.7	15%
Nitrate	1	NC	NC	87	NC	NC	87.0	NC
Phosphate	3	1370	1440	1510	2375	3240	2040.0	51%
Sulphate	3	318	415.5	513	526	539	456.7	26%

NC = Not Calculated

Table 10.5. Anion concentrations (mg/kg) in sludge for Tank W-4

W-4 Tank Group 2	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
Bromide	0	NC	NC	NC	NC	NC	NC	NC
Chloride	0	NC	NC	NC	NC	NC	NC	NC
Fluoride	2	20	20.65	21.3	21.95	22.6	21.3	9%
Nitrate	3	1370	1395	1420	1575	1730	1507	13%
Phosphate	3	147	290.5	434	1752	3070	1217	132%
Sulphate	3	1530	1720	1910	2065	2220	1887	18%

NC = Not Calculated

Table 10.6. Anion concentrations (mg/kg) in sludge for Tank W-5

W-5 Tank Group 2	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
Bromide	0	NC	NC	NC	NC	NC	NC	NC
Chloride	1	NC	NC	72.7	NC	NC	72.7	NC
Fluoride	3	1880	1919	1958	2019	2080	1972.7	5%
Nitrate	3	422	512	602	620.5	639	554.3	21%
Phosphate	3	2678	2884	3090	3370	3650	3139.3	16%
Sulphate	3	250	279	308	311.5	315	291.0	12%

NC = Not Calculated

Table 10.7. Anion concentrations (mg/kg) in sludge for Tank W-6

W-6 Tank Group 2	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
Bromide	0	NC	NC	NC	NC	NC	NC	NC
Chloride	2	144	149.75	155.5	161.25	167	155.5	10%
Fluoride	3	1760	2965	4170	8035	11900	5943.3	89%
Nitrate	3	8570	10085	11600	11950	12300	10823.3	18%
Phosphate	3	4430	5545	6660	7280	7900	6330.0	28%
Sulphate	3	5690	7100	8510	8955	9400	7866.7	25%

NC = Not Calculated

Table 10.8 Anion concentrations (mg/kg) in sludge for Tank TH-4

TH-4 Tank Group 2	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
Bromide	0	NC	NC	NC	NC	NC	NC	NC
Chloride	0	NC	NC	NC	NC	NC	NC	NC
Fluoride	2	398	398	398	398	398	398.0	0%
Nitrate	2	19400	19404	19409	19413	19417	19408.5	0%
Phosphate	2	184	201	218	234	251	217.5	22%
Sulphate	2	10700	10700	10700	10700	10700	10700.0	0%

NC = Not Calculated

Table 10.9. Anion concentrations (mg/kg) in sludge for Tank W-7

W-7 Tank Group 3	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
Bromide	5	88	101	106	109	111	103	9%
Chloride	5	2360	2530	2730	2840	3280	2748	13%
Fluoride	5	1720	1870	2320	2480	2770	2232	19%
Nitrate	5	30000	32600	36700	38500	42000	35960	13%
Phosphate	5	3470	4490	4750	5185	5320	4643	16%
Sulphate	5	6540	7510	7700	8130	8720	7720	10%

NC = Not Calculated

Table 10.10. Anion concentrations (mg/kg) in sludge for Tank W-7 sludge layer

W-7 Chips Tank Group 3	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
Bromide	2	102	106	110	114	118	110	10%
Chloride	2	2820	2848	2875	2903	2930	2875	3%
Fluoride	2	1100	1788	2475	3163	3850	2475	79%
Nitrate	2	37300	37400	37500	37600	37700	37500	1%
Phosphate	2	4770	4878	4985	5093	5200	4985	6%
Sulphate	2	7700	7773	7845	7918	7990	7845	3%

NC = Not Calculated

Table 10.11. Anion concentrations (mg/kg) in sludge for Tank W-8

W-8 Tank Group 3	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
Bromide	2	9	9	9	9	10	9	4%
Chloride	2	422	422	423	423	423	423	0%
Fluoride	3	130	141	151	335	518	266	82%
Nitrate	3	2500	2540	2580	2635	2690	2590	4%
Phosphate	2	191	234	276	319	361	276	44%
Sulphate	3	3280	3375	3470	3885	4300	3683	15%

NC = Not Calculated

Table 10.12. Anion concentrations (mg/kg) in sludge for Tank W-9

W-9 Tank Group 3	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
Bromide	2	7	7	7	7	7	7	2%
Chloride	2	134	136	138	139	141	138	4%
Fluoride	3	77	80	84	194	305	155	84%
Nitrate	3	122	347	572	593	613	436	63%
Phosphate	3	2230	2610	2990	3325	3660	2960	24%
Sulphate	3	476	494	511	567	622	536	14%

NC = Not Calculated

Table 10.13. Anion concentrations (mg/kg) in sludge for Tank W-10

W-10 Tank Group 3	N	Minimum	X(0.25)	Median	X(0.75)	Maximum	Average	RSD (%)
Bromide	2	13	17	21	26	30	21	56%
Chloride	3	546	559	571	584	597	571	4%
Fluoride	3	333	349	364	401	437	378	14%
Nitrate	3	4440	5100	5760	6015	6270	5490	17%
Phosphate	2	242	254	267	279	291	267	13%
Sulphate	3	1770	1860	1950	2410	2870	2197	27%

NC = Not Calculated

Median concentrations for anions in sludge for each tank is presented in Tables 10.14 and 10.15. Excluding TH-4, W-6 in Tank Group 2 represents the maximum anion concentration in the sludge and drives the group spatial variability. Tank W-7 represents the maximum anion concentration in the sludge and drives Tank Group 3 spatial variability.

Table 10.14. Sludge anion median concentrations (mg/kg) for individual tanks in Tank Group 2

Anions	W-3	W-4	W-5	W-6	TH-4	Min	Max
Bromide	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	NC	72.7	155.5	NC	72.7	155.5
Fluoride	20.9	21.3	1958	4170	398	20.9	4170
Nitrate	87	1420	602	11600	19408.5	87	19408.5
Phosphate	1510	434	3090	6660	217.5	217.5	6660
Sulphate	513	1910	308	8510	10700	308	10700

NC = Not Calculated

Table 10.15. Sludge anion median concentrations (mg/kg) for individual tanks in Tank Group 3

Anions	W-7	W-7 Layer	W-8	W-9	W-10	Min	Max
Bromide	106	110	9.3	7.4	21.4	7.4	110
Chloride	2,730	2,875	422	137.5	571	137.5	2,875
Fluoride	2,320	2,475	151	83.8	364	83.8	2,475
Nitrate	36,700	37,500	2,580	572	5,760	572	37,500
Phosphate	4,750	4,985	276	2,990	266.5	266.5	4,985
Sulphate	7,700	7,845	3,470	511	1,950	511	7,845

NC = Not Calculated

Summary statistics of concentrations for individual anions in sludge for Tank Groups 2 and 3 are presented in Tables 10.16 and 10.17. Although the number of samples is limited, Tank Group 2 clearly exhibits high spatial variability in anion concentration in sludge. Samples which contain the largest and smallest median concentrations are indicated. The RSD is also provided.

Bromide Samples were reported for only Tank Group 3. The median concentration is 9.5 mg/kg. The maximum concentration is in W-7. Spatial variability is 76%.

Chloride The largest median concentration is in Tank Group 3 (2,360 mg/kg), and the smallest median concentration is in Tank Group 2 (144 mg/kg). W-7 contains the maximum value, and W-5 contains the minimum value. Spatial variability between Tank Groups ranges from 38% to 76%

Fluoride The largest median concentration is in Tank Group 3 (518 mg/kg), and the smallest median concentration is in Tank Group 2 (398 mg/kg). TH-4 and W-6 contain the maximum values, and W-3 contains the minimum value. Tank Group 2 exhibits spatial variability greater than 100%.

Nitrate The largest median concentration is in Tank Group 3 (6,270 mg/kg), and the smallest median concentration is in Tank Group 2 (1,575 mg/kg). W-7 contains the maximum value, and W-3 contains the minimum value. While Tank Group 2 exhibits spatial variability greater than 100%, Tank Group 2 spatial variability is 97%.

Phosphate The largest median concentration is in Tank Group 3 (3,660 mg/kg), and the smallest median concentration is in Tank Group 2 (2,874 mg/kg). W-6 contains the maximum value, and TH-4 contains the minimum value. RSDs are less than 100%.

Sulphate The largest median concentration is in Tank Group 3 (4,300 mg/kg), and the smallest median concentration is in Tank Group 2 (1,720 mg/kg). TH-4 and W-6 contain the maximum values, and W-5 contains the minimum value. Spatial variability in Tank Group 2 is greater than 100%.

Table 10.16. Summary statistics for anion concentrations (mg/kg) for Tank Group 2

Tank Group 2	N	Min	Median	Max	Range	Average	RSD	RSD > 100%
Bromide	0	NC	NC	NC	NC	NC	NC	
Chloride	3	72.7	144	167	94.3	128	38%	
Fluoride	13	17.5	398	11,900	11,882	1,896	172%	Yes
Nitrate	12	87	1,575	19,417	19,330	6,463	116%	Yes
Phosphate	14	147	2,874	7,900	7,753	2,758	87%	
Sulphate	14	250	1,720	10,700	10,450	378	112%	Yes

NC = Not Calculated

Table 10.17. Summary statistics for anion concentrations (mg/kg) for Tank Group 3

Tank Group 3	N	Min	Median	Max	Range	Avg	RSD	RSD > 100%
Bromide	12	7.27	9.5	118	110.73	65.11	76%	
Chloride	13	134	2,360	3,280	3,146	1,671	76%	
Fluoride	15	76.6	518	3,850	3,773	1,212	100%	Yes
Nitrate	15	122	6,270	42,000	41,878	18,306	97%	
Phosphate	13	191	3,660	5,320	5,129	3,301	59%	
Sulphate	15	476	4,300	8,720	8,244	4,773	65%	

NC = Not Calculated

11. SUMMARY AND CONCLUSIONS

11.1 SUMMARY

The report has provided evaluations to (1) support the GAAT TS and (2) provide input to the Record of Decision for the remediation of selected tanks that are part of the NTF and STF. This report presents an evaluation of GAAT sampling and analysis data from various tanks in the NTF and the STF.

Several major areas of evaluation have been performed:

- Answer DQO Question 1. What is the spatial homogeneity or heterogeneity of key chemical and radionuclide concentrations in tanks suspected of significant curie loading?
- Determine current values for tank volumes. Sludge and supernate volumes for all tanks are updated based on Phase II sludge mapping information.
- Determine curie loading for each tank. Using Phase I and Phase II data, in addition to 1988 sampling data, curie loadings for sludge and supernate are determined.
- Determine tanks that are TRU and non-TRU under DOE Order 5820.2A. Using Phase I and Phase II data, tanks are classified as TRU or non-TRU.
- Describe risk/transport drivers for tanks. Using Phase I and Phase II data, the beta/gamma radioisotopes in the sludge and supernate that significantly affect GAAT transport modeling are determined.
- Describe Physical Properties of tanks. The physical properties of the sludge and supernate are updated based on additional Phase II data.
- Determine which tanks exceed RCRA metals standards. Identification of which tanks exceed RCRA metals standards in the sludge and supernate are updated based on additional Phase II data.
- Describe concentrations of process metals for tanks. The concentrations of process metals in the sludge and supernate are updated based on additional Phase II data.
- Describe concentrations of Anions for tanks. The concentrations of anions in the sludge and supernate are updated based on additional Phase II data.
- Describe concentrations of other chemicals and radioisotopes (e.g., alkaloids, PCBs, etc.) for tanks. The concentrations in the sludge and supernate are updated based on additional Phase II data.

The scope was to evaluate sludge and supernate radiological, inorganic, and wet chemistry sample data for the Gunite tanks W-1, W-2, W-3, W-4, W-5, W-6, W-7, W-8, W-9, W-10, W-11, and TH-4. Tank Group 1 (W-1, W-2, W-11), Tank Group 2 (W-3, W-4, W-5, W-6, TH-4), and Tank Group 3 (W-7, W-8, W-9, W-10) represent current operational grouping definitions of the GAAT. The GAAT TS has made the programmatic decision not to collect samples from the stainless-steel tanks (W-1A, W-13, W-14, and W-15), and these tanks are not evaluated in this report.

11.2 CONCLUSIONS

Tanks contained in Tank Group 3 contain 96% of the expected (or most likely) curies in the sludge and 90% of the expected curies in supernate for all tank groups. Tanks suspected of significant sludge curie loading in Tank Group 3 are W-10, W-8, and W-7. Tanks suspected of significant supernate curie loading in Tank Group 3 are W-8 and W-10. Tank W-6 in Tank Group 2 is suspected to contain 87% of the expected curies in sludge for Tank Group 2 and 94% of the expected curies in supernate in Tank Group 2. Tank Group 1 accounts for 0% of the expected curies in the sludge and supernate

Tanks W-3, W-4, W-6, W-8, W-9, and W-10 are considered TRU under DOE Order 5820.2A.

Beta/gamma emitters, particularly Sr-90 and Cs-137, are considered significant variables in the transport and human health and environmental risk modeling for the GAAT. Several observations of the average concentrations and the spatial homogeneity or heterogeneity of the Sr-90 and Cs-137 concentrations are made:

- Tanks W-8, W-9, and W-10 indicate the largest average concentration of Sr-90
- Tanks W-7 and W-10 indicate the largest average concentration of Cs-137
- Tanks W-3 and W-4 exhibit the most heterogeneity for Sr-90 average concentration
- Tank W-4 exhibits the most heterogeneity for Cs-137 average concentration
- Tanks W-8 and W-9 exhibit the most homogeneity for Sr-90 average concentration
- Tanks W-3, W-5, W-8, W-9, and TH-4 exhibit the most homogeneity for Cs-137 average concentration

There are 3 key sources of measurement error (sample location, sample method, and analytical method) associated with samples obtained from either GAAT sludge or supernate. Sources of measurement error are "confounded" with each other. This means that it is not statistically possible to determine if the reason for a change in a sample value between Phase I, Phase II, and 1988 sampling is due explicitly to the sample location, the sample method, or the analytical method. Confounding says we cannot "decouple" the combined measurement error effects of the sample location, the sample method, or the analytical method. Two key reasons for confounding are:

- Different sample methods were not used for samples from the same sample location (port, riser, and depth)
- Different analytical methods were not used for samples from the same location

Cost of sampling and analysis is the key driver. If confounding were desired to be completely eliminated, a minimum of eight samples from the sludge and eight samples from the supernate per tank would have been required. Furthermore, if we wanted to compare Phase I and Phase II data with 1988 data, we would have to replicate the analytical methods used during 1995 and 1988 for each sample collected. This is prohibitive in cost, and, as such, the trade-off between cost and "confounding" occurred.

Based upon the statistical evaluations performed, the benefit of additional sampling after 1988 considerably supports the remediation decisions planned for the GAAT TS.

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Appendix A

DATA QUALITY OBJECTIVES FOR GAAT PHASE II SAMPLING AND ANALYSIS

This appendix contains the major questions and the DQOs for the Phase II GAAT sampling and analysis effort performed in FY 1995. The major questions are contained in *Oak Ridge National Laboratory Inactive Tanks Sampling and Analysis Plan, Addendum 1, Revision 2, Oak Ridge, Tennessee*, DOE/OR/02-1354&D2, February 1995. The DQOs are presentation material associated with DQO workshop for the Phase II sampling held in January 1995.

- Question 1. What is the spatial homogeneity or heterogeneity of key chemical and radionuclide concentrations in tanks suspected of significant curie loading?
- Question 2. What are the locations and the composition of sludge and debris in the tanks?
- Question 3. What is the integrity of the tank walls?
- Question 4. What is the extent of contamination in the tank walls?

Question 1	**What is the spatial homogeneity or heterogeneity of key chemical and radionuclide concentrations in tanks suspected of significant Curie loading?** ***Determine average concentration and variance of average concentration of analytes or radionuclides; compare to Phase I results.***		
Information Need	Data Requirement	Data Elements	Data Quality Objectives
SAFETY			
Gunite	None Required	None Required	None required
Sludge	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of sludge	Subjective evaluation
	Assay sludge	Gross alpha/beta [Bq/g]	Gross alpha/beta ± 30%
		Alpha Spectroscopy	Use Alpha Spectroscopy if
		Gamma scan [Bq/g]	Gamma scan ± 30% RPD
		U-233, U-235, U-238	U-233,U-235,U-238 ± 30%
WASTE MANAGEMENT PLANNING			
Gunite	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of washed	Subjective evaluation
	Assay washed chips	Gross alpha/beta [Bq/g]	Gross alpha/beta ± 30%
		Alpha Spectroscopy	Use Alpha Spectroscopy if
		Gamma scan [Bq/g]	Gamma scan ± 30% RPD
Sludge	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of sludge	Subjective evaluation
	Assay sludge	RCRA Metals [mg/g]	TCLP for RCRA Metals in
		Process Metals [mg/g]	Process Metals ± 30% RPD
		Anions [mg/g]	Anions ± 30% RPD
		Total Carbon [mg/g]	Total Carbon± 30% RPD
		PCBs [mg/kg]	PCBs ± 30% RPD

Question 1	**What is the spatial homogeneity or heterogeneity of key chemical and radionuclide concentrations in tanks suspected of significant Curie loading?** ***Determine average concentration and variance of average concentration of analytes or radionuclides; compare to Phase I results.***		
Information Need	Data Requirement	Data Elements	Data Quality Objectives
WIPP			
Gunite	None Required	None Required	None required
Sludge	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of sludge	Subjective evaluation
	Assay sludge	RCRA Metals [mg/g]	RCRA Metals ± 30% RPD
		Be [mg/g]	Be ± 30% RPD
		Gross alpha/beta [Bq/g]	Gross alpha/beta ± 30%
		Gamma scan [Bq/g]	Gamma scan ± 30% RPD
		Pu (Total) [Bq/g]	Pu (Total) ± 30% RPD
		SVOC	SVOC -60%/+40% RPD
		VOC	VOC -60%/+40% RPD
		NHVOC	NHVOC -60%/+40% RPD
RISK REFINEMENT AND ARARS IDENTIFICATION			
Gunite	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Assay washed chips	Gross alpha/beta [Bq/g]	Gross alpha/beta ± 30%
		Alpha Spectroscopy	Use Alpha Spectroscopy if
		Gamma scan [Bq/g]	Gamma scan ± 30% RPD
		Density [g/mL]	Density ± 30% RPD
		Total Sr-90 [Bq/g]	Total Sr-90 ± 30% RPD
		Pu (Total) [Bq/g]	Pu (Total) ± 30% RPD
		Th (Total) [Bq/g]	Th (Total) ± 30% RPD
		K_d	K_d ± TBD% RSD

Question 1	**What is the spatial homogeneity or heterogeneity of key chemical and radionuclide concentrations in tanks suspected of significant Curie loading?** ***Determine average concentration and variance of average concentration of analytes or radionuclides; compare to Phase I results.***		
Information Need	Data Requirement	Data Elements	Data Quality Objectives
RISK REFINEMENT AND ARARS IDENTIFICATION			
Sludge	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Assay sludge	Gross alpha/beta [Bq/g]	Gross alpha/beta ± 30% RPD
		Alpha Spectroscopy	Use Alpha Spectroscopy if
		Gamma scan [Bq/g]	Gamma scan ± 30% RPD
		Density [g/mL]	Density ± 30% RPD
		Total Sr-90 [Bq/g]	Total Sr-90 ± 30% RPD
		Pu (Total) [Bq/g]	Pu (Total) ± 30% RPD
		Th (Total) [Bq/g]	Th (Total) ± 30% RPD
		K_d	K_d ± TBD% RSD
RETRIEVAL SYSTEM DESIGN (FOR SLUDGE)			
Gunite	None Required	None Required	None required
Sludge	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of sludge	Subjective evaluation
		Physical description	Color and consistency
	Assay sludge	Density [g/mL]	Density ± 30% RPD
		Gross water [% moisture]	Gross Water ± 30% RPD
		Physical properties	Physical properties ± TBD
TANK STRUCTURAL INTEGRITY			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None required

Question 2	What are the locations and the composition of sludge and debris in the tanks? *Determine (x,y) and depth locations of sludge and debris in tanks; correlate average concentration of analytes or radionuclides to (x,y) and depth; qualitatively evaluate sludge, debris, and Gunite chip characteristics; and, use information for refined volume estimates and Curie loading.*		
Information Need	Data Requirement	Data Elements	Data Quality Objectives
SAFETY			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None required
WASTE MANAGEMENT PLANNING			
Gunite	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of washed chips	Subjective evaluation
	Assay washed chips	Gross alpha/beta [Bq/g]	Gross alpha/beta ± 30% RPD
		Alpha Spectroscopy	Use Alpha Spectroscopy if
		Gamma scan [Bq/g]	Gamma scan ± 30% RPD
Sludge	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of sludge	Subjective evaluation
	Assay sludge	RCRA Metals [mg/g]	TCLP for RCRA Metals in
		Process Metals [mg/g]	Process Metals ± 30% RPD
		Anions [mg/g]	Anions ± 30% RPD
		Total Carbon [mg/g]	Total Carbon± 30% RPD
		PCBs [mg/kg]	PCBs ± 30% RPD
WIPP			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None required

Question 2	**What are the locations and the composition of sludge and debris in the tanks?** ***Determine (x,y) and depth locations of sludge and debris in tanks; correlate average concentration of analytes or radionuclides to (x,y) and depth; qualitatively evaluate sludge, debris, and Gunite chip characteristics; and, use information for refined volume estimates and Curie loading.***		
Information Need	Data Requirement	Data Elements	Data Quality Objectives
RISK REFINEMENT AND ARARS IDENTIFICATION			
Gunite	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of washed chips	Subjective evaluation
	Assay washed chips	Gross alpha/beta [Bq/g]	Gross alpha/beta ± 30% RPD
		Alpha Spectroscopy	Use Alpha Spectroscopy if
		Gamma scan [Bq/g]	Gamma scan ± 30% RPD
		Density [g/mL]	Density ± 30% RPD
		Total Sr-90 [Bq/g]	Total Sr-90 ± 30% RPD
		Pu (Total) [Bq/g]	Pu (Total) ± 30% RPD
		Th (Total) [Bq/g]	Th (Total) ± 30% RPD
		K_d	K_d ± TBD% RSD
Sludge	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of sludge	Subjective evaluation
	Assay sludge	Gross alpha/beta [Bq/g]	Gross alpha/beta ± 30% RPD
		Alpha Spectroscopy	Use Alpha Spectroscopy if
		Gamma scan [Bq/g]	Gamma scan ± 30% RPD
		Density [g/mL]	Density ± 30% RPD
		Total Sr-90 [Bq/g]	Total Sr-90 ± 30% RPD
		Pu (Total) [Bq/g]	Pu (Total) ± 30% RPD
		Th (Total) [Bq/g]	Th (Total) ± 30% RPD
		K_d	K_d ± TBD% RSD

Question 2	**What are the locations and the composition of sludge and debris in the tanks?** ***Determine (x,y) and depth locations of sludge and debris in tanks; correlate average concentration of analytes or radionuclides to (x,y) and depth; qualitatively evaluate sludge, debris, and Gunite chip characteristics; and, use information for refined volume estimates and Curie loading.***		
Information Need	Data Requirement	Data Elements	Data Quality Objectives
RETRIEVAL SYSTEM DESIGN (FOR SLUDGE)			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None required
TANK STRUCTURAL INTEGRITY			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None required

Question 3	**What is the integrity of the tank walls?** ***Ascertain structural condition and related aspects of Gunite walls; correlate condition of tank walls to average concentration of analytes and radionuclides; correlate condition of tank walls to sludge, debris, and Gunite characteristics.***		
Information Need	Data Requirement	Data Elements	Data Quality Objectives
SAFETY			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None required
WASTE MANAGEMENT PLANNING			
Gunite	Location of sample	(x,y) [ft] Depth [ft]	(x,y) $\pm$ 1 ft Depth $\pm$ 1 ft
	Characteristics of Gunite chips and walls	Photograph of sludge	Subjective evaluation
Sludge	Location of sample	(x,y) [ft] Depth [ft]	(x,y) $\pm$ 1 ft Depth $\pm$ 1 ft
	Characteristics of walls and any sludge that adheres to walls	Photograph of sludge	Subjective evaluation
WIPP			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None required
RISK REFINEMENT AND ARARS IDENTIFICATION			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None required
RETRIEVAL SYSTEM DESIGN (FOR SLUDGE)			
Gunite	Location of sample	(x,y) [ft] Depth [ft]	(x,y) $\pm$ 1 ft Depth $\pm$ 1 ft
	Characteristics of Gunite chips and walls	Photograph	Subjective evaluation
		Physical description	Color and consistency
Sludge	None Required	None Required	None required
TANK STRUCTURAL INTEGRITY			
Gunite	Location of sample	(x,y) [ft]	(x,y) $\pm$ 1 ft
	Tank wall integrity	Video of tank walls	Subjective evaluation
Sludge	None Required	None Required	None Required

Question 4	**What is the extent of contamination in and on the tank walls?** ***Determine average concentration of analytes and radionuclides in and on Gunite walls; correlate concentrations to condition of tank walls; correlate concentrations to sludge, debris, and Gunite characteristics.***		
Information Need	Data Requirement	Data Elements	Data Quality Objectives
SAFETY			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None Required
WASTE MANAGEMENT PLANNING			
Gunite	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of washed chips	Subjective evaluation
	Assay washed chips	Gross alpha/beta [Bq/g]	Gross alpha/beta ± 30% RPD
		Alpha Spectroscopy	Use Alpha Spectroscopy if
		Gamma scan [Bq/g]	Gamma scan ± 30% RPD
Sludge	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph	Subjective evaluation
WIPP			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None required

Question 4	**What is the extent of contamination in and on the tank walls?** ***Determine average concentration of analytes and radionuclides in and on Gunite walls; correlate concentrations to condition of tank walls; correlate concentrations to sludge, debris, and Gunite characteristics.***		
Information Need	Data Requirement	Data Elements	Data Quality Objectives
RISK REFINEMENT AND ARARS IDENTIFICATION			
Gunite	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of washed chips	Subjective evaluation
	Assay washed chips	Gross alpha/beta [Bq/g]	Gross alpha/beta ± 30% RPD
		Alpha Spectroscopy	Use Alpha Spectroscopy if
		Gamma scan [Bq/g]	Gamma scan ± 30% RPD
		Density [g/mL]	Density ± 30% RPD
		Total Sr-90 [Bq/g]	Total Sr-90 ± 30% RPD
		Pu (Total) [Bq/g]	Pu (Total) ± 30% RPD
		Th (Total) [Bq/g]	Th (Total) ± 30% RPD
		K_d	K_d ± TBD% RSD
Sludge	Location of sample	(x,y) [ft]	(x,y) ± 1 ft
	Characteristics of	Photograph of sludge	Subjective evaluation
	Assay sludge (if	Gross alpha/beta [Bq/g]	Gross alpha/beta ± 30% RPD
		Alpha Spectroscopy	Use Alpha Spectroscopy if
		Gamma scan [Bq/g]	Gamma scan ± 30% RPD
		Density [g/mL]	Density ± 30% RPD
		Total Sr-90 [Bq/g]	Total Sr-90 ± 30% RPD
		Pu (Total) [Bq/g]	Pu (Total) ± 30% RPD
		Th (Total) [Bq/g]	Th (Total) ± 30% RPD
		K_d	K_d ± TBD% RSD

Question 4	**What is the extent of contamination in and on the tank walls?** ***Determine average concentration of analytes and radionuclides in and on Gunite walls; correlate concentrations to condition of tank walls; correlate concentrations to sludge, debris, and Gunite characteristics.***		
Information Need	Data Requirement	Data Elements	Data Quality Objectives
RETRIEVAL SYSTEM DESIGN (FOR SLUDGE)			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None required
TANK STRUCTURAL INTEGRITY			
Gunite	None Required	None Required	None required
Sludge	None Required	None Required	None required

Appendix B

SLUDGE DATA BASE AND SUMMARY STATISTICS

INTRODUCTION

The GAAT sludge TS Phase I and Phase II data base presented. The following sample information is provided for W-03, W-04, W-05, W-06, W-07, W-08, W-09, W-10, and TH-4:

- Physical properties
- RCRA metals
- Process metals
- Anions by ion chromatography (water wash)
- Beta/gamma emitters
- Alpha emitters by alpha spectrometry
- Uranium isotopics by mass spectrometry
- Plutonium isotopics by mass spectrometry

Analytical data for each sample from each tank is presented. If the maximum value exceeds RCRA standards, this information is indicated. Summary statistics include: the number of observations (samples), the minimum, the 25%-tile, the median value, the 75%-tile, and the maximum value. Additional summary statistics are: the arithmetic average, RSD expressed as a percentage, and the range of the sample values (the difference between the maximum and the minimum).

Table B.1. Tank W-3, GAAT sludge Phase I and Phase II data base (Page 1 of 6)

W-3 SLUDGE	Units	W-03S 212	W-03S 309	W-03S 310
NR=Not Reported				
NC=Not Computed				
Physical Properties				
Water	%	57.6	87.9	88.6
Bulk density	g/mL	1.07	NR	NR
TIC	mg/kg	< 2400	1860	1110
TC	mg/kg	5100	6100	5590
TOC	mg/kg	5300	4240	4480
Aroclor 1248	mg/kg	0.003	NR	NR
Aroclor 1254	mg/kg	0.009	NR	NR
Aroclor 1260	mg/kg	< 0.27	NR	NR
RCRA Metals (mg/kg)	Limits			
Ag	100	< 1.1	25.1	22.7
As	100	< 1.1	< 0.5	< 0.5
Ba	2000	9.01	5.4	2.94
Cd	20	1.3	< 1.5	< 1.44
Cr	100	468	288	252
Hg	4	6.42	22.3	16.7
Ni	1000	5.71	5.5	5.78
Pb	100	< 71	< 5	9.9
Se	20	< 1.1	< 0.5	< 0.5
Tl	18	< 25.2	< 0.5	< 0.5
Process Metals				
Al	mg/kg	51100	733	913
B	mg/kg	< 2.5	3.3	2.94
Be	mg/kg	< 0.189	< 0.02	< 0.02
Ca	mg/kg	7160	13400	8120
Co	mg/kg	< 1.47	3.2	3.82
Cu	mg/kg	17.5	32.3	27.2
Fe	mg/kg	2890	245	195
K	mg/kg	381	334	298
Mg	mg/kg	303	874	577
Mn	mg/kg	127	26.4	44.1
Na	mg/kg	16900	9540	8380
Sb	mg/kg	< 27.3	< 20	< 20
Si	mg/kg	509	NR	NR
Sr	mg/kg	17.5	31.8	21.2
Th	mg/kg	< 336	2160	1320
U	mg/kg	128000	47900	42300
V	mg/kg	< 4.2	< 0.5	< 0.5
Zn	mg/kg	18.2	3.1	< 1.5

Table B.1. Tank W-3, GAAT sludge Phase I and Phase II data base (Page 2 of 6)

W-3 SLUDGE	Units	W-03S 212	W-03S 309	W-03S 310
NR=Not Reported				
NC=Not Computed				
Anions by Ion Chromatrography (Water Wash)				
pH		10.5	NR	NR
Bromide	mg/kg	< 5	< 6	< 5
Chloride	mg/kg	< 5	< 6	< 5
Fluoride	mg/kg	23.7	20.9	17.5
Nitrate	mg/kg	87	< 12	< 10
Phosphate	mg/kg	3240	1510	1370
Sulphate	mg/kg	318	513	539
Beta/gamma Emitters				
Gross beta	Bq/g	1.00E+06	1.40E+05	1.50E+05
Co-60	Bq/g	< 5.0E+01	< 1.2E+02	< 1.5E+02
Cs-134	Bq/g	NR	< 2.2E+02	< 2.1E+02
Cs-137/Ba-137m	Bq/g	4.60E+04	4.70E+04	4.30E+04
Eu-152	Bq/g	< 2.2E+02	< 8.8E+02	< 7.8E+02
Eu-154	Bq/g	< 1.3E+02	< 3.4E+02	< 4.9E+02
Eu-155	Bq/g	< 4.5E+02	< 6.4E+02	< 5.9E+02
Sr-90/Y-90	Bq/g	5.80E+05	3.90E+04	1.90E+04
Am-241	Bq/g	NR	1.70E+03	2.30E+03
Alpha Emitters (Alpha Spec)				
Gross alpha	Bq/g	12000	6500	8400
Cm-244	Bq/g	180	NR	NR
Pu-239/Pu-240	Bq/g	6744	4728	5148
Pu-238/Am-241	Bq/g	408	1956	3084
Th-232+d	Bq/g	NR	NR	NR
U-238+d	Bq/g	4800	NR	NR
U-234	Bq/g	NR	4056	3144
U-238	Bq/g	NR	1260	612
U-233/U-234	Bq/g	2640	NR	NR
Total Pu alpha	Bq/g	4900	2100	3000
Pu-238	Bq/g	69	180	140
Pu-239/Pu-240	Bq/g	4831	1900	2800
Pu-242	Bq/g	NR	NR	NR
[Pu-239]	ng/g	2110	828	1220
Th-232/Pu-239	NR	NR	2610	1080

Table B.1. Tank W-3, GAAT sludge Phase I and Phase II data base (Page 3 of 6)

W-3 SLUDGE	Units	W-03S 212	W-03S 309	W-03S 310
NR=Not Reported				
NC=Not Computed				
Uranium Isotopics (Mass Spec)				
U-233	atom %	0.0015	NR	0.008
U-234	atom %	0.0053	NR	0.005
U-235	atom %	0.7234	NR	0.699
U-236	atom %	0.0006	NR	0.003
U-238	atom %	99.2692	NR	99.285
U-238/U-235 Ratio		137.0	NR	142.2
U-235 MS	mg/kg	914	NR	0.271
U-235 NAA	mg/kg	859	NR	270
U Activity				
U-233	Bq/g	670.5	NC	1181.7
U-234	Bq/g	1536.3	NC	479.0
U-235	Bq/g	65.0	NC	20.8
U-236	Bq/g	1.8	NC	3.0
U-238	Bq/g	1580.9	NC	522.5
Plutonium Isotopics (Mass Spec)				
Pu-238	atom %	0.02	NR	0.41
Pu-239	atom %	98.24	NR	88.22
Pu-240	atom %	1.7	NR	10.72
Pu-241	atom %	0.02	NR	0.33
Pu-242	atom %	0.02	NR	0.32
Pu-244	atom %	< 0.01	NR	<0.01
Pu Activity				
Pu-238	Bq/g	244.8	NC	1406.6
Pu-239	Bq/g	4376.9	NC	1101.5
Pu-240	Bq/g	278.2	NC	491.7
Pu-241	Bq/g	1491.4	NC	6896.1
Pu-242	Bq/g	0.1	NC	0.3
Pu-244	Bq/g	0.0	NC	0.0
Pu-239 + Pu-241	ng/g	5868	0.0	8000
Th-232/Pu-239 Ratio		178	0.0	2741

Table B.1. Tank W-3, GAAT sludge Phase I and Phase II data base (Page 4 of 6)

W-3 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Physical Properties										
Water	%	3	57.6	72.8	87.9	88.3	88.6	78.0	23%	31.0
Bulk density	g/mL	1	NC	NC	1.07	NC	NC	1.07	NC	1.07
TIC	mg/kg	2	1110	1298	1485	1673	1860	1485	36%	750
TC	mg/kg	3	5100	5345	5590	5845	6100	5597	9%	1000
TOC	mg/kg	3	4240	4360	4480	4890	5300	4673	12%	1060
Aroclor 1248	mg/kg	1	NC	NC	0.0	NC	NC	0.0	NC	0.0
Aroclor 1254	mg/kg	1	NC	NC	0.0	NC	NC	0.0	NC	0.0
Aroclor 1260	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
RCRA Metals (mg/kg)	Limits									
Ag	100	2	22.7	23.3	23.9	24.5	25.1	23.9	7%	2.4
As	100	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	2000	3	2.94	4.17	5.40	7.21	9.01	5.78	53%	6.07
Cd	20	1	NC	NC	1.30	NC	NC	1.30	NC	1.30
Cr	100	3	252	270	288	378	468	336	34%	216
Hg	4	3	6.42	11.56	16.70	19.50	22.30	15.14	53%	15.88
Ni	1000	3	5.5	5.6	5.7	5.7	5.78	5.7	3%	0.3
Pb	100	1	NC	NC	9.9	NC	NC	9.9	NC	9.9
Se	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	18	0	NC	NC	NC	NC	NC	NC	NC	NC
Process Metals										
Al	mg/kg	3	733	823	913	26007	51100	17582	165%	50367
B	mg/kg	2	2.94	3.03	3.12	3.21	3.30	3.12	8%	0.36
Be	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Ca	mg/kg	3	7160	7640	8120	10760	13400	9560	35%	6240
Co	mg/kg	2	3.20	3.36	3.51	3.67	3.82	3.51	12%	0.62
Cu	mg/kg	3	17.5	22.4	27.2	29.8	32.3	25.7	29%	14.8
Fe	mg/kg	3	195	220	245	1568	2890	1110	139%	2695
K	mg/kg	3	298	316	334	358	381	338	12%	83
Mg	mg/kg	3	303.0	440.0	577.0	725.5	874.0	584.7	49%	571.0
Mn	mg/kg	3	26.4	35.3	44.1	85.6	127.0	65.8	82%	100.6
Na	mg/kg	3	8380	8960	9540	13220	16900	11607	40%	8520
Sb	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	mg/kg	1	NC	NC	509	NC	NC	509	NC	509
Sr	mg/kg	3	17.5	19.4	21.2	26.5	31.8	23.5	32%	14.3
Th	mg/kg	2	1320	1530	1740	1950	2160	1740	34%	840
U	mg/kg	3	42300	45100	47900	87950	128000	72733	66%	85700
V	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	mg/kg	2	3.1	6.9	10.7	14.4	18.2	10.7	100%	15.1

Table B.1. Tank W-3, GAAT sludge Phase I and Phase II data base (Page 5 of 6)

W-3 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Anions by Ion Chromatrography (Water Wash)										
pH		1	NC	NC	11	NC	NC	11	NC	11
Bromide	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Fluoride	mg/kg	3	18	19	21	22	24	21	15%	6
Nitrate	mg/kg	1	NC	NC	87	NC	NC	87	NC	87
Phosphate	mg/kg	3	1370	1440	1510	2375	3240	2040	51%	1870
Sulphate	mg/kg	3	318	416	513	526	539	457	26%	221
Beta/gamma Emitters										
Gross beta	Bq/g	3	1.4E+05	1.5E+05	1.5E+05	5.8E+05	1.0E+06	4.3E+05	115%	8.60E+05
Co-60	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-134	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	Bq/g	3	4.3E+04	4.5E+04	4.6E+04	4.7E+04	4.7E+04	4.5E+04	5%	4.00E+03
Eu-152	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-154	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-155	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	Bq/g	3	1.9E+04	2.9E+04	3.9E+04	3.1E+05	5.8E+05	2.1E+05	150%	5.61E+05
Am-241	Bq/g	2	1.7E+03	1.9E+03	2.0E+03	2.2E+03	2.3E+03	2.0E+03	21%	6.00E+02
Alpha Emitters (Alpha Spec)										
Gross alpha	Bq/g	3	6500	7450	8400	10200	12000	8967	31%	5500
Cm-244	Bq/g	1	NC	NC	180	NC	NC	180	NC	180
Pu-239/Pu-240	Bq/g	3	4728	4938	5148	5946	6744	5540	19%	2016
Pu-238/Am-241	Bq/g	3	408	1182	1956	2520	3084	1816	74%	2676
Th-232+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238+d	Bq/g	1	NC	NC	4800	NC	NC	4800	NC	4800
U-234	Bq/g	2	3144	3372	3600	3828	4056	3600	18%	912
U-238	Bq/g	2	612	774	936	1098	1260	936	49%	648
U-233/U-234	Bq/g	1	NC	NC	2640	NC	NC	2640	NC	2640
Total Pu alpha	Bq/g	3	2100	2550	3000	3950	4900	3333	43%	2800
Pu-238	Bq/g	3	69	104	140	160	180	130	44%	111
Pu-239/Pu-240	Bq/g	3	1900	2350	2800	3816	4831	3177	47%	2931
Pu-242	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
[Pu-239]	ng/g	3	828	1024	1220	1665	2110	1386	47%	1282
Th-232/Pu-239		2	1080	1463	1845	2228	2610	1845	59%	1530

Table B.1. Tank W-3, GAAT sludge Phase I and Phase II data base (Page 6 of 6)

W-3 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Avg	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Uranium Isotopics (Mass Spec)										
U-233	atom %	2	0.0015	0.0031	0.0048	0.0064	0.0080	0.0048	97%	0.0065
U-234	atom %	2	0.0050	0.0051	0.0052	0.0052	0.0053	0.0052	4%	0.0003
U-235	atom %	2	0.6990	0.7051	0.7112	0.7173	0.7234	0.7112	2%	0.0244
U-236	atom %	2	0.0006	0.0012	0.0018	0.0024	0.0030	0.0018	94%	0.0024
U-238	atom %	2	99.2692	99.2732	99.2771	99.2811	99.2850	99.2771	0%	0.0158
U-238/U-235 Ratio		2	137.0	138.3	139.6	140.9	142.2	139.6	3%	5.2
U-235 MS	mg/kg	2	0	229	457	686	914	457	141%	914
U-235 NAA	mg/kg	2	270	417	565	712	859	565	74%	589
U Activity										
U-233	Bq/g	2	670.5	798.3	926.1	1053.9	1181.7	926.1	39%	511.2
U-234	Bq/g	2	479.0	743.3	1007.7	1272.0	1536.3	1007.7	74%	1057.4
U-235	Bq/g	2	20.8	31.8	42.9	54.0	65.0	42.9	73%	44.3
U-236	Bq/g	2	1.8	2.1	2.4	2.7	3.0	2.4	35%	1.2
U-238	Bq/g	2	522.5	787.1	1051.7	1316.3	1580.9	1051.7	71%	1058.4
Plutonium Isotopics (Mass Spec)										
Pu-238	atom %	2	0.02	0.12	0.22	0.31	0.41	0.22	128%	0.39
Pu-239	atom %	2	88.22	90.73	93.23	95.74	98.24	93.23	8%	10.02
Pu-240	atom %	2	1.70	3.96	6.21	8.47	10.72	6.21	103%	9.02
Pu-241	atom %	2	0.02	0.10	0.18	0.25	0.33	0.18	125%	0.31
Pu-242	atom %	2	0.02	0.10	0.17	0.25	0.32	0.17	125%	0.30
Pu-244	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu Activity										
Pu-238	Bq/g	2	244.8	535.3	825.7	1116.2	1406.6	825.7	99%	1161.7
Pu-239	Bq/g	2	1101.5	1920.3	2739.2	3558.0	4376.9	2739.2	85%	3275.4
Pu-240	Bq/g	2	278.2	331.6	385.0	438.3	491.7	385.0	39%	213.5
Pu-241	Bq/g	2	1491.4	2842.6	4193.8	5545.0	6896.1	4193.8	91%	5404.7
Pu-242	Bq/g	2	0.1	0.1	0.2	0.2	0.3	0.2	90%	0.2
Pu-244	Bq/g	2	0.0	0.0	0.0	0.0	0.0	0.0	0%	0.0
Pu-239 + Pu-241	ng/g	3	0.0	2934.1	5868.3	6934.1	8000.0	4622.8	90%	8000.0
Th-232/Pu-239 Ratio		3	0.0	89.1	178.3	1459.6	2741.0	973.1	158%	2741.0

Table B.2. Tank W-4, GAAT sludge Phase I and Phase II data base (Page 1 of 6)

W-4 SLUDGE	Units	W-04S 216	W-04H 217	W-04S 306	W-04S 307
NR=Not Reported					
NC=Not Computed					
Physical Properties					
Water	%	63.5	71.1	83.4	76.6
Bulk density	g/mL	1.35	NR	NR	1.20
TIC	mg/kg	1700	NR	1990	1380
TC	mg/kg	1900	NR	2450	2510
TOC	mg/kg	200	NR	453	1130
Aroclor 1248	mg/kg	0.012	NR	NR	NR
Aroclor 1254	mg/kg	0.033	NR	NR	NR
Aroclor 1260	mg/kg	0.043	NR	NR	NR
RCRA Metals (mg/kg)	RCRA Limits				
Ag	100	< 1.1	< 1.1	23.1	26.3
As	100	< 1.2	< 1.1	< 0.5	< 0.5
Ba	2000	5.66	5.49	6.54	18
Cd	20	< 1.4	1.97	5.55	4.84
Cr	100	316	158	212	227
Hg	4	5.75	3.41	25.9	62.6
Ni	1000	5.92	6.5	15.2	14.2
Pb	100	< 79	< 73	15.6	17.1
Se	20	< 1.2	< 1.1	< 0.5	< 0.5
Tl	18	< 28	< 26	< 0.5	< 0.5
Process Metals					
Al	mg/kg	2550	815	8150	7480
B	mg/kg	< 2.8	< 2.6	4.86	5.44
Be	mg/kg	< 0.21	< 0.19	15.6	6.55
Ca	mg/kg	683	620	1660	2040
Co	mg/kg	< 1.6	< 1.5	4.76	5.64
Cu	mg/kg	7.08	6.03	38.3	39.6
Fe	mg/kg	1020	294	839	1700
K	mg/kg	299	251	219	459
Mg	mg/kg	47.8	66.2	291	538
Mn	mg/kg	24.9	47.2	18	28.6
Na	mg/kg	30200	25000	11700	10900
Sb	mg/kg	< 30	< 28	< 20	< 20
Si	mg/kg	277	190	NR	NR
Sr	mg/kg	3.39	3.22	16.5	22.2
Th	mg/kg	< 370	< 345	4430	3050
U	mg/kg	211000	186000	43100	49900
V	mg/kg	< 4.6	< 4.3	< 0.5	< 0.5
Zn	mg/kg	9.88	12.6	7.93	10.3

Table B.2. Tank W-4, GAAT sludge Phase I and Phase II data base (Page 2 of 6)

W-4 SLUDGE	Units	W-04S 216	W-04H 217	W-04S 306	W-04S 307
NR=Not Reported					
NC=Not Computed					
Anions by Ion Chromatrography (Water Wash)					
pH		10.6	NR	NR	NR
Bromide	mg/kg	< 53	NR	< 5	< 5
Chloride	mg/kg	< 53	NR	< 5	< 5
Fluoride	mg/kg	< 53	NR	22.6	20
Nitrate	mg/kg	1370	NR	1730	1420
Phosphate	mg/kg	3070	NR	434	147
Sulphate	mg/kg	1910	NR	2220	1530
Beta/gamma Emitters					
Gross beta	Bq/g	1.2E+05	7.0E+04	9.0E+05	9.2E+05
Co-60	Bq/g	< 2.3E+01	< 2.7E+01	< 1.4E+02	< 1.4E+02
Cs-134	Bq/g	NR	NR	< 2.6E+02	< 4.8E+02
Cs-137/Ba-137m	Bq/g	3.8E+04	2.0E+04	8.5E+04	3.4E+05
Eu-152	Bq/g	< 1.4E+02	< 1.5E+02	< 1.2E+03	< 2.3E+03
Eu-154	Bq/g	< 6.4E+01	< 6.7E+01	< 4.8E+02	< 3.4E+02
Eu-155	Bq/g	< 2.2E+02	< 1.5E+02	< 9.6E+02	< 1.5E+03
Sr-90/Y-90	Bq/g	4.0E+04	1.9E+04	2.6E+05	1.7E+05
Am-241	Bq/g	NR	NR	< 2.0+E03	< 3.1E+03
Alpha Emitters (Alpha Spec)					
Gross alpha	Bq/g	5700	4700	7200	16000
Cm-244	Bq/g	234	239	NR	NR
Pu-239/Pu-240	Bq/g	359	279	5328	5126
Pu-238/Am-241	Bq/g	NR	NR	446	691
Th-232+d	Bq/g	NR	NR	NR	NR
U-238+d	Bq/g	5107	5181	NR	NR
U-234	Bq/g	NR	NR	929	1130
U-238	Bq/g	NR	NR	497	259
U-233/U-234	Bq/g	NR	NR	NR	NR
Total Pu alpha	Bq/g	350	210	5160	12000
Pu-238	Bq/g	NR	NR	67	170
Pu-239/Pu-240	Bq/g	350	210	5100	12000
Pu-242	Bq/g	NR	NR	NR	NR
[Pu-239]	ng/g	152	92	2230	5140
Th-232/Pu-239		NR	NR	1990	593

Table B.2. Tank W-4, GAAT sludge Phase I and Phase II data base (Page 3 of 6)

W-4 SLUDGE	Units	W-04S 216	W-04H 217	W-04S 306	W-04S 307
NR=Not Reported					
NC=Not Computed					
Uranium Isotopics (Mass Spec)					
U-233	atom %	< 0.0001	< 0.001	NR	< 0.001
U-234	atom %	0.0057	0.006	NR	0.0055
U-235	atom %	0.7219	0.72	NR	0.705
U-236	atom %	0.0012	0.0004	NR	0.003
U-238	atom %	99.2711	99.27	NR	99.286
U-238/U-235 Ratio		138.0	138.0	NR	142.6
U-235 MS	mg/kg	1500	1320	NR	347
U-235 NAA	mg/kg	1360	1200	NR	340
U Activity					
U-233	Bq/g	73.7	649.5	NC	174.3
U-234	Bq/g	2723.7	2527.4	NC	621.5
U-235	Bq/g	107.0	94.0	NC	24.7
U-236	Bq/g	6.0	4.4	NC	3.6
U-238	Bq/g	2606.1	2297.3	NC	616.4
Plutonium Isotopics (Mass Spec)					
Pu-238	atom %	0.05	0.38	NR	0.02
Pu-239	atom %	98.51	98.51	NR	96.74
Pu-240	atom %	1.43	1.09	NR	3.15
Pu-241	atom %	< 0.01	< 0.01	NR	0.05
Pu-242	atom %	< 0.01	< 0.01	NR	0.04
Pu-244	atom %	< 0.01	< 0.01	NR	< 0.01
Pu Activity					
Pu-238	Bq/g	40.9	106.0	NC	579.4
Pu-239	Bq/g	293.4	100.0	NC	10,200.2
Pu-240	Bq/g	15.6	4.1	NC	1,220.1
Pu-241	Bq/g	16.6	11.3	NC	8,823.9
Pu-242	Bq/g	0.0	0.0	NC	0.3
Pu-244	Bq/g	0.0	0.0	NC	0.0
Pu-239 + Pu-241	ng/g	NR	NR	NR	19020
Th-232/Pu-239 Ratio		NR	NR	NR	686

Table B.2. Tank W-4, GAAT sludge Phase I and Phase II data base (Page 4 of 6)

W-4 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Physical Properties										
Water	%	4	63.5	69.2	73.9	78.3	83.4	73.7	11%	19.9
Bulk density	g/mL	2	1.20	1.24	1.28	1.31	1.35	1.28	8%	0.15
TIC	mg/kg	3	1380	1540	1700	1845	1990	1690	18%	610
TC	mg/kg	3	1900	2175	2450	2480	2510	2287	15%	610
TOC	mg/kg	3	200	327	453	792	1130	594	81%	930
Aroclor 1248	mg/kg	1	NC	NC	0.0	NC	NC	0.0	NC	0.0
Aroclor 1254	mg/kg	1	NC	NC	0.0	NC	NC	0.0	NC	0.0
Aroclor 1260	mg/kg	1	NC	NC	0.04	NC	NC	0.04	NC	0.04
RCRA Metals (mg/kg)	RCRA Limits									
Ag	100	2	23.1	23.9	24.7	25.5	26.3	24.7	9%	3.2
As	100	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	2000	4	5.49	5.62	6.10	9.41	18.00	8.92	68%	12.51
Cd	20	3	1.97	3.41	4.84	5.20	5.55	4.12	46%	3.58
Cr	100	4	158	199	220	249	316	228	29%	158
Hg	4	4	3.41	5.17	15.83	35.08	62.60	24.42	112%	59.19
Ni	1000	4	5.9	6.4	10.4	14.5	15.2	10.5	47%	9.3
Pb	100	2	15.6	16.0	16.4	16.7	17.1	16.4	6%	1.5
Se	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	18	0	NC	NC	NC	NC	NC	NC	NC	NC
Process Metals										
Al	mg/kg	4	815	2116	5015	7648	8150	4749	76%	7335
B	mg/kg	2	4.86	5.01	5.15	5.30	5.44	5.15	8%	0.58
Be	mg/kg	2	6.55	8.81	11.08	13.34	15.60	11.08	58%	9.05
Ca	mg/kg	4	620	667	1172	1755	2040	1251	57%	1420
Co	mg/kg	2	4.76	4.98	5.20	5.42	5.64	5.20	12%	0.88
Cu	mg/kg	4	6.0	6.8	22.7	38.6	39.6	22.8	82%	33.6
Fe	mg/kg	4	294	703	930	1190	1700	963	60%	1406
K	mg/kg	4	219	243	275	339	459	307	35%	240
Mg	mg/kg	4	47.8	61.6	178.6	352.8	538.0	235.8	97%	490.2
Mn	mg/kg	4	18.0	23.2	26.8	33.3	47.2	29.7	42%	29.2
Na	mg/kg	4	10900	11500	18350	26300	30200	19450	50%	19300
Sb	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	mg/kg	2	190	212	234	255	277	234	26%	87
Sr	mg/kg	4	3.2	3.3	9.9	17.9	22.2	11.3	84%	19.0
Th	mg/kg	2	3050	3395	3740	4085	4430	3740	26%	1380
U	mg/kg	4	43100	48200	117950	192250	211000	122500	72%	167900
V	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	mg/kg	4	7.9	9.4	10.1	10.9	12.6	10.2	19%	4.7

Table B.2. Tank W-4, GAAT sludge Phase I and Phase II data base (Page 5 of 6)

W-4 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Anions by Ion Chromatrography (Water Wash)										
pH		1	NC	NC	11	NC	NC	11	NC	11
Bromide	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Fluoride	mg/kg	2	20	21	21	22	23	21	9%	3
Nitrate	mg/kg	3	1370	1395	1420	1575	1730	1507	13%	360
Phosphate	mg/kg	3	147	291	434	1752	3070	1217	132%	2923
Sulphate	mg/kg	3	1530	1720	1910	2065	2220	1887	18%	690
Beta/gamma Emitters										
Gross beta	Bq/g	4	7.0E+04	1.1E+05	5.1E+05	9.1E+05	9.2E+05	5.0E+05	94%	8.50E+05
Co-60	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-134	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	Bq/g	4	2.0E+04	3.4E+04	6.2E+04	1.5E+05	3.4E+05	1.2E+05	123%	3.20E+05
Eu-152	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-154	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-155	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	Bq/g	4	1.9E+04	3.5E+04	1.1E+05	1.9E+05	2.6E+05	1.2E+05	93%	2.41E+05
Am-241	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Alpha Emitters (Alpha Spec)										
Gross alpha	Bq/g	4	4700	5450	6450	9400	16000	8400	62%	11300
Cm-244	Bq/g	2	234	235	237	238	239	237	2%	6
Pu-239/Pu-240	Bq/g	4	279	339	2743	5177	5328	2773	102%	5049
Pu-238/Am-241	Bq/g	2	446	508	569	630	691	569	30%	245
Th-232+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238+d	Bq/g	2	5107	5126	5144	5163	5181	5144	1%	74
U-234	Bq/g	2	929	979	1030	1080	1130	1030	14%	202
U-238	Bq/g	2	259	319	378	437	497	378	44%	238
U-233/U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Total Pu alpha	Bq/g	4	210	315	2755	6870	12000	4430	125%	11790
Pu-238	Bq/g	2	67	93	119	144	170	119	61%	103
Pu-239/Pu-240	Bq/g	4	210	315	2725	6825	12000	4415	126%	11790
Pu-242	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
[Pu-239]	ng/g	4	92	137	1191	2958	5140	1904	125%	5048
Th-232/Pu-239		2	593	942	1292	1641	1990	1292	76%	1397

Table B.2. Tank W-4, GAAT sludge Phase I and Phase II data base (Page 6 of 6)

W-4 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Uranium Isotopics (Mass Spec)										
U-233	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	atom %	3	0.0055	0.0056	0.0057	0.0059	0.0060	0.0057	4%	0.0005
U-235	atom %	3	0.7050	0.7125	0.7200	0.7210	0.7219	0.7156	1%	0.0169
U-236	atom %	3	0.0004	0.0008	0.0012	0.0021	0.0030	0.0015	87%	0.0026
U-238	atom %	3	99.2700	99.2706	99.2711	99.2786	99.2860	99.2757	0%	0.0160
U-238/U-235 Ratio		3	138.0	138.0	138.0	140.3	142.6	139.5	2%	4.6
U-235 MS	mg/kg	3	347	834	1320	1410	1500	1056	59%	1153
U-235 NAA	mg/kg	3	340	770	1200	1280	1360	967	57%	1020
U Activity										
U-233	Bq/g	3	73.7	124.0	174.3	411.9	649.5	299.2	103%	575.9
U-234	Bq/g	3	621.5	1574.5	2527.4	2625.6	2723.7	1957.6	59%	2102.2
U-235	Bq/g	3	24.7	59.4	94.0	100.5	107.0	75.2	59%	82.3
U-236	Bq/g	3	3.6	4.0	4.4	5.2	6.0	4.7	27%	2.5
U-238	Bq/g	3	616.4	1456.9	2297.3	2451.7	2606.1	1839.9	58%	1989.7
Plutonium Isotopics (Mass Spec)										
Pu-238	atom %	3	0.02	0.04	0.05	0.22	0.38	0.15	133%	0.36
Pu-239	atom %	3	96.74	97.63	98.51	98.51	98.51	97.92	1%	1.77
Pu-240	atom %	3	1.09	1.26	1.43	2.29	3.15	1.89	58%	2.06
Pu-241	atom %	1	NC	NC	0.05	NC	NC	0.05	NC	0.05
Pu-242	atom %	1	NC	NC	0.04	NC	NC	0.04	NC	0.04
Pu-244	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu Activity										
Pu-238	Bq/g	3	40.9	73.4	106.0	342.7	579.4	242.1	121%	538.5
Pu-239	Bq/g	3	100.0	196.7	293.4	5246.8	10200.2	3531.2	164%	10100.2
Pu-240	Bq/g	3	4.1	9.9	15.6	617.9	1220.1	413.3	169%	1216.1
Pu-241	Bq/g	3	11.3	14.0	16.6	4420.3	8823.9	2950.6	172%	8812.6
Pu-242	Bq/g	3	0.0	0.0	0.0	0.1	0.3	0.1	172%	0.3
Pu-244	Bq/g	3	0.0	0.0	0.0	0.0	0.0	0.0	91%	0.0
Pu-239 + Pu-241	ng/g	1	NC	NC	19020.0	NC	NC	19020.0	NC	19020.0
Th-232/Pu-239 Ratio		1	NC	NC	686.0	NC	NC	686.0	NC	686.0

Table B.3. Tank W-5, GAAT sludge Phase I and Phase II data base (Page 1 of 6)

W-5 SLUDGE	Units	W-05S 230	W-05S 314	W-05S 315
NR=Not Reported				
NC=Not Computed				
Physical Properties				
Water	%	72	68.3	78
Bulk density	g/mL	NR	1.26	1.07
TIC	mg/kg	1800	1900	1990
TC	mg/kg	2500	2740	2620
TOC	mg/kg	700	847	627
Aroclor 1248	mg/kg	< 0.13	NR	NR
Aroclor 1254	mg/kg	0.145	NR	NR
Aroclor 1260	mg/kg	0.06	NR	NR
RCRA Metals (mg/kg)	Limits			
Ag	100	< 0.92	< 3.94	< 3.83
As	100	< 3.7	0.695	0.706
Ba	2000	60.9	39.7	95.3
Cd	20	5.37	2.38	< 2.2
Cr	100	1220	1580	1020
Hg	4	107	132	71.8
Ni	1000	129	96.3	86.9
Pb	100	333	213	303
Se	20	< 3.7	< 0.52	< 0.50
Tl	18	< 22	< 0.52	< 0.50
Process Metals				
Al	mg/kg	21200	15700	10400
B	mg/kg	104	16.3	11.8
Be	mg/kg	0.665	< 1.5	< 1.46
Ca	mg/kg	11300	9000	19900
Co	mg/kg	< 1.3	< 2.51	< 2.44
Cu	mg/kg	30.7	40.5	26.5
Fe	mg/kg	19200	19400	14400
K	mg/kg	310	509	436
Mg	mg/kg	284	10100	476
Mn	mg/kg	276	433	530
Na	mg/kg	21100	52700	30900
Sb	mg/kg	< 24	< 10.7	< 10.4
Si	mg/kg	NR	NR	NR
Sr	mg/kg	33.9	24.5	33.1
Th	mg/kg	94.6	8370	319
U	mg/kg	927	45500	895
V	mg/kg	< 3.7	< 2.65	< 2.58
Zn	mg/kg	35.2	27.1	26

Table B.3. Tank W-5, GAAT sludge Phase I and Phase II data base (Page 2 of 6)

W-5 SLUDGE	Units	W-05S 230	W-05S 314	W-05S 315
NR=Not Reported				
NC=Not Computed				
Anions by Ion Chromatrography (Water Wash)				
pH		NR	NR	NR
Bromide	mg/kg	< 48	< 34	< 38
Chloride	mg/kg	< 48	< 34	72.7
Fluoride	mg/kg	1958	1880	2080
Nitrate	mg/kg	422	602	639
Phosphate	mg/kg	2678	3090	3650
Sulphate	mg/kg	250	308	315
Beta/gamma Emitters				
Gross beta	Bq/g	2.0E+05	9.90E+04	8.10E+04
Co-60	Bq/g	2.3E+02	1.40E+02	1.10E+02
Cs-134	Bq/g	NR	NR	NR
Cs-137/Ba-137m	Bq/g	2.4E+04	1.50E+04	1.90E+04
Eu-152	Bq/g	< 3.4E+02	< 4.4E+02	< 4.6E+02
Eu-154	Bq/g	< 3.0E+02	< 3.5E+02	< 3.0E+02
Eu-155	Bq/g	< 3.5E+02	< 3.3E+02	< 3.4E+02
Sr-90/Y-90	Bq/g	7.9E+04	2.40E+04	1.60E+04
Am-241	Bq/g	NR	NR	NR
Alpha Emitters (Alpha Spec)				
Gross alpha	Bq/g	1900	900	940
Cm-244	Bq/g	661	97	70
Pu-239/Pu-240	Bq/g	699	243	353
Pu-238/Am-241	Bq/g	540	115	162
Th-232+d	Bq/g	NR	130	103
U-238+d	Bq/g	NR	NR	NR
U-234	Bq/g	NR	89	66
U-238	Bq/g	NR	68	55
U-233/U-234	Bq/g	NR	158	131
Total Pu alpha	Bq/g	580	380	500
Pu-238	Bq/g	82	37	29
Pu-239/Pu-240	Bq/g	498	340	470
Pu-242	Bq/g	NR	< 4.1	< 5.5
[Pu-239]	ng/g	217	NR	NR
Th-232/Pu-239		> 435	NR	NR

Table B.3. Tank W-5, GAAT sludge Phase I and Phase II data base (Page 3 of 6)

W-5 SLUDGE	Units	W-05S 230	W-05S 314	W-05S 315
NR=Not Reported				
NC=Not Computed				
Uranium Isotopics (Mass Spec)				
U-233	atom %	< 0.01	NR	NR
U-234	atom %	< 0.01	NR	NR
U-235	atom %	0.54	NR	NR
U-236	atom %	< 0.01	NR	NR
U-238	atom %	99.44	NR	NR
U-238/U-235 Ratio		184.0	NR	NR
U-235 MS	mg/kg	4.94	NR	NR
U-235 NAA	mg/kg	4.75	NR	NR
U Activity				
U-233	Bq/g	32.4	NC	NC
U-234	Bq/g	21.0	NC	NC
U-235	Bq/g	0.4	NC	NC
U-236	Bq/g	0.2	NC	NC
U-238	Bq/g	11.5	NC	NC
Plutonium Isotopics (Mass Spec)				
Pu-238	atom %	0.15	NR	NR
Pu-239	atom %	95.81	NR	NR
Pu-240	atom %	3.69	NR	NR
Pu-241	atom %	0.11	NR	NR
Pu-242	atom %	0.23	NR	NR
Pu-244	atom %	< 0.01	NR	NR
Pu Activity				
Pu-238	Bq/g	158.7	NC	NC
Pu-239	Bq/g	369.0	NC	NC
Pu-240	Bq/g	52.2	NC	NC
Pu-241	Bq/g	709.1	NC	NC
Pu-242	Bq/g	0.1	NC	NC
Pu-244	Bq/g	0.0	NC	NC
Pu-239 + Pu-241	ng/g	NR	NR	NR
Th-232/Pu-239 Ratio		NR	NR	NR

Table B.3. Tank W-5, GAAT sludge Phase I and Phase II data base (Page 4 of 6)

W-5 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Physical Properties										
Water	%	3	68.3	70.2	72.0	75.0	78.0	72.8	7%	9.7
Bulk density	g/mL	2	1.07	1.12	1.17	1.21	1.26	1.17	12%	0.19
TIC	mg/kg	3	1800	1850	1900	1945	1990	1897	5%	190
TC	mg/kg	3	2500	2560	2620	2680	2740	2620	5%	240
TOC	mg/kg	3	627	664	700	774	847	725	15%	220
Aroclor 1248	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1254	mg/kg	1	NC	NC	0.1	NC	NC	0.1	NC	0.1
Aroclor 1260	mg/kg	1	NC	NC	0.06	NC	NC	0.06	NC	0.06
RCRA Metals (mg/kg)	Limits									
Ag	100	0	NC	NC	NC	NC	NC	NC	NC	NC
As	100	2	0.70	0.70	0.70	0.70	0.71	0.70	1%	0.01
Ba	2000	3	39.70	50.30	60.90	78.10	95.30	65.30	43%	55.60
Cd	20	2	2.38	3.13	3.88	4.62	5.37	3.88	55%	2.99
Cr	100	3	1020	1120	1220	1400	1580	1273	22%	560
Hg	4	3	71.80	89.40	107.00	119.50	132.00	103.60	29%	60.20
Ni	1000	3	86.9	91.6	96.3	112.7	129	104.1	21%	42.1
Pb	100	3	213.0	258.0	303.0	318.0	333	283.0	22%	120 0
Se	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	18	0	NC	NC	NC	NC	NC	NC	NC	NC
Process Metals										
Al	mg/kg	3	10400	13050	15700	18450	21200	15767	34%	10800
B	mg/kg	3	11.80	14.05	16.30	60.15	104.00	44.03	118%	92.20
Be	mg/kg	1	NC	NC	0.67	NC	NC	0.67	NC	0.67
Ca	mg/kg	3	9000	10150	11300	15600	19900	13400	43%	10900
Co	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Cu	mg/kg	3	26.5	28.6	30.7	35.6	40.5	32.6	22%	14.0
Fe	mg/kg	3	14400	16800	19200	19300	19400	17667	16%	5000
K	mg/kg	3	310	373	436	473	509	418	24%	199
Mg	mg/kg	3	284.0	380.0	476.0	5288.0	10100.0	3620.0	155%	9816.0
Mn	mg/kg	3	276.0	354.5	433.0	481.5	530.0	413.0	31%	254.0
Na	mg/kg	3	21100	26000	30900	41800	52700	34900	46%	31600
Sb	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr	mg/kg	3	24.5	28.8	33.1	33.5	33.9	30.5	17%	9.4
Th	mg/kg	3	95	207	319	4345	8370	2928	161%	8275
U	mg/kg	3	895	911	927	23214	45500	15774	163%	44605
V	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	mg/kg	3	26.0	26.6	27.1	31.2	35.2	29.4	17%	9.2

Table B.3. Tank W-5, GAAT sludge Phase I and Phase II data base (Page 5 of 6)

W-5 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Anions by Ion Chromatrography (Water Wash)										
pH		0	NC	NC	NC	NC	NC	NC	NC	NC
Bromide	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	mg/kg	1	NC	NC	73	NC	NC	73	NC	73
Fluoride	mg/kg	3	1880	1919	1958	2019	2080	1973	5%	200
Nitrate	mg/kg	3	422	512	602	621	639	554	21%	217
Phosphate	mg/kg	3	2678	2884	3090	3370	3650	3139	16%	972
Sulphate	mg/kg	3	250	279	308	312	315	291	12%	65
Beta/gamma Emitters										
Gross beta	Bq/g	3	8.1E+04	9.0E+04	9.9E+04	1.5E+05	2.0E+05	1.3E+05	51%	1.19E+05
Co-60	Bq/g	3	1.1E+02	1.3E+02	1.4E+02	1.9E+02	2.3E+02	1.6E+02	39%	1.20E+02
Cs-134	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	Bq/g	3	1.5E+04	1.7E+04	1.9E+04	2.2E+04	2.4E+04	1.9E+04	23%	9.00E+03
Eu-152	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-154	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-155	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	Bq/g	3	1.6E+04	2.0E+04	2.4E+04	5.2E+04	7.9E+04	4.0E+04	86%	6.30E+04
Am-241	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Alpha Emitters (Alpha Spec)										
Gross alpha	Bq/g	3	900	920	940	1420	1900	1247	45%	1000
Cm-244	Bq/g	3	70	83	97	379	661	276	121%	592
Pu-239/Pu-240	Bq/g	3	243	298	353	526	699	432	55%	456
Pu-238/Am-241	Bq/g	3	115	138	162	351	540	272	86%	424
Th-232+d	Bq/g	2	103	110	117	123	130	117	16%	26
U-238+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	Bq/g	2	66	72	77	83	89	77	21%	23
U-238	Bq/g	2	55	58	61	64	68	61	14%	12
U-233/U-234	Bq/g	2	131	138	145	151	158	145	14%	28
Total Pu alpha	Bq/g	3	380	440	500	540	580	487	21%	200
Pu-238	Bq/g	3	29	33	37	60	82	49	58%	53
Pu-239/Pu-240	Bq/g	3	340	405	470	484	498	436	19%	158
Pu-242	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
[Pu-239]	ng/g	1	NC	NC	217	NC	NC	217	NC	217
Th-232/Pu-239		0	NC	NC	NC	NC	NC	NC	NC	NC

Table B.3. Tank W-5, GAAT sludge Phase I and Phase II data base (Page 6 of 6)

W-5 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Uranium Isotopics (Mass Spec)										
U-233	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-235	atom %	1	NC	NC	0.5400	NC	NC	0.5400	NC	0.5400
U-236	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238	atom %	1	NC	NC	99.4400	NC	NC	99.4400	NC	99.4400
U-238/U-235 Ratio		1	NC	NC	184.0	NC	NC	184.0	NC	184.0
U-235 MS	mg/kg	1	NC	NC	5	NC	NC	5	NC	5
U-235 NAA	mg/kg	1	NC	NC	5	NC	NC	5	NC	5
U Activity										
U-233	Bq/g	1	NC	NC	32.4	NC	NC	32.4	NC	32.4
U-234	Bq/g	1	NC	NC	21.0	NC	NC	21.0	NC	21.0
U-235	Bq/g	1	NC	NC	0.4	NC	NC	0.4	NC	0.4
U-236	Bq/g	1	NC	NC	0.2	NC	NC	0.2	NC	0.2
U-238	Bq/g	1	NC	NC	11.5	NC	NC	11.5	NC	11.5
Plutonium Isotopics (Mass Spec)										
Pu-238	atom %	1	NC	NC	0.15	NC	NC	0.15	NC	0.15
Pu-239	atom %	1	NC	NC	95.81	NC	NC	95.81	NC	95.81
Pu-240	atom %	1	NC	NC	3.69	NC	NC	3.69	NC	3.69
Pu-241	atom %	1	NC	NC	0.11	NC	NC	0.11	NC	0.11
Pu-242	atom %	1	NC	NC	0.23	NC	NC	0.23	NC	0.23
Pu-244	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu Activity										
Pu-238	Bq/g	1	NC	NC	158.7	NC	NC	158.7	NC	158.7
Pu-239	Bq/g	1	NC	NC	369.0	NC	NC	369.0	NC	369.0
Pu-240	Bq/g	1	NC	NC	52.2	NC	NC	52.2	NC	52.2
Pu-241	Bq/g	1	NC	NC	709.1	NC	NC	709.1	NC	709.1
Pu-242	Bq/g	1	NC	NC	0.1	NC	NC	0.1	NC	0.1
Pu-244	Bq/g	1	NC	NC	0.0	NC	NC	0.0	NC	0.0
Pu-239 + Pu-241	ng/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Th-232/Pu-239 Ratio		0	NC	NC	NC	NC	NC	NC	NC	NC

Table B.4. Tank W-6, GAAT sludge Phase I and Phase II data base (Page 1 of 6)

W-6 SLUDGE	Units	W-06S 221	W-06S 311	W-06S 312
NR=Not Reported				
NC=Not Computed				
Physical Properties				
Water	%	65.6	72.8	62.5
Bulk density	g/mL	1.19	1.17	1.46
TIC	mg/kg	3300	3480	4990
TC	mg/kg	5600	6790	16600
TOC	mg/kg	2400	3310	11700
Aroclor 1248	mg/kg	< 0.13	NR	NR
Aroclor 1254	mg/kg	0.29	NR	NR
Aroclor 1260	mg/kg	0.11	NR	NR
RCRA Metals (mg/kg)	Limits			
Ag	100	8.6	< 3.8	9.21
As	100	< 0.48	0.695	2.22
Ba	2000	210	210	107
Cd	20	4.95	6.75	8.13
Cr	100	1390	930	1770
Hg	4	40.2	82.8	112
Ni	1000	102	138	212
Pb	100	1010	2110	7320
Se	20	< 0.48	< 0.50	< 0.50
Tl	18	36.1	< 0.50	< 0.50
Process Metals				
Al	mg/kg	10900	12100	9630
B	mg/kg	6.36	9.87	14.3
Be	mg/kg	< 0.087	< 1.5	< 1.4
Ca	mg/kg	31600	25800	29800
Co	mg/kg	4.89	7.35	24.2
Cu	mg/kg	31.2	41.5	58.8
Fe	mg/kg	14700	9950	14200
K	mg/kg	595	764	1120
Mg	mg/kg	746	90.9	3540
Mn	mg/kg	1510	801	341
Na	mg/kg	43900	35800	42400
Sb	mg/kg	< 13	< 10	< 10
Si	mg/kg	3360	NR	NR
Sr	mg/kg	54.5	65.1	64.6
Th	mg/kg	679	86.2	1320
U	mg/kg	8860	17900	91100
V	mg/kg	< 1.9	< 2.6	< 2.5
Zn	mg/kg	89.9	157	362

Table B.4. Tank W-6, GAAT sludge Phase I and Phase II data base (Page 2 of 6)

W-6 SLUDGE	Units	W-06S 221	W-06S 311	W-06S 312
NR=Not Reported				
NC=Not Computed				
Anions by Ion Chromatrography (Water Wash)				
pH		11.1	NR	NR
Bromide	mg/kg	< 64	< 42	< 40
Chloride	mg/kg	< 64	167	144
Fluoride	mg/kg	11900	4170	1760
Nitrate	mg/kg	12300	11600	8570
Phosphate	mg/kg	7900	6660	4430
Sulphate	mg/kg	9400	8510	5690
Beta/gamma Emitters				
Gross beta	Bq/g	1.1E+06	3.0E+06	1.2E+06
Co-60	Bq/g	5.6E+02	1.4E+03	4.5E+02
Cs-134	Bq/g	NR	NR	NR
Cs-137/Ba-137m	Bq/g	9.0E+04	1.5E+05	1.8E+05
Eu-152	Bq/g	< 3.7E+02	< 1.3E+03	< 1.2E+03
Eu-154	Bq/g	4.6E+02	1.1E+03	< 4.8E+02
Eu-155	Bq/g	< 5.8E+01	< 1.2E+03	< 8.4E+02
Sr-90/Y-90	Bq/g	1.9E+05	9.5E+05	4.0E+05
Am-241	Bq/g	NR	NR	NR
Alpha Emitters (Alpha Spec)				
Gross alpha	Bq/g	11000	33000	22000
Cm-244	Bq/g	6886	22440	7436
Pu-239/Pu-240	Bq/g	3410	4818	11220
Pu-238/Am-241	Bq/g	704	5775	3344
Th-232+d	Bq/g	NR	NR	NR
U-238+d	Bq/g	NR	NR	NR
U-234	Bq/g	NR	NR	NR
U-238	Bq/g	NR	NR	NR
U-233/U-234	Bq/g	NR	NR	NR
Total Pu alpha	Bq/g	2700	5500	8100
Pu-238	Bq/g	232	600	200
Pu-239/Pu-240	Bq/g	2468	4900	7900
Pu-242	Bq/g	NR	NR	NR
[Pu-239]	ng/g	1080	NR	NR
Th-232/Pu-239	Bq/g	> 630	NR	NR

Table B.4. Tank W-6, GAAT sludge Phase I and Phase II data base (Page 3 of 6)

W-6 SLUDGE	Units	W-06S 221	W-06S 311	W-06S 312
NR=Not Reported				
NC=Not Computed				
Uranium Isotopics (Mass Spec)				
U-233	atom %	< 0.0001	NR	NR
U-234	atom %	0.007	NR	NR
U-235	atom %	0.71	NR	NR
U-236	atom %	0.002	NR	NR
U-238	atom %	99.27	NR	NR
U-238/U-235 Ratio		140.0	NR	NR
U-235 MS	mg/kg	62.1	NR	NR
U-235 NAA	mg/kg	58.8	NR	NR
U Activity				
U-233	Bq/g	3.1	NC	NC
U-234	Bq/g	140.5	NC	NC
U-235	Bq/g	4.4	NC	NC
U-236	Bq/g	0.4	NC	NC
U-238	Bq/g	109.4	NC	NC
Plutonium Isotopics (Mass Spec)				
Pu- 238	atom %	0.61	NR	NR
Pu-239	atom %	95.88	NR	NR
Pu-240	atom %	3.28	NR	NR
Pu-241	atom %	0.05	NR	NR
Pu-242	atom %	0.17	NR	NR
Pu-244	atom %	0.01	NR	NR
Pu Activity				
Pu-238	Bq/g	1,642.4	NC	NC
Pu-239	Bq/g	939.5	NC	NC
Pu-240	Bq/g	118.1	NC	NC
Pu-241	Bq/g	820.0	NC	NC
Pu-242	Bq/g	0.1	NC	NC
Pu-244	Bq/g	0.0	NC	NC
Pu-239 + Pu-241	ng/g	NR	NR	NR
Th-232/Pu-239 Ratio		NR	NR	NR

Table B.4. Tank W-6, GAAT sludge Phase I and Phase II data base (Page 4 of 6)

W-6 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Physical Properties										
Water	%	3	62.5	64.1	65.6	69.2	72.8	67.0	8%	10.3
Bulk density	g/mL	3	1.17	1.18	1.19	1.33	1.46	1.27	13%	0.29
TIC	mg/kg	3	3300	3390	3480	4235	4990	3923	24%	1690
TC	mg/kg	3	5600	6195	6790	11695	16600	9663	62%	11000
TOC	mg/kg	3	2400	2855	3310	7505	11700	5803	88%	9300
Aroclor 1248	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1254	mg/kg	1	NC	NC	0.3	NC	NC	0.3	NC	0.3
Aroclor 1260	mg/kg	1	NC	NC	0.11	NC	NC	0.11	NC	0.11
RCRA Metals (mg/kg)	Limits									
Ag	100	2	8.6	8.8	8.9	9.1	9.21	8.9	5%	0.6
As	100	2	0.70	1.08	1.46	1.84	2.22	1.46	74%	1.53
Ba	2000	3	107.00	158.50	210.00	210.00	210.00	175.67	34%	103.00
Cd	20	3	4.95	5.85	6.75	7.44	8.13	6.61	24%	3.18
Cr	100	3	930	1160	1390	1580	1770	1363	31%	840
Hg	4	3	40.20	61.50	82.80	97.40	112.00	78.33	46%	71.80
Ni	1000	3	102.0	120.0	138.0	175.0	212	150.7	37%	110.0
Pb	100	3	1010.0	1560.0	2110.0	4715.0	7320	3480.0	97%	6310.0
Se	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	18	1	NC	NC	36.1	NC	NC	36.1	NC	36.1
Process Metals										
Al	mg/kg	3	9630	10265	10900	11500	12100	10877	11%	2470
B	mg/kg	3	6.36	8.12	9.87	12.09	14.30	10.18	39%	7.94
Be	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Ca	mg/kg	3	25800	27800	29800	30700	31600	29067	10%	5800
Co	mg/kg	3	4.89	6.12	7.35	15.78	24.20	12.15	87%	19.31
Cu	mg/kg	3	31.2	36.4	41.5	50.2	58.8	43.8	32%	27.6
Fe	mg/kg	3	9950	12075	14200	14450	14700	12950	20%	4750
K	mg/kg	3	595	680	764	942	1120	826	32%	525
Mg	mg/kg	3	90.9	418.5	746.0	2143.0	3540.0	1459.0	126%	3449.1
Mn	mg/kg	3	341.0	571.0	801.0	1155.5	1510.0	884.0	67%	1169.0
Na	mg/kg	3	35800	39100	42400	43150	43900	40700	11%	8100
Sb	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	mg/kg	1	NC	NC	3360	NC	NC	3360	NC	3360
Sr	mg/kg	3	54.5	59.6	64.6	64.9	65.1	61.4	10%	10.6
Th	mg/kg	3	86	383	679	1000	1320	695	89%	1234
U	mg/kg	3	8860	13380	17900	54500	91100	39287	115%	82240
V	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	mg/kg	3	89.9	123.5	157.0	259.5	362.0	203.0	70%	272.1

Table B.4. Tank W-6, GAAT sludge Phase I and Phase II data base (Page 5 of 6)

W-6 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Anions by Ion Chromatrography (Water Wash)										
pH		1	NC	NC	11	NC	NC	11	NC	11
Bromide	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	mg/kg	2	144	150	156	161	167	156	10%	23
Fluoride	mg/kg	3	1760	2965	4170	8035	11900	5943	89%	10140
Nitrate	mg/kg	3	8570	10085	11600	11950	12300	10823	18%	3730
Phosphate	mg/kg	3	4430	5545	6660	7280	7900	6330	28%	3470
Sulphate	mg/kg	3	5690	7100	8510	8955	9400	7867	25%	3710
Beta/gamma Emitters										
Gross beta	Bq/g	3	1.1E+06	1.2E+06	1.2E+06	2.1E+06	3.0E+06	1.8E+06	61%	1.90E+06
Co-60	Bq/g	3	4.5E+02	5.1E+02	5.6E+02	9.8E+02	1.4E+03	8.0E+02	65%	9.50E+02
Cs-134	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	Bq/g	3	9.0E+04	1.2E+05	1.5E+05	1.7E+05	1.8E+05	1.4E+05	33%	9.00E+04
Eu-152	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-154	Bq/g	2	4.6E+02	6.2E+02	7.8E+02	9.4E+02	1.1E+03	7.8E+02	58%	6.40E+02
Eu-155	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	Bq/g	3	1.9E+05	3.0E+05	4.0E+05	6.8E+05	9.5E+05	5.1E+05	76%	7.60E+05
Am-241	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Alpha Emitters (Alpha Spec)										
Gross alpha	Bq/g	3	11000	16500	22000	27500	33000	22000	50%	22000
Cm-244	Bq/g	3	6886	7161	7436	14938	22440	12254	72%	15554
Pu-239/Pu-240	Bq/g	3	3410	4114	4818	8019	11220	6483	64%	7810
Pu-238/Am-241	Bq/g	3	704	2024	3344	4560	5775	3274	77%	5071
Th-232+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-233/U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Total Pu alpha	Bq/g	3	2700	4100	5500	6800	8100	5433	50%	5400
Pu-238	Bq/g	3	200	216	232	416	600	344	65%	400
Pu-239/Pu-240	Bq/g	3	2468	3684	4900	6400	7900	5089	53%	5432
Pu-242	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
[Pu-239]	ng/g	1	NC	NC	1080	NC	NC	1080	NC	1080
Th-232/Pu-239	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC

Table B.4. Tank W-6, GAAT sludge Phase I and Phase II data base (Page 6 of 6)

W-6 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Uranium Isotopics (Mass Spec)										
U-233	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	atom %	1	NC	NC	0.0070	NC	NC	0.0070	NC	0.0070
U-235	atom %	1	NC	NC	0.7100	NC	NC	0.7100	NC	0.7100
U-236	atom %	1	NC	NC	0.0020	NC	NC	0.0020	NC	0.0020
U-238	atom %	1	NC	NC	99.2700	NC	NC	99.2700	NC	99.2700
U-238/U-235 Ratio		1	NC	NC	140.0	NC	NC	140.0	NC	140.0
U-235 MS	mg/kg	1	NC	NC	62	NC	NC	62	NC	62
U-235 NAA	mg/kg	1	NC	NC	59	NC	NC	59	NC	59
U Activity										
U-233	Bq/g	1	NC	NC	3.1	NC	NC	3.1	NC	3.1
U-234	Bq/g	1	NC	NC	140.5	NC	NC	140.5	NC	140.5
U-235	Bq/g	1	NC	NC	4.4	NC	NC	4.4	NC	4.4
U-236	Bq/g	1	NC	NC	0.4	NC	NC	0.4	NC	0.4
U-238	Bq/g	1	NC	NC	109.4	NC	NC	109.4	NC	109.4
Plutonium Isotopics (Mass Spec)										
Pu- 238	atom %	1	NC	NC	0.61	NC	NC	0.61	NC	0.61
Pu-239	atom %	1	NC	NC	95.88	NC	NC	95.88	NC	95.88
Pu-240	atom %	1	NC	NC	3.28	NC	NC	3.28	NC	3.28
Pu-241	atom %	1	NC	NC	0.05	NC	NC	0.05	NC	0.05
Pu-242	atom %	1	NC	NC	0.17	NC	NC	0.17	NC	0.17
Pu-244	atom %	1	NC	NC	0.01	NC	NC	0.01	NC	0.01
Pu Activity										
Pu-238	Bq/g	1	NC	NC	1642.4	NC	NC	1642.4	NC	1642.4
Pu-239	Bq/g	1	NC	NC	939.5	NC	NC	939.5	NC	939.5
Pu-240	Bq/g	1	NC	NC	118.1	NC	NC	118.1	NC	118.1
Pu-241	Bq/g	1	NC	NC	820.0	NC	NC	820.0	NC	820.0
Pu-242	Bq/g	1	NC	NC	0.1	NC	NC	0.1	NC	0.1
Pu-244	Bq/g	1	NC	NC	0.0	NC	NC	0.0	NC	0.0
Pu-239 + Pu-241	ng/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Th-232/Pu-239 Ratio		0	NC	NC	NC	NC	NC	NC	NC	NC

Table B.5. Tank W-7, GAAT sludge Phase I and Phase II data base (Page 1 of 6)

W-7 SLUDGE	Units	W-07S 228	W-07S 229	W-07H 301	W-07S 302	W-07S 304
NR=Not Reported						
NC=Not Computed						
Physical Properties						
Water	%	70.4	67.9	65.9	74.7	57.7
Bulk density	g/mL	1.21	1.23	NR	1.47	1.57
TIC	mg/kg	4700	4700	NR	4290	5040
TC	mg/kg	6100	6000	NR	6030	5830
TOC	mg/kg	1300	1300	NR	1740	796
Aroclor 1248	mg/kg	< 0.13	< 0.13	NR	NR	NR
Aroclor 1254	mg/kg	0.082	0.111	NR	NR	NR
Aroclor 1260	mg/kg	< 0.27	0.014	NR	NR	NR
RCRA Metals (mg/kg)	Limits					
Ag	100	< 0.92	< 1.4	< 1.24	< 1.24	4.06
As	100	< 0.92	< 1.4	NR	< 4.97	< 5
Ba	2000	231	79.9	54.7	23.9	16.7
Cd	20	< 1.1	< 1.6	< 3.64	< 3.65	< 3.7
Cr	100	264	337	115	143	132
Hg	4	137	111	264	138	104
Ni	1000	43.5	54.7	37.1	19.6	7.35
Pb	100	< 63	< 92	62.6	39.2	18.7
Se	20	< 3.7	< 5.4	NR	< 4.97	< 5
Tl	18	< 22	< 32	NR	< 4.97	< 5
Process Metals						
Al	mg/kg	5130	5970	6580	4130	3160
B	mg/kg	30.1	21.5	24.2	19.9	24.3
Be	mg/kg	2.19	2.32	0.99	< 0.50	< 0.05
Ca	mg/kg	1300	1440	2600	791	477
Co	mg/kg	< 1.3	< 1.9	< 2.7	< 2.7	< 2.7
Cu	mg/kg	98	100	115	80	78.4
Fe	mg/kg	4670	6570	5250	887	715
K	mg/kg	8310	8330	13000	9170	10900
Mg	mg/kg	273	299	409	267	145
Mn	mg/kg	110	116	83.4	34.8	20.5
Na	mg/kg	42900	43200	41100	54400	63500
Sb	mg/kg	< 24	< 35	< 49	< 49	< 50
Si	mg/kg	NR	NR	NR	NR	NR
Sr	mg/kg	11.4	12.6	16.1	7.71	3.8
Th	mg/kg	3920	4490	4180	3180	4710
U	mg/kg	73400	86800	84600	63500	195000
V	mg/kg	< 3.7	< 5.4	2.47	1.74	< 1.3
Zn	mg/kg	31.1	33.4	49.7	31.8	22.1

Table B.5. Tank W-7, GAAT sludge Phase I and Phase II data base (Page 2 of 6)

W-7 SLUDGE	Units	W-07S 228	W-07S 229	W-07H 301	W-07S 302	W-07S 304
NR=Not Reported						
NC=Not Computed						
Anions by Ion Chromatrography (Water Wash)						
pH		10.27	10.2	NR	NR	NR
Bromide	mg/kg	88	111	101	106	109
Chloride	mg/kg	2840	2530	2360	3280	2730
Fluoride	mg/kg	2320	1870	2770	2480	1720
Nitrate	mg/kg	38500	32600	30000	42000	36700
Phosphate	mg/kg	5320	4750	3470	4490	5185
Sulphate	mg/kg	8130	7700	6540	8720	7510
Beta/gamma Emitters						
Gross beta	Bq/g	3.1E+06	3.8E+06	3.3E+06	2.5E+06	2.8E+06
Co-60	Bq/g	2.7E+03	3.1E+03	2.9E+03	1.4E+03	7.6E+02
Cs-134	Bq/g	NR	NR	< 1.6E+03	< 1.5E+03	< 2.2E+03
Cs-137/Ba-137m	Bq/g	1.1E+06	1.4E+06	1.1E+06	8.9E+05	2.2E+06
Eu-152	Bq/g	< 8.3E+02	1.6E+03	< 7.9E+03	< 7.4E+03	< 1.2E+04
Eu-154	Bq/g	1.2E+03	7.4E+02	< 1.9E+03	< 1.3E+03	< 1.2E+03
Eu-155	Bq/g	< 1.2E+03	< 1.9E+03	< 5.2E+03	< 4.8E+03	< 6.9E+03
Sr-90/Y-90	Bq/g	7.9E+05	8.7E+05	9.5E+05	6.8E+05	1.4E+05
Am-241	Bq/g	NR	NR	< 1.1E+04	< 9.7E+03	< 1.5E+04
Alpha Emitters (Alpha Spec)						
Gross alpha	Bq/g	20000	22000	17000	12000	7100
Cm-244	Bq/g	12160	16214	9486	6852	504
Pu-239/Pu-240	Bq/g	2100	1386	2516	1044	1548
Pu-238/Am-241	Bq/g	5740	4400	2567	2256	682
Th-232+d	Bq/g	NR	NR	NR	NR	NR
U-238+d	Bq/g	NR	NR	NR	NR	NR
U-234	Bq/g	NR	NR	1462	1092	2407
U-238	Bq/g	NR	NR	969	756	1960
U-233/U-234	Bq/g	NR	NR	NR	NR	NR
Total Pu alpha	Bq/g	2600	3300	NR	3000	1800
Pu-238	Bq/g	1747	2204	NR	2100	500
Pu-239/Pu-240	Bq/g	853	1096	NR	830	1300
Pu-242	Bq/g	NR	NR	NR	14	2.2
[Pu-239]	ng/g	372	477	1100	362	566
Th-232/Pu-239		> 10500	> 9410	3810	8790	8320

Table B.5. Tank W-7, GAAT sludge Phase I and Phase II data base (Page 3 of 6)

W-7 SLUDGE	Units	W-07S 228	W-07S 229	W-07H 301	W-07S 302	W-07S 304
NR=Not Reported						
NC=Not Computed						
Uranium Isotopics (Mass Spec)						
U-233	atom %	0.001	0.0009	NR	NR	NR
U-234	atom %	0.0056	0.0056	NR	NR	NR
U-235	atom %	0.725	0.727	NR	NR	NR
U-236	atom %	0.0005	0.0005	NR	NR	NR
U-238	atom %	99.268	99.27	NR	NR	NR
U-238/U-235 Ratio		136.0	136.0	NR	NR	NR
U-235 MS	mg/kg	529	626	NR	NR	NR
U-235 NAA	mg/kg	506	602	NR	NR	NR
U Activity						
U-233	Bq/g	256.3	272.8	NC	NC	NC
U-234	Bq/g	930.9	1100.8	NC	NC	NC
U-235	Bq/g	37.4	44.3	NC	NC	NC
U-236	Bq/g	0.9	1.0	NC	NC	NC
U-238	Bq/g	906.5	1072.0	NC	NC	NC
Plutonium Isotopics (Mass Spec)						
Pu-238	atom %	0.99	0.99	NR	NR	NR
Pu-239	atom %	93.4	93.37	NR	NR	NR
Pu-240	atom %	4.77	4.64	NR	NR	NR
Pu-241	atom %	0.16	0.23	NR	NR	NR
Pu-242	atom %	0.6	0.62	NR	NR	NR
Pu-244	atom %	0.08	0.15	NR	NR	NR
Pu Activity						
Pu-238	Bq/g	1,846.7	2,347.0	NC	NC	NC
Pu-239	Bq/g	634.1	805.6	NC	NC	NC
Pu-240	Bq/g	119.0	147.1	NC	NC	NC
Pu-241	Bq/g	1,818.0	3,321.4	NC	NC	NC
Pu-242	Bq/g	0.3	0.3	NC	NC	NC
Pu-244	Bq/g	0.0	0.0	NC	NC	NC
Pu-239 + Pu-241	ng/g	NR	NR	NR	NR	NR
Th-232/Pu-239 Ratio		NR	NR	NR	NR	NR

Table B.5. Tank W-7, GAAT sludge Phase I and Phase II data base (Page 4 of 6)

W-7 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Physical Properties										
Water	%	5	57.7	65.9	67.9	70.4	74.7	67.3	9%	17.0
Bulk density	g/mL	4	1.21	1.23	1.35	1.50	1.57	1.37	13%	0.36
TIC	mg/kg	4	4290	4598	4700	4785	5040	4683	7%	750
TC	mg/kg	4	5830	5958	6015	6048	6100	5990	2%	270
TOC	mg/kg	4	796	1174	1300	1410	1740	1284	30%	944
Aroclor 1248	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1254	mg/kg	2	0.1	0.1	0.1	0.1	0.1	0.1	21%	0.0
Aroclor 1260	mg/kg	1	NC	NC	0.01	NC	NC	0.01	NC	0.01
RCRA Metals (mg/kg)	Limits									
Ag	100	1	NC	NC	4.1	NC	NC	4.1	NC	4.1
As	100	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	2000	5	16.70	23.90	54.70	79.90	231.00	81.24	108%	214.30
Cd	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Cr	100	5	115	132	143	264	337	198	49%	222
Hg	4	5	104.00	111.00	137.00	138.00	264.00	150.80	43%	160.00
Ni	1000	5	7.4	19.6	37.1	43.5	54.7	32.5	58%	47.4
Pb	100	3	18.7	29.0	39.2	50.9	62.6	40.2	55%	43.9
Se	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	18	0	NC	NC	NC	NC	NC	NC	NC	NC
Process Metals										
Al	mg/kg	5	3160	4130	5130	5970	6580	4994	28%	3420
B	mg/kg	5	19.90	21.50	24.20	24.30	30.10	24.00	16%	10.20
Be	mg/kg	3	0.99	1.59	2.19	2.26	2.32	1.83	40%	1.33
Ca	mg/kg	5	477	791	1300	1440	2600	1322	62%	2123
Co	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Cu	mg/kg	5	78.4	80.0	98.0	100.0	115.0	94.3	16%	36.6
Fe	mg/kg	5	715	887	4670	5250	6570	3618	74%	5855
K	mg/kg	5	8310	8330	9170	10900	13000	9942	20%	4690
Mg	mg/kg	5	145.0	267.0	273.0	299.0	409.0	278.6	34%	264.0
Mn	mg/kg	5	20.5	34.8	83.4	110.0	116.0	72.9	60%	95.5
Na	mg/kg	5	41100	42900	43200	54400	63500	49020	20%	22400
Sb	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr	mg/kg	5	3.8	7.7	11.4	12.6	16.1	10.3	46%	12.3
Th	mg/kg	5	3180	3920	4180	4490	4710	4096	14%	1530
U	mg/kg	5	63500	73400	84600	86800	195000	100660	53%	131500
V	mg/kg	2	1.7	1.9	2.1	2.3	2.5	2.1	25%	0.7
Zn	mg/kg	5	22.1	31.1	31.8	33.4	49.7	33.6	30%	27.6

Table B.5. Tank W-7, GAAT sludge Phase I and Phase II data base (Page 5 of 6)

W-7 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Anions by Ion Chromatrography (Water Wash)										
pH		2	10	10	10	10	10	10	0%	0
Bromide	mg/kg	5	88	101	106	109	111	103	9%	23
Chloride	mg/kg	5	2360	2530	2730	2840	3280	2748	13%	920
Fluoride	mg/kg	5	1720	1870	2320	2480	2770	2232	19%	1050
Nitrate	mg/kg	5	30000	32600	36700	38500	42000	35960	13%	12000
Phosphate	mg/kg	5	3470	4490	4750	5185	5320	4643	16%	1850
Sulphate	mg/kg	5	6540	7510	7700	8130	8720	7720	10%	2180
Beta/gamma Emitters										
Gross beta	Bq/g	5	2.5E+06	2.8E+06	3.1E+06	3.3E+06	3.8E+06	3.1E+06	16%	1.30E+06
Co-60	Bq/g	5	7.6E+02	1.4E+03	2.7E+03	2.9E+03	3.1E+03	2.2E+03	48%	2.34E+03
Cs-134	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	Bq/g	5	8.9E+05	1.1E+06	1.1E+06	1.4E+06	2.2E+06	1.3E+06	38%	1.31E+06
Eu-152	Bq/g	1	NC	NC	1.6E+03	NC	NC	1.6E+03	NC	1.60E+03
Eu-154	Bq/g	2	7.4E+02	8.6E+02	9.7E+02	1.1E+03	1.2E+03	9.7E+02	34%	4.60E+02
Eu-155	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	Bq/g	5	1.4E+05	6.8E+05	7.9E+05	8.7E+05	9.5E+05	6.9E+05	47%	8.10E+05
Am-241	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Alpha Emitters (Alpha Spec)										
Gross alpha	Bq/g	5	7100	12000	17000	20000	22000	15620	39%	14900
Cm-244	Bq/g	5	504	6852	9486	12160	16214	9043	65%	15710
Pu-239/Pu-240	Bq/g	5	1044	1386	1548	2100	2516	1719	34%	1472
Pu-238/Am-241	Bq/g	5	682	2256	2567	4400	5740	3129	63%	5058
Th-232+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	Bq/g	3	1092	1277	1462	1934	2407	1654	41%	1315
U-238	Bq/g	3	756	863	969	1464	1960	1228	52%	1204
U-233/U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Total Pu alpha	Bq/g	4	1800	2400	2800	3075	3300	2675	24%	1500
Pu-238	Bq/g	4	500	1435	1924	2126	2204	1638	48%	1704
Pu-239/Pu-240	Bq/g	4	830	847	974	1147	1300	1020	22%	470
Pu-242	Bq/g	2	2	5	8	11	14	8	103%	12
[Pu-239]	ng/g	5	362	372	477	566	1100	575	53%	738
Th-232/Pu-239		3	3810	6065	8320	8555	8790	6973	39%	4980

Table B.5. Tank W-7, GAAT sludge Phase I and Phase II data base (Page 6 of 6)

W-7 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Uranium Isotopics (Mass Spec)										
U-233	atom %	2	0.0009	0.0009	0.0010	0.0010	0.0010	0.0010	7%	0.0001
U-234	atom %	2	0.0056	0.0056	0.0056	0.0056	0.0056	0.0056	0%	0.0000
U-235	atom %	2	0.7250	0.7255	0.7260	0.7265	0.7270	0.7260	0%	0.0020
U-236	atom %	2	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0%	0.0000
U-238	atom %	2	99.2680	99.2685	99.2690	99.2695	99.2700	99.2690	0%	0.0020
U-238/U-235 Ratio		2	136.0	136.0	136.0	136.0	136.0	136.0	0%	0.0
U-235 MS	mg/kg	2	529	553	578	602	626	578	12%	97
U-235 NAA	mg/kg	2	506	530	554	578	602	554	12%	96
U Activity										
U-233	Bq/g	2	256.3	260.4	264.6	268.7	272.8	264.6	4%	16.5
U-234	Bq/g	2	930.9	973.3	1015.8	1058.3	1100.8	1015.8	12%	169.9
U-235	Bq/g	2	37.4	39.1	40.8	42.6	44.3	40.8	12%	6.9
U-236	Bq/g	2	0.9	0.9	1.0	1.0	1.0	1.0	12%	0.2
U-238	Bq/g	2	906.5	947.9	989.3	1030.7	1072.0	989.3	12%	165.5
Plutonium Isotopics (Mass Spec)										
Pu-238	atom %	2	0.99	0.99	0.99	0.99	0.99	0.99	0%	0.00
Pu-239	atom %	2	93.37	93.38	93.39	93.39	93.40	93.39	0%	0.03
Pu-240	atom %	2	4.64	4.67	4.71	4.74	4.77	4.71	2%	0.13
Pu-241	atom %	2	0.16	0.18	0.20	0.21	0.23	0.20	25%	0.07
Pu-242	atom %	2	0.60	0.61	0.61	0.62	0.62	0.61	2%	0.02
Pu-244	atom %	2	0.08	0.10	0.12	0.13	0.15	0.12	43%	0.07
Pu Activity										
Pu-238	Bq/g	2	1846.7	1971.8	2096.9	2221.9	2347.0	2096.9	17%	500.3
Pu-239	Bq/g	2	634.1	676.9	719.8	762.7	805.6	719.8	17%	171.5
Pu-240	Bq/g	2	119.0	126.0	133.0	140.0	147.1	133.0	15%	28.1
Pu-241	Bq/g	2	1818.0	2193.8	2569.7	2945.5	3321.4	2569.7	41%	1503.4
Pu-242	Bq/g	2	0.3	0.3	0.3	0.3	0.3	0.3	19%	0.1
Pu-244	Bq/g	2	0.0	0.0	0.0	0.0	0.0	0.0	58%	0.0
Pu-239 + Pu-241	ng/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Th-232/Pu-239 Ratio		0	NC	NC	NC	NC	NC	NC	NC	NC

Table B.6. Tank W-7, GAAT sludge layers Phase I and Phase II data base (Page 1 of 6)

W-7 SLUDGE	Units	W-07H 303A	W-07H 303B
NR=Not Reported		Orange Layer	Brown Layer
NC=Not Computed			
Physical Properties			
Water	%	58.7	62.1
Bulk density	g/mL	1.18	1.45
TIC	mg/kg	4080	4450
TC	mg/kg	4950	5960
TOC	mg/kg	866	1520
Aroclor 1248	mg/kg	NR	NR
Aroclor 1254	mg/kg	NR	NR
Aroclor 1260	mg/kg	NR	NR
RCRA Metals (mg/kg)	Limits		
Ag	100	< 1.2	< 1.2
As	100	< 5	< 5
Ba	2000	61.1	318
Cd	20	< 3.6	< 3.6
Cr	100	168	1550
Hg	4	121	140
Ni	1000	12.6	178
Pb	100	15.0	106.0
Se	20	< 5	< 5
Tl	18	< 5	< 5
Process Metals			
Al	mg/kg	1190	4660
B	mg/kg	15.3	61.9
Be	mg/kg	< 0.05	< 0.05
Ca	mg/kg	384	1020
Co	mg/kg	< 2.7	< 2.7
Cu	mg/kg	59.8	43.8
Fe	mg/kg	787	20300
K	mg/kg	10200	6150
Mg	mg/kg	95	203
Mn	mg/kg	36.6	479
Na	mg/kg	66100	68700
Sb	mg/kg	< 49	< 50
Si	mg/kg	NR	NR
Sr	mg/kg	4.2	13
Th	mg/kg	4240	1510
U	mg/kg	179000	63100
V	mg/kg	1.48	1.47
Zn	mg/kg	18.5	28.8

Table B.6. Tank W-7, GAAT sludge layers Phase I and Phase II data base (Page 2 of 6)

W-7 SLUDGE	Units	W-07H 303A	W-07H 303B
NR=Not Reported		Orange Layer	Brown Layer
NC=Not Computed			
Anions by Ion Chromatrography (Water Wash)			
pH		NR	NR
Bromide	mg/kg	118	102
Chloride	mg/kg	2820	2930
Fluoride	mg/kg	1100	3850
Nitrate	mg/kg	37300	37700
Phosphate	mg/kg	4770	5200
Sulphate	mg/kg	7700	7990
Beta/gamma Emitters			
Gross beta	Bq/g	3.9E+06	2.5E+06
Co-60	Bq/g	< 4.7E+02	< 7.2E+02
Cs-134	Bq/g	< 2.8E+03	< 2.3E+03
Cs-137/Ba-137m	Bq/g	3.1E+06	2.1E+06
Eu-152	Bq/g	< 1.3E+04	< 1.1E+04
Eu-154	Bq/g	< 1.5E+03	< 1.4E+03
Eu-155	Bq/g	< 8.1E+03	< 6.7E+03
Sr-90/Y-90	Bq/g	1.1E+05	1.8E+04
Am-241	Bq/g	< 1.7E+04	< 1.4E+04
Alpha Emitters (Alpha Spec)			
Gross alpha	Bq/g	6500	2400
Cm-244	Bq/g	507	67
Pu-239/Pu-240	Bq/g	1027	497
Pu-238/Am-241	Bq/g	670	194
Th-232+d	Bq/g	NR	NR
U-238+d	Bq/g	NR	NR
U-234	Bq/g	2204	977
U-238	Bq/g	2093	662
U-233/U-234	Bq/g	NR	NR
Total Pu alpha	Bq/g	1100	780
Pu-238	Bq/g	390	210
Pu-239/Pu-240	Bq/g	710	570
Pu-242	Bq/g	2.1	2.8
[Pu-239]	ng/g	309	248
Th-232/Pu-239		13700	6080

Table B.6. Tank W-7, GAAT sludge layers Phase I and Phase II data base (Page 3 of 6)

W-7 SLUDGE	Units	W-07H 303A	W-07H 303B
NR=Not Reported		Orange Layer	Brown Layer
NC=Not Computed			
Uranium Isotopics (Mass Spec)			
U-233	atom %	< 0.001	< 0.001
U-234	atom %	0.006	0.0055
U-235	atom %	0.722	0.711
U-236	atom %	0.001	0.0004
U-238	atom %	99.271	99.283
U-238/U-235 Ratio		139.3	141.4
U-235 MS	mg/kg	1280	443
U-235 NAA	mg/kg	1200	NR
U Activity			
U-233	Bq/g	625.1	220.3
U-234	Bq/g	2432.2	785.9
U-235	Bq/g	90.8	31.5
U-236	Bq/g	4.3	1.5
U-238	Bq/g	2210.8	779.4
Plutonium Isotopics (Mass Spec)			
Pu-238	atom %	0.74	2.13
Pu-239	atom %	96.29	96.98
Pu-240	atom %	2.83	0.83
Pu-241	atom %	0.03	0.01
Pu-242	atom %	0.1	0.05
Pu-244	atom %	< 0.10	< 0.01
Pu Activity			
Pu-238	Bq/g	721.4	666.1
Pu-239	Bq/g	341.6	110.4
Pu-240	Bq/g	36.9	3.5
Pu-241	Bq/g	178.2	19.1
Pu-242	Bq/g	0.0	0.0
Pu-244	Bq/g	0.0	0.0
Pu-239 + Pu-241	ng/g	148.8	48.1
Th-232/Pu-239 Ratio		28479	31399

Table B.6. Tank W-7, GAAT sludge layers Phase I and Phase II data base (Page 4 of 6)

W-7 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Physical Properties										
Water	%	2	58.7	59.6	60.4	61.3	62.1	60.4	4%	3.4
Bulk density	g/mL	2	1.18	1.25	1.32	1.38	1.45	1.32	15%	0.27
TIC	mg/kg	2	4080	4173	4265	4358	4450	4265	6%	370
TC	mg/kg	2	4950	5203	5455	5708	5960	5455	13%	1010
TOC	mg/kg	2	866	1030	1193	1357	1520	1193	39%	654
Aroclor 1248	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1254	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1260	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
RCRA Metals (mg/kg)	Limits									
Ag	100	0	NC	NC	NC	NC	NC	NC	NC	NC
As	100	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	2000	2	61.10	125.33	189.55	253.78	318.00	189.55	96%	256.90
Cd	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Cr	100	2	168	514	859	1205	1550	859	114%	1382
Hg	4	2	121.00	125.75	130.50	135.25	140.00	130.50	10%	19.00
Ni	1000	2	12.6	54.0	95.3	136.7	178	95.3	123%	165.4
Pb	100	2	15.0	37.8	60.5	83.3	106	60.5	106%	91.0
Se	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	18	0	NC	NC	NC	NC	NC	NC	NC	NC
Process Metals										
Al	mg/kg	2	1190	2058	2925	3793	4660	2925	84%	3470
B	mg/kg	2	15.30	26.95	38.60	50.25	61.90	38.60	85%	46.60
Be	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Ca	mg/kg	2	384	543	702	861	1020	702	64%	636
Co	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Cu	mg/kg	2	43.8	47.8	51.8	55.8	59.8	51.8	22%	16.0
Fe	mg/kg	2	787	5665	10544	15422	20300	10544	131%	19513
K	mg/kg	2	6150	7163	8175	9188	10200	8175	35%	4050
Mg	mg/kg	2	95.0	122.0	149.0	176.0	203.0	149.0	51%	108.0
Mn	mg/kg	2	36.6	147.2	257.8	368.4	479.0	257.8	121%	442.4
Na	mg/kg	2	66100	66750	67400	68050	68700	67400	3%	2600
Sb	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr	mg/kg	2	4.2	6.4	8.6	10.8	13.0	8.6	72%	8.8
Th	mg/kg	2	1510	2193	2875	3558	4240	2875	67%	2730
U	mg/kg	2	63100	92075	121050	150025	179000	121050	68%	115900
V	mg/kg	2	1.5	1.5	1.5	1.5	1.5	1.5	0%	0.0
Zn	mg/kg	2	18.5	21.1	23.7	26.2	28.8	23.7	31%	10.3

Table B.6. Tank W-7, GAAT sludge layers Phase I and Phase II data base (Page 5 of 6)

W-7 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Anions by Ion Chromatrography (Water Wash)										
pH		0	NC	NC	NC	NC	NC	NC	NC	NC
Bromide	mg/kg	2	102	106	110	114	118	110	10%	16
Chloride	mg/kg	2	2820	2848	2875	2903	2930	2875	3%	110
Fluoride	mg/kg	2	1100	1788	2475	3163	3850	2475	79%	2750
Nitrate	mg/kg	2	37300	37400	37500	37600	37700	37500	1%	400
Phosphate	mg/kg	2	4770	4878	4985	5093	5200	4985	6%	430
Sulphate	mg/kg	2	7700	7773	7845	7918	7990	7845	3%	290
Beta/gamma Emitters										
Gross beta	Bq/g	2	2.5E+06	2.9E+06	3.2E+06	3.6E+06	3.9E+06	3.2E+06	31%	1.40E+06
Co-60	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-134	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	Bq/g	2	2.1E+06	2.4E+06	2.6E+06	2.9E+06	3.1E+06	2.6E+06	27%	1.00E+06
Eu-152	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-154	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-155	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	Bq/g	2	1.8E+04	4.1E+04	6.4E+04	8.7E+04	1.1E+05	6.4E+04	102%	9.20E+04
Am-241	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Alpha Emitters (Alpha Spec)										
Gross alpha	Bq/g	2	2400	3425	4450	5475	6500	4450	65%	4100
Cm-244	Bq/g	2	67	177	287	397	507	287	108%	440
Pu-239/Pu-240	Bq/g	2	497	629	762	894	1027	762	49%	530
Pu-238/Am-241	Bq/g	2	194	313	432	551	670	432	78%	475
Th-232+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	Bq/g	2	977	1283	1590	1897	2204	1590	55%	1227
U-238	Bq/g	2	662	1020	1378	1735	2093	1378	73%	1431
U-233/U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Total Pu alpha	Bq/g	2	780	860	940	1020	1100	940	24%	320
Pu-238	Bq/g	2	210	255	300	345	390	300	42%	180
Pu-239/Pu-240	Bq/g	2	570	605	640	675	710	640	15%	140
Pu-242	Bq/g	2	2	2	2	3	3	2	20%	1
[Pu-239]	ng/g	2	248	263	279	294	309	279	15%	61
Th-232/Pu-239		2	6080	7985	9890	11795	13700	9890	54%	7620

Table B.6. Tank W-7, GAAT sludge layers Phase I and Phase II data base (Page 6 of 6)

W-7 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Uranium Isotopics (Mass Spec)										
U-233	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	atom %	2	0.0055	0.0056	0.0058	0.0059	0.0060	0.0058	6%	0.0005
U-235	atom %	2	0.7110	0.7138	0.7165	0.7193	0.7220	0.7165	1%	0.0110
U-236	atom %	2	0.0004	0.0006	0.0007	0.0009	0.0010	0.0007	61%	0.0006
U-238	atom %	2	99.2710	99.2740	99.2770	99.2800	99.2830	99.2770	0%	0.0120
U-238/U-235 Ratio		2	139.3	139.8	140.4	140.9	141.4	140.4	1%	2.1
U-235 MS	mg/kg	2	443	652	862	1071	1280	862	69%	837
U-235 NAA	mg/kg	1	NC	NC	1200	NC	NC	1200	NC	1200
U Activity										
U-233	Bq/g	2	220.3	321.5	422.7	523.9	625.1	422.7	68%	404.7
U-234	Bq/g	2	785.9	1197.5	1609.1	2020.7	2432.2	1609.1	72%	1646.3
U-235	Bq/g	2	31.5	46.3	61.1	75.9	90.8	61.1	69%	59.2
U-236	Bq/g	2	1.5	2.2	2.9	3.6	4.3	2.9	68%	2.8
U-238	Bq/g	2	779.4	1137.3	1495.1	1853.0	2210.8	1495.1	68%	1431.4
Plutonium Isotopics (Mass Spec)										
Pu-238	atom %	2	0.74	1.09	1.44	1.78	2.13	1.44	68%	1.39
Pu-239	atom %	2	96.29	96.46	96.64	96.81	96.98	96.64	1%	0.69
Pu-240	atom %	2	0.83	1.33	1.83	2.33	2.83	1.83	77%	2.00
Pu-241	atom %	2	0.01	0.02	0.02	0.03	0.03	0.02	71%	0.02
Pu-242	atom %	2	0.05	0.06	0.08	0.09	0.10	0.08	47%	0.05
Pu-244	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu Activity										
Pu-238	Bq/g	2	666.1	680.0	693.8	707.6	721.4	693.8	6%	55.3
Pu-239	Bq/g	2	110.4	168.2	226.0	283.8	341.6	226.0	72%	231.3
Pu-240	Bq/g	2	3.5	11.8	20.2	28.5	36.9	20.2	117%	33.4
Pu-241	Bq/g	2	19.1	58.8	98.6	138.4	178.2	98.6	114%	159.1
Pu-242	Bq/g	2	0.0	0.0	0.0	0.0	0.0	0.0	102%	0.0
Pu-244	Bq/g	2	0.0	0.0	0.0	0.0	0.0	0.0	141%	0.0
Pu-239 + Pu-241	ng/g	2	48.1	73.3	98.5	123.6	148.8	98.5	72%	100.7
Th-232/Pu-239 Ratio		2	28479.0	29209.0	29939.0	30669.0	31399.0	29939.0	7%	2920.0

Table B.7. Tank W-7, GAAT sludge chips Phase I and Phase II data base (Page 1 of 6)

W-7 SLUDGE	Units	W-07S 303C	W-07S 303D
NR=Not Reported		Yellow Chips	Orange Chips
NC=Not Computed			
Physical Properties			
Water	%	NR	NR
Bulk density	g/mL	NR	NR
TIC	mg/kg	NR	NR
TC	mg/kg	NR	NR
TOC	mg/kg	NR	NR
Aroclor 1248	mg/kg	NR	NR
Aroclor 1254	mg/kg	NR	NR
Aroclor 1260	mg/kg	NR	NR
RCRA Metals (mg/kg)	Limits		
Ag	100	18	10.1
As	100	NR	NR
Ba	2000	76.9	24.8
Cd	20	< 3.6	< 3.7
Cr	100	124	114
Hg	4	58.6	60.5
Ni	1000	< 4.6	< 4.8
Pb	100	41.0	56.1
Se	20	NR	NR
Tl	18	NR	NR
Process Metals			
Al	mg/kg	17.5	1170
B	mg/kg	13.6	13.4
Be	mg/kg	< 0.05	< 0.05
Ca	mg/kg	301	326
Co	mg/kg	2.67	< 2.8
Cu	mg/kg	30.8	49.3
Fe	mg/kg	240	423
K	mg/kg	11100	8930
Mg	mg/kg	247	176
Mn	mg/kg	27.9	19.5
Na	mg/kg	59500	56100
Sb	mg/kg	< 50	< 50
Si	mg/kg	NR	NR
Sr	mg/kg	2.43	3.79
Th	mg/kg	5160	5060
U	mg/kg	222000	212000
V	mg/kg	2.91	2.28
Zn	mg/kg	8.25	8.09

Table B.7. Tank W-7, GAAT sludge chips Phase I and Phase II data base (Page 2 of 6)

W-7 SLUDGE	Units	W-07S 303C	W-07S 303D
NR=Not Reported		Yellow Chips	Orange Chips
NC=Not Computed			
Anions by Ion Chromatrography (Water Wash)			
pH		NR	NR
Chloride	mg/kg	NR	NR
Bromide	mg/kg	NR	NR
Fluoride	mg/kg	NR	NR
Nitrate	mg/kg	NR	NR
Phosphate	mg/kg	NR	NR
Sulphate	mg/kg	NR	NR
Beta/gamma Emitters			
Gross beta	Bq/g	6.4E+06	3.1E+06
Co-60	Bq/g	< 7.2E+02	< 6.2E+02
Cs-134	Bq/g	< 3.5E+03	< 2.3E+03
Cs-137/Ba-137m	Bq/g	5.4E+06	2.5E+06
Eu-152	Bq/g	< 1.7E+04	< 1.2E+04
Eu-154	Bq/g	< 7.0E+02	< 1.4E+03
Eu-155	Bq/g	1.1E+04	< 7.3E+03
Sr-90/Y-90	Bq/g	1.8E+04	1.0E+05
Am-241	Bq/g	< 2.2E+04	< 1.5E+04
Alpha Emitters (Alpha Spec)			
Gross alpha	Bq/g	5800	6300
Cm-244	Bq/g	< 1.0	252
Pu-239/Pu-240	Bq/g	557	699
Pu-238/Am-241	Bq/g	481	536
Th-232+d	Bq/g	NR	NR
U-238+d	Bq/g	NR	NR
U-234	Bq/g	2291	2463
U-238	Bq/g	2471	2350
U-233/U-234	Bq/g	NR	NR
Total Pu alpha	Bq/g	NR	NR
Pu-238	Bq/g	NR	NR
Pu-239/Pu-240	Bq/g	NR	NR
Pu-242	Bq/g	NR	NR
[Pu-239]	ng/g	243	305
Th-232/Pu-239	Bq/g	21300	16610

Table B.7. Tank W-7, GAAT sludge chips Phase I and Phase II data base (Page 3 of 6)

W-7 SLUDGE	Units	W-07S 303C	W-07S 303D
NR=Not Reported		Yellow Chips	Orange Chips
NC=Not Computed			
Uranium Isotopics (Mass Spec)			
U-233	atom %	NR	NR
U-234	atom %	NR	NR
U-235	atom %	NR	NR
U-236	atom %	NR	NR
U-238	atom %	NR	NR
U-238/U-235 Ratio		NR	NR
U-235 MS	mg/kg	NR	NR
U-235 NAA	mg/kg	NR	NR
U Activity			
U-233	Bq/g	NC	NC
U-234	Bq/g	NC	NC
U-235	Bq/g	NC	NC
U-236	Bq/g	NC	NC
U-238	Bq/g	NC	NC
Plutonium Isotopics (Mass Spec)			
Pu-238	atom %	NR	NR
Pu-239	atom %	NR	NR
Pu-240	atom %	NR	NR
Pu-241	atom %	NR	NR
Pu-242	atom %	NR	NR
Pu-244	atom %	NR	NR
Pu Activity			
Pu-238	Bq/g	NC	NC
Pu-239	Bq/g	NC	NC
Pu-240	Bq/g	NC	NC
Pu-241	Bq/g	NC	NC
Pu-242	Bq/g	NC	NC
Pu-244	Bq/g	NC	NC
Pu-239 + Pu-241	ng/g	NR	NR
Th-232/Pu-239 Ratio		NR	NR

Table B.7. Tank W-7, GAAT sludge chips Phase I and Phase II data base (Page 4 of 6)

W-7 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Physical Properties										
Water	%	0	NC	NC	NC	NC	NC	NC	NC	NC
Bulk density	g/mL	0	NC	NC	NC	NC	NC	NC	NC	NC
TIC	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
TC	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
TOC	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1248	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1254	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1260	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
RCRA Metals (mg/kg)	Limits									
Ag	100	2	10.1	12.1	14.1	16.0	18	14.1	40%	7.9
As	100	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	2000	2	24.80	37.83	50.85	63.88	76.90	50.85	72%	52.10
Cd	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Cr	100	2	114	117	119	122	124	119	6%	10
Hg	4	2	58.60	59.08	59.55	60.03	60.50	59.55	2%	1.90
Ni	1000	0	NC	NC	NC	NC	NC	NC	NC	NC
Pb	100	2	41.0	44.8	48.6	52.3	56.1	48.6	22%	15.1
Se	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	18	0	NC	NC	NC	NC	NC	NC	NC	NC
Process Metals										
Al	mg/kg	2	18	306	594	882	1170	594	137%	1153
B	mg/kg	2	13.40	13.45	13.50	13.55	13.60	13.50	1%	0.20
Be	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Ca	mg/kg	2	301	307	314	320	326	314	6%	25
Co	mg/kg	1	NC	NC	2.67	NC	NC	2.67	NC	2.67
Cu	mg/kg	2	30.8	35.4	40.1	44.7	49.3	40.1	33%	18.5
Fe	mg/kg	2	240	286	332	377	423	332	39%	183
K	mg/kg	2	8930	9473	10015	10558	11100	10015	15%	2170
Mg	mg/kg	2	176.0	193.8	211.5	229.3	247.0	211.5	24%	71.0
Mn	mg/kg	2	19.5	21.6	23.7	25.8	27.9	23.7	25%	8.4
Na	mg/kg	2	56100	56950	57800	58650	59500	57800	4%	3400
Sb	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr	mg/kg	2	2.4	2.8	3.1	3.5	3.8	3.1	31%	1.4
Th	mg/kg	2	5060	5085	5110	5135	5160	5110	1%	100
U	mg/kg	2	212000	214500	217000	219500	222000	217000	3%	10000
V	mg/kg	2	2.3	2.4	2.6	2.8	2.9	2.6	17%	0.6
Zn	mg/kg	2	8.1	8.1	8.2	8.2	8.3	8.2	1%	0.2

Table B.7. Tank W-7, GAAT sludge chips Phase I and Phase II data base (Page 5 of 6)

W-7 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Anions by Ion Chromatrography (Water Wash)										
pH		0	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Bromide	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Fluoride	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Nitrate	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Phosphate	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Sulphate	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Beta/gamma Emitters										
Gross beta	Bq/g	2	3.1E+06	3.9E+06	4.8E+06	5.6E+06	6.4E+06	4.8E+06	49%	3.30E+06
Co-60	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-134	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	Bq/g	2	2.5E+06	3.2E+06	4.0E+06	4.7E+06	5.4E+06	4.0E+06	52%	2.90E+06
Eu-152	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-154	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-155	Bq/g	1	NC	NC	1.1E+04	NC	NC	1.1E+04	NC	1.10E+04
Sr-90/Y-90	Bq/g	2	1.8E+04	3.9E+04	5.9E+04	8.0E+04	1.0E+05	5.9E+04	98%	8.20E+04
Am-241	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Alpha Emitters (Alpha Spec)										
Gross alpha	Bq/g	2	5800	5925	6050	6175	6300	6050	6%	500
Cm-244	Bq/g	1	NC	NC	252	NC	NC	252	NC	252
Pu-239/Pu-240	Bq/g	2	557	592	628	664	699	628	16%	143
Pu-238/Am-241	Bq/g	2	481	495	508	522	536	508	8%	54
Th-232+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	Bq/g	2	2291	2334	2377	2420	2463	2377	5%	172
U-238	Bq/g	2	2350	2380	2410	2441	2471	2410	4%	121
U-233/U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Total Pu alpha	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-238	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-242	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
[Pu-239]	ng/g	2	243	259	274	290	305	274	16%	62
Th-232/Pu-239	Bq/g	2	16610	17783	18955	20128	21300	18955	17%	4690

Table B.7. Tank W-7, GAAT sludge chips Phase I and Phase II data base (Page 6 of 6)

W-7 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Uranium Isotopics (Mass Spec)										
U-233	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-235	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-236	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238/U-235 Ratio		0	NC	NC	NC	NC	NC	NC	NC	NC
U-235 MS	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
U-235 NAA	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
U Activity										
U-233	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-235	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-236	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Plutonium Isotopics (Mass Spec)										
Pu-238	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-239	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-240	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-241	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-242	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-244	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu Activity										
Pu-238	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-239	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-240	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-241	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-242	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-244	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-239 + Pu-241	ng/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Th-232/Pu-239 Ratio		0	NC	NC	NC	NC	NC	NC	NC	NC

Table B.8. Tank W-8, GAAT sludge Phase I and Phase II data base (Page 1 of 6)

W-8 SLUDGE	Units	W-08S 224	W-08S 320	W-08S 321
NR=Not Reported				
NC=Not Computed				
Physical Properties				
Water	%	78.6	83.4	83.5
Bulk density	g/mL	1.24	1.08	1.19
TIC	mg/kg	7900	6050	4240
TC	mg/kg	16400	12500	9530
TOC	mg/kg	8400	6420	5290
Aroclor 1248	mg/kg	< 0.13	NR	NR
Aroclor 1254	mg/kg	0.12	NR	NR
Aroclor 1260	mg/kg	< 0.27	NR	NR
RCRA Metals (mg/kg)	Limits			
Ag	100	< 1.3	< 3.7	< 3.9
As	100	< 1.3	< 0.5	< 0.5
Ba	2000	52	45.9	25.4
Cd	20	4.69	5.22	3.78
Cr	100	314	256	206
Hg	4	416	81.3	55.4
Ni	1000	133	130	95.6
Pb	100	1440	1520	1150
Se	20	< 5.1	< 0.49	< 0.51
Tl	18	< 31	< 0.49	< 0.51
Process Metals				
Al	mg/kg	9800	9880	10300
B	mg/kg	34.5	13.1	10.6
Be	mg/kg	8.67	14.6	9.71
Ca	mg/kg	9140	7850	7230
Co	mg/kg	2.45	2.95	< 2.5
Cu	mg/kg	62.6	62.2	44
Fe	mg/kg	9240	5920	4100
K	mg/kg	1420	1500	1370
Mg	mg/kg	5520	5460	11100
Mn	mg/kg	163	142	98.5
Na	mg/kg	5070	10100	9730
Sb	mg/kg	< 33	< 10	< 11
Si	mg/kg	NR	NR	NR
Sr	mg/kg	55.4	50.2	35.4
Th	mg/kg	16400	14300	9750
U	mg/kg	5070	5690	5930
V	mg/kg	< 5.1	4.63	< 2.6
Zn	mg/kg	100	95.6	78.5

Table B.8. Tank W-8, GAAT sludge Phase I and Phase II data base (Page 2 of 6)

W-8 SLUDGE	Units	W-08S 224	W-08S 320	W-08S 321
NR=Not Reported				
NC=Not Computed				
Anions by Ion Chromatrography (Water Wash)				
pH		9.1	NR	NR
Bromide	mg/kg	< 110	9.63	9.04
Chloride	mg/kg	< 110	422	423
Fluoride	mg/kg	518	151	130
Nitrate	mg/kg	2500	2690	2580
Phosphate	mg/kg	< 1100	191	361
Sulphate	mg/kg	4300	3470	3280
Beta/gamma Emitters				
Gross beta	Bq/g	7.5E+06	6.4E+06	4.8E+06
Co-60	Bq/g	4.8E+03	3.3E+03	1.9E+03
Cs-134	Bq/g	NR	< 4.2E+02	< 3.6E+02
Cs-137/Ba-137m	Bq/g	7.6E+05	6.9E+05	5.1E+05
Eu-152	Bq/g	2.5E+03	2.0E+03	1.3E+03
Eu-154	Bq/g	2.4E+03	2.3E+03	< 6.3E+03
Eu-155	Bq/g	< 1.4E+03	< 1.5E+03	< 1.3E+03
Sr-90/Y-90	Bq/g	2.9E+06	2.2E+06	1.8E+06
Am-241	Bq/g	NR	5.7E+03	4.0E+03
Alpha Emitters (Alpha Spec)				
Gross alpha	Bq/g	47000	33000	24000
Cm-244	Bq/g	21620	17655	9288
Pu-239/Pu-240	Bq/g	11703	6864	6240
Pu-238/Am-241	Bq/g	13677	8481	8472
Th-232+d	Bq/g	NR	NR	NR
U-238+d	Bq/g	NR	NR	NR
U-234	Bq/g	NR	NR	NR
U-238	Bq/g	NR	NR	NR
U-233/U-234	Bq/g	NR	NR	NR
Total Pu alpha	Bq/g	9100	8100	6600
Pu-238	Bq/g	3758	2700	2000
Pu-239/Pu-240	Bq/g	5342	5400	4600
Pu-242	Bq/g	NR	< 90	< 80
[Pu-239]	ng/g	2330	NR	NR
Th-232/Pu-239	Bq/g	> 7040	NR	NR

Table B.8. Tank W-8, GAAT sludge Phase I and Phase II data base (Page 3 of 6)

W-8 SLUDGE	Units	W-08S 224	W-08S 320	W-08S 321
NR=Not Reported				
NC=Not Computed				
Uranium Isotopics (Mass Spec)				
U-233	atom %	0.04	0.0370	0.0269
U-234	atom %	0.0054	0.0059	0.0057
U-235	atom %	0.667	0.6734	0.6850
U-236	atom %	0.0027	0.0039	0.0026
U-238	atom %	99.28	99.2808	99.2798
U-238/U-235 Ratio		150.0	139.8	139.5
U-235 MS	mg/kg	33.1	NR	NR
U-235 NAA	mg/kg	36.7	41	44
U Activity				
U-233	Bq/g	708.1	735.2	557.0
U-234	Bq/g	114.8	76.0	76.5
U-235	Bq/g	2.4	2.7	2.9
U-236	Bq/g	1.2	0.5	0.4
U-238	Bq/g	62.6	70.3	73.2
Plutonium Isotopics (Mass Spec)				
Pu-238	atom %	0.47	0.51	0.2
Pu-239	atom %	93.58	93.89	94.3
Pu-240	atom %	5.51	5.21	5.36
Pu-241	atom %	0.13	0.11	0.09
Pu-242	atom %	0.31	0.27	0.2
Pu-244	atom %	< 0.01	0.01	0.02
Pu Activity				
Pu-238	Bq/g	4,837	4,483	2,147
Pu-239	Bq/g	3,505	3,004	3,684
Pu-240	Bq/g	758	612	769
Pu-241	Bq/g	8,149	5,890	5,884
Pu-242	Bq/g	0.7	0.6	0.5
Pu-244	Bq/g	0.0	0.0	0.0
Pu-239 + Pu-241	ng/g	1530	NR	NR
Th-232/Pu-239 Ratio		10700	NR	NR

Table B.8. Tank W-8, GAAT sludge Phase I and Phase II data base (Page 4 of 6)

W-8 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Physical Properties										
Water	%	3	78.6	81.0	83.4	83.5	83.5	81.8	3%	4.9
Bulk density	g/mL	3	1.08	1.14	1.19	1.22	1.24	1.17	7%	0.16
TIC	mg/kg	3	4240	5145	6050	6975	7900	6063	30%	3660
TC	mg/kg	3	9530	11015	12500	14450	16400	12810	27%	6870
TOC	mg/kg	3	5290	5855	6420	7410	8400	6703	23%	3110
Aroclor 1248	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1254	mg/kg	1	NC	NC	0.1	NC	NC	0.1	NC	0.1
Aroclor 1260	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
RCRA Metals (mg/kg)	Limits									
Ag	100	0	NC	NC	NC	NC	NC	NC	NC	NC
As	100	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	2000	3	25.40	35.65	45.90	48.95	52.00	41.10	34%	26.60
Cd	20	3	3.78	4.24	4.69	4.96	5.22	4.56	16%	1.44
Cr	100	3	206	231	256	285	314	259	21%	108
Hg	4	3	55.40	68.35	81.30	248.65	416.00	184.23	109%	360.60
Ni	1000	3	95.6	112.8	130.0	131.5	133	119.5	17%	37.4
Pb	100	3	1150.0	1295.0	1440.0	1480.0	1520	1370.0	14%	370.0
Se	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	18	0	NC	NC	NC	NC	NC	NC	NC	NC
Process Metals										
Al	mg/kg	3	9800	9840	9880	10090	10300	9993	3%	500
B	mg/kg	3	10.60	11.85	13.10	23.80	34.50	19.40	68%	23.90
Be	mg/kg	3	8.67	9.19	9.71	12.16	14.60	10.99	29%	5.93
Ca	mg/kg	3	7230	7540	7850	8495	9140	8073	12%	1910
Co	mg/kg	2	2.45	2.58	2.70	2.83	2.95	2.70	13%	0.50
Cu	mg/kg	3	44.0	53.1	62.2	62.4	62.6	56.3	19%	18.6
Fe	mg/kg	3	4100	5010	5920	7580	9240	6420	41%	5140
K	mg/kg	3	1370	1395	1420	1460	1500	1430	5%	130
Mg	mg/kg	3	5460.0	5490.0	5520.0	8310.0	11100.0	7360.0	44%	5640.0
Mn	mg/kg	3	98.5	120.3	142.0	152.5	163.0	134.5	24%	64.5
Na	mg/kg	3	5070	7400	9730	9915	10100	8300	34%	5030
Sb	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr	mg/kg	3	35.4	42.8	50.2	52.8	55.4	47.0	22%	20.0
Th	mg/kg	3	9750	12025	14300	15350	16400	13483	25%	6650
U	mg/kg	3	5070	5380	5690	5810	5930	5563	8%	860
V	mg/kg	1	NC	NC	4.6	NC	NC	4.6	NC	4.6
Zn	mg/kg	3	78.5	87.1	95.6	97.8	100.0	91.4	12%	21.5

Table B.8. Tank W-8, GAAT sludge Phase I and Phase II data base (Page 5 of 6)

W-8 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Anions by Ion Chromatrography (Water Wash)										
pH		1	NC	NC	9	NC	NC	9	NC	9
Bromide	mg/kg	2	9.0	9.2	9.3	9.5	9.6	9	4%	1
Chloride	mg/kg	2	422	422	423	423	423	423	0%	1
Fluoride	mg/kg	3	130	141	151	335	518	266	82%	388
Nitrate	mg/kg	3	2500	2540	2580	2635	2690	2590	4%	190
Phosphate	mg/kg	2	191	234	276	319	361	276	44%	170
Sulphate	mg/kg	3	3280	3375	3470	3885	4300	3683	15%	1020
Beta/gamma Emitters										
Gross beta	Bq/g	3	4.8E+06	5.6E+06	6.4E+06	7.0E+06	7.5E+06	6.2E+06	22%	2.70E+06
Co-60	Bq/g	3	1.9E+03	2.6E+03	3.3E+03	4.1E+03	4.8E+03	3.3E+03	44%	2.90E+03
Cs-134	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	Bq/g	3	5.1E+05	6.0E+05	6.9E+05	7.3E+05	7.6E+05	6.5E+05	20%	2.50E+05
Eu-152	Bq/g	3	1.3E+03	1.7E+03	2.0E+03	2.3E+03	2.5E+03	1.9E+03	31%	1.20E+03
Eu-154	Bq/g	2	2.3E+03	2.3E+03	2.4E+03	2.4E+03	2.4E+03	2.4E+03	3%	1.00E+02
Eu-155	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	Bq/g	3	1.8E+06	2.0E+06	2.2E+06	2.6E+06	2.9E+06	2.3E+06	24%	1.10E+06
Am-241	Bq/g	2	4.0E+03	4.4E+03	4.9E+03	5.3E+03	5.7E+03	4.9E+03	25%	1.70E+03
Alpha Emitters (Alpha Spec)										
Gross alpha	Bq/g	3	24000	28500	33000	40000	47000	34667	33%	23000
Cm-244	Bq/g	3	9288	13472	17655	19638	21620	16188	39%	12332
Pu-239/Pu-240	Bq/g	3	6240	6552	6864	9284	11703	8269	36%	5463
Pu-238/Am-241	Bq/g	3	8472	8477	8481	11079	13677	10210	29%	5205
Th-232+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-233/U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Total Pu alpha	Bq/g	3	6600	7350	8100	8600	9100	7933	16%	2500
Pu-238	Bq/g	3	2000	2350	2700	3229	3758	2819	31%	1758
Pu-239/Pu-240	Bq/g	3	4600	4971	5342	5371	5400	5114	9%	800
Pu-242	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
[Pu-239]	ng/g	1	NC	NC	2330	NC	NC	2330	NC	2330
Th-232/Pu-239	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC

Table B.8. Tank W-8, GAAT sludge Phase I and Phase II data base (Page 6 of 6)

W-8 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Uranium Isotopics (Mass Spec)										
U-233	atom %	3	0.0269	0.0320	0.0370	0.0385	0.0400	0.0346	20%	0.0131
U-234	atom %	3	0.0054	0.0056	0.0057	0.0058	0.0059	0.0057	4%	0.0005
U-235	atom %	3	0.6670	0.6702	0.6734	0.6792	0.6850	0.6751	1%	0.0180
U-236	atom %	3	0.0026	0.0027	0.0027	0.0033	0.0039	0.0031	24%	0.0013
U-238	atom %	3	99.2798	99.2799	99.2800	99.2804	99.2808	99.2802	0%	0.0010
U-238/U-235 Ratio		3	139.5	139.7	139.8	144.9	150.0	143.1	4%	10.5
U-235 MS	mg/kg	1	NC	NC	33	NC	NC	33	NC	33
U-235 NAA	mg/kg	3	37	39	41	43	44	41	9%	7
U Activity										
U-233	Bq/g	3	557.0	632.6	708.1	721.7	735.2	666.8	14%	178.1
U-234	Bq/g	3	76.0	76.3	76.5	95.7	114.8	89.1	25%	38.8
U-235	Bq/g	3	2.4	2.5	2.7	2.8	2.9	2.6	9%	0.5
U-236	Bq/g	3	0.4	0.4	0.5	0.9	1.2	0.7	64%	0.8
U-238	Bq/g	3	62.6	66.5	70.3	71.8	73.2	68.7	8%	10.6
Plutonium Isotopics (Mass Spec)										
Pu-238	atom %	3	0.20	0.34	0.47	0.49	0.51	0.39	43%	0.31
Pu-239	atom %	3	93.58	93.74	93.89	94.10	94.30	93.92	0%	0.72
Pu-240	atom %	3	5.21	5.29	5.36	5.44	5.51	5.36	3%	0.30
Pu-241	atom %	3	0.09	0.10	0.11	0.12	0.13	0.11	18%	0.04
Pu-242	atom %	3	0.20	0.24	0.27	0.29	0.31	0.26	21%	0.11
Pu-244	atom %	2	0.01	0.01	0.02	0.02	0.02	0.02	47%	0.01
Pu Activity										
Pu-238	Bq/g	3	2146.7	3315.0	4483.3	4660.0	4836.6	3822.2	38%	2689.9
Pu-239	Bq/g	3	3003.8	3254.2	3504.6	3594.1	3683.6	3397.3	10%	679.8
Pu-240	Bq/g	3	612.3	685.2	758.1	763.6	769.2	713.2	12%	156.8
Pu-241	Bq/g	3	5884.3	5887.3	5890.2	7019.5	8148.8	6641.1	20%	2264.5
Pu-242	Bq/g	3	0.5	0.5	0.6	0.6	0.7	0.6	21%	0.2
Pu-244	Bq/g	3	0.0	0.0	0.0	0.0	0.0	0.0	107%	0.0
Pu-239 + Pu-241	ng/g	1	NC	NC	1530.0	NC	NC	1530.0	NC	1530.0
Th-232/Pu-239 Ratio		1	NC	NC	10700.0	NC	NC	10700.0	NC	10700.0

Table B.9. Tank W-9, GAAT sludge Phase I and Phase II data base (Page 1 of 6)

W-9 SLUDGE	Units	W-09S 227	W-09S 323	W-09S 324
NR=Not Reported				
NC=Not Computed				
Physical Properties				
Water	%	82.8	86.6	86.7
Bulk density	g/mL	1.10	1.28	1.25
TIC	mg/kg	1900	1590	2180
TC	mg/kg	4800	4520	4300
TOC	mg/kg	2900	2930	2120
Aroclor 1248	mg/kg	< 0.13	NR	NR
Aroclor 1254	mg/kg	0.08	NR	NR
Aroclor 1260	mg/kg	< 0.27	NR	NR
RCRA Metals (mg/kg)	Limits			
Ag	100	< 0.98	< 3.7	< 3.7
As	100	< 0.98	< 0.48	< 0.48
Ba	2000	89.6	99.3	114
Cd	20	3.49	3.1	2.7
Cr	100	131	113	115
Hg	4	62.7	75.3	62.1
Ni	1000	73.3	73	71.8
Pb	100	513	487	488
Se	20	< 3.9	< 0.48	< 0.48
Tl	18	< 23	< 0.48	< 0.48
Process Metals				
Al	mg/kg	8850	8540	9150
B	mg/kg	6.16	7.07	6.76
Be	mg/kg	4.91	7.26	7.53
Ca	mg/kg	6010	6090	6350
Co	mg/kg	1.72	3.1	2.9
Cu	mg/kg	50.4	48.6	46.1
Fe	mg/kg	3410	3040	3170
K	mg/kg	4010	2520	2430
Mg	mg/kg	613	845	843
Mn	mg/kg	143	144	152
Na	mg/kg	7050	6310	5660
Sb	mg/kg	< 25	< 10	< 10
Si	mg/kg	NR	NR	NR
Sr	mg/kg	37.4	39.3	41.6
Th	mg/kg	6260	5780	5870
U	mg/kg	31600	14000	11900
V	mg/kg	< 3.9	< 2.5	< 2.5
Zn	mg/kg	67	51	50.1

Table B.9. Tank W-9, GAAT sludge Phase I and Phase II data base (Page 2 of 6)

W-9 SLUDGE	Units	W-09S 227	W-09S 323	W-09S 324
NR=Not Reported				
NC=Not Computed				
Anions by Ion Chromatrography (Water Wash)				
pH		9.9	NR	NR
Bromide	mg/kg	< 61	7.27	7.43
Chloride	mg/kg	< 61	134	141
Fluoride	mg/kg	305	76.6	83.8
Nitrate	mg/kg	122	572	613
Phosphate	mg/kg	3660	2990	2230
Sulphate	mg/kg	622	476	511
Beta/gamma Emitters				
Gross beta	Bq/g	4.7E+06	4.9E+06	5.2E+06
Co-60	Bq/g	7.3E+03	7.0E+03	7.1E+03
Cs-134	Bq/g	NR	< 3.1E+02	< 3.0E+02
Cs-137/Ba-137m	Bq/g	3.9E+05	3.3E+05	3.3E+05
Eu-152	Bq/g	3.4E+03	3.8E+03	4.0E+03
Eu-154	Bq/g	5.6E+03	4.6E+03	4.7E+03
Eu-155	Bq/g	< 9.6E+02	< 1.2E+03	< 1.2E+03
Sr-90/Y-90	Bq/g	1.7E+06	1.7E+06	1.8E+06
Am-241	Bq/g	NR	5.4E+03	5.2E+03
Alpha Emitters (Alpha Spec)				
Gross alpha	Bq/g	100000	61000	65000
Cm-244	Bq/g	58300	41236	44785
Pu-239/Pu-240	Bq/g	13500	4819	6305
Pu-238/Am-241	Bq/g	28200	13725	12545
Th-232+d	Bq/g	NR	NR	NR
U-238+d	Bq/g	NR	NR	NR
U-234	Bq/g	NR	NR	NR
U-238	Bq/g	NR	NR	NR
U-233/U-234	Bq/g	NR	1220	1365
Total Pu alpha	Bq/g	25000	12000	10000
Pu-238	Bq/g	16875	7800	6300
Pu-239/Pu-240	Bq/g	8125	4200	3700
Pu-242	Bq/g	NR	< 130	< 110
[Pu-239]	ng/g	3540	NR	NR
Th-232/Pu-239		> 1770	NR	NR

Table B.9. Tank W-9, GAAT sludge Phase I and Phase II data base (Page 3 of 6)

W-9 SLUDGE	Units	W-09S 227	W-09S 323	W-09S 324
NR=Not Reported				
NC=Not Computed				
Uranium Isotopics (Mass Spec)				
U-233	atom %	0.006	0.0162	0.0186
U-234	atom %	0.004	0.0051	0.005
U-235	atom %	0.67	0.6827	0.6129
U-236	atom %	0.002	0.0033	0.0033
U-238	atom %	99.32	99.3467	99.3602
U-238/U-235 Ratio		148.0	154.0	157.3
U-235 MS	mg/kg	209	NR	NR
U-235 NAA	mg/kg	208	NR	74
U Activity				
U-233	Bq/g	791.6	772.9	715.8
U-234	Bq/g	161.6	134.7	464.2
U-235	Bq/g	6.7	5.1	9.1
U-236	Bq/g	1.1	0.9	4.9
U-238	Bq/g	173.0	147.1	253.4
Plutonium Isotopics (Mass Spec)				
Pu-238	atom %	0.96	1.77	1.38
Pu-239	atom %	92.89	88.37	87.4
Pu-240	atom %	4.95	8.37	9.54
Pu-241	atom %	0.11	0.2	0.23
Pu-242	atom %	1.09	1.25	1.41
Pu-244	atom %	< 0.01	0.04	0.04
Pu Activity				
Pu-238	Bq/g	17,589.0	9,637.9	7,557.7
Pu-239	Bq/g	6,193.8	1,751.2	1,742.0
Pu-240	Bq/g	1,212.5	609.3	698.5
Pu-241	Bq/g	12,276.4	6,633.6	7,672.7
Pu-242	Bq/g	4.7	1.6	1.8
Pu-244	Bq/g	0.0	0.0	0.0
Pu-239 + Pu-241	ng/g	2700	NR	NR
Th-232/Pu-239 Ratio		2320	NR	NR

Table B.9. Tank W-9, GAAT sludge Phase I and Phase II data base (Page 4 of 6)

W-9 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Physical Properties										
Water	%	3	82.8	84.7	86.6	86.7	86.7	85.4	3%	3.9
Bulk density	g/mL	3	1.10	1.18	1.25	1.27	1.28	1.21	8%	0.18
TIC	mg/kg	3	1590	1745	1900	2040	2180	1890	16%	590
TC	mg/kg	3	4300	4410	4520	4660	4800	4540	6%	500
TOC	mg/kg	3	2120	2510	2900	2915	2930	2650	17%	810
Aroclor 1248	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1254	mg/kg	1	NC	NC	0.1	NC	NC	0.1	NC	0.1
Aroclor 1260	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
RCRA Metals (mg/kg)	Limits									
Ag	100	0	NC	NC	NC	NC	NC	NC	NC	NC
As	100	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	2000	3	89.60	94.45	99.30	106.65	114.00	100.97	12%	24.40
Cd	20	3	2.70	2.90	3.10	3.30	3.49	3.10	13%	0.79
Cr	100	3	113	114	115	123	131	120	8%	18
Hg	4	3	62.10	62.40	62.70	69.00	75.30	66.70	11%	13.20
Ni	1000	3	71.8	72.4	73.0	73.2	73.3	72.7	1%	1.5
Pb	100	3	487.0	487.5	488.0	500.5	513	496.0	3%	26.0
Se	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	18	0	NC	NC	NC	NC	NC	NC	NC	NC
Process Metals										
Al	mg/kg	3	8540	8695	8850	9000	9150	8847	3%	610
B	mg/kg	3	6.16	6.46	6.76	6.92	7.07	6.66	7%	0.91
Be	mg/kg	3	4.91	6.09	7.26	7.40	7.53	6.57	22%	2.62
Ca	mg/kg	3	6010	6050	6090	6220	6350	6150	3%	340
Co	mg/kg	3	1.72	2.31	2.90	3.00	3.10	2.57	29%	1.38
Cu	mg/kg	3	46.1	47.4	48.6	49.5	50.4	48.4	4%	4.3
Fe	mg/kg	3	3040	3105	3170	3290	3410	3207	6%	370
K	mg/kg	3	2430	2475	2520	3265	4010	2987	30%	1580
Mg	mg/kg	3	613.0	728.0	843.0	844.0	845.0	767.0	17%	232.0
Mn	mg/kg	3	143.0	143.5	144.0	148.0	152.0	146.3	3%	9.0
Na	mg/kg	3	5660	5985	6310	6680	7050	6340	11%	1390
Sb	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr	mg/kg	3	37.4	38.4	39.3	40.5	41.6	39.4	5%	4.2
Th	mg/kg	3	5780	5825	5870	6065	6260	5970	4%	480
U	mg/kg	3	11900	12950	14000	22800	31600	19167	56%	19700
V	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	mg/kg	3	50.1	50.6	51.0	59.0	67.0	56.0	17%	16.9

Table B.9. Tank W-9, GAAT sludge Phase I and Phase II data base (Page 5 of 6)

W-9 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Anions by Ion Chromatrography (Water Wash)										
pH		1	NC	NC	10	NC	NC	10	NC	10
Bromide	mg/kg	2	7	7	7	7	7	7	2%	0
Chloride	mg/kg	2	134	136	138	139	141	138	4%	7
Fluoride	mg/kg	3	77	80	84	194	305	155	84%	228
Nitrate	mg/kg	3	122	347	572	593	613	436	63%	491
Phosphate	mg/kg	3	2230	2610	2990	3325	3660	2960	24%	1430
Sulphate	mg/kg	3	476	494	511	567	622	536	14%	146
Beta/gamma Emitters										
Gross beta	Bq/g	3	4.7E+06	4.8E+06	4.9E+06	5.1E+06	5.2E+06	4.9E+06	5%	5.00E+05
Co-60	Bq/g	3	7.0E+03	7.1E+03	7.1E+03	7.2E+03	7.3E+03	7.1E+03	2%	3.00E+02
Cs-134	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	Bq/g	3	3.3E+05	3.3E+05	3.3E+05	3.6E+05	3.9E+05	3.5E+05	10%	6.00E+04
Eu-152	Bq/g	3	3.4E+03	3.6E+03	3.8E+03	3.9E+03	4.0E+03	3.7E+03	8%	6.00E+02
Eu-154	Bq/g	3	4.6E+03	4.7E+03	4.7E+03	5.2E+03	5.6E+03	5.0E+03	11%	1.00E+03
Eu-155	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	Bq/g	3	1.7E+06	1.7E+06	1.7E+06	1.8E+06	1.8E+06	1.7E+06	3%	1.00E+05
Am-241	Bq/g	2	5.2E+03	5.3E+03	5.3E+03	5.4E+03	5.4E+03	5.3E+03	3%	2.00E+02
Alpha Emitters (Alpha Spec)										
Gross alpha	Bq/g	3	61000	63000	65000	82500	100000	75333	28%	39000
Cm-244	Bq/g	3	41236	43011	44785	51543	58300	48107	19%	17064
Pu-239/Pu-240	Bq/g	3	4819	5562	6305	9903	13500	8208	57%	8681
Pu-238/Am-241	Bq/g	3	12545	13135	13725	20963	28200	18157	48%	15655
Th-232+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-233/U-234	Bq/g	2	1220	1256	1293	1329	1365	1293	8%	145
Total Pu alpha	Bq/g	3	10000	11000	12000	18500	25000	15667	52%	15000
Pu-238	Bq/g	3	6300	7050	7800	12338	16875	10325	55%	10575
Pu-239/Pu-240	Bq/g	3	3700	3950	4200	6163	8125	5342	45%	4425
Pu-242	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
[Pu-239]	ng/g	1	NC	NC	3540	NC	NC	3540	NC	3540
Th-232/Pu-239		0	NC	NC	NC	NC	NC	NC	NC	NC

Table B.9. Tank W-9, GAAT sludge Phase I and Phase II data base (Page 6 of 6)

W-9 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Uranium Isotopics (Mass Spec)										
U-233	atom %	3	0.0060	0.0111	0.0162	0.0174	0.0186	0.0136	49%	0.0126
U-234	atom %	3	0.0040	0.0045	0.0050	0.0051	0.0051	0.0047	13%	0.0011
U-235	atom %	3	0.6129	0.6415	0.6700	0.6764	0.6827	0.6552	6%	0.0698
U-236	atom %	3	0.0020	0.0027	0.0033	0.0033	0.0033	0.0029	26%	0.0013
U-238	atom %	3	99.3200	99.3334	99.3467	99.3535	99.3602	99.3423	0%	0.0402
U-238/U-235 Ratio		3	148.0	151.0	154.0	155.7	157.3	153.1	3%	9.3
U-235 MS	mg/kg	1	NC	NC	209	NC	NC	209	NC	209
U-235 NAA	mg/kg	2	74	108	141	175	208	141	67%	134
U Activity										
U-233	Bq/g	3	715.8	744.4	772.9	782.2	791.6	760.1	5%	75.8
U-234	Bq/g	3	134.7	148.2	161.6	312.9	464.2	253.5	72%	329.5
U-235	Bq/g	3	5.1	5.9	6.7	7.9	9.1	7.0	29%	3.9
U-236	Bq/g	3	0.9	1.0	1.1	3.0	4.9	2.3	97%	4.0
U-238	Bq/g	3	147.1	160.0	173.0	213.2	253.4	191.1	29%	106.3
Plutonium Isotopics (Mass Spec)										
Pu-238	atom %	3	0.96	1.17	1.38	1.58	1.77	1.37	30%	0.81
Pu-239	atom %	3	87.40	87.89	88.37	90.63	92.89	89.55	3%	5.49
Pu-240	atom %	3	4.95	6.66	8.37	8.96	9.54	7.62	31%	4.59
Pu-241	atom %	3	0.11	0.16	0.20	0.22	0.23	0.18	35%	0.12
Pu-242	atom %	3	1.09	1.17	1.25	1.33	1.41	1.25	13%	0.32
Pu-244	atom %	2	0.04	0.04	0.04	0.04	0.04	0.04	0%	0.00
Pu Activity										
Pu-238	Bq/g	3	7557.7	8597.8	9637.9	13613.5	17589.0	11594.9	46%	10031.3
Pu-239	Bq/g	3	1742.0	1746.6	1751.2	3972.5	6193.8	3229.0	80%	4451.8
Pu-240	Bq/g	3	609.3	653.9	698.5	955.5	1212.5	840.1	39%	603.2
Pu-241	Bq/g	3	6633.6	7153.1	7672.7	9974.6	12276.4	8860.9	34%	5642.8
Pu-242	Bq/g	3	1.6	1.7	1.8	3.2	4.7	2.7	64%	3.1
Pu-244	Bq/g	3	0.0	0.0	0.0	0.0	0.0	0.0	87%	0.0
Pu-239 + Pu-241	ng/g	1	NC	NC	2700.0	NC	NC	2700.0	NC	2700.0
Th-232/Pu-239 Ratio		1	NC	NC	2320.0	NC	NC	2320.0	NC	2320.0

Table B.10. Tank W-10, GAAT sludge Phase I and Phase II data base (Page 1 of 6)

W-10 SLUDGE	Units	W-10S 226	W-10S 325	W-10S 326
NR=Not Reported				
NC=Not Computed				
Physical Properties				
Water	%	72.8	61.1	77.1
Bulk density	g/mL	1.13	1.25	1.23
TIC	mg/kg	5100	3550	3430
TC	mg/kg	10000	6180	8300
TOC	mg/kg	4900	2640	4870
Aroclor 1248	mg/kg	< 0.13	NR	NR
Aroclor 1254	mg/kg	28	NR	NR
Aroclor 1260	mg/kg	6.3	NR	NR
RCRA Metals (mg/kg)	Limits			
Ag	100	2.09	5.82	8.4
As	100	< 1.3	< 0.47	< 0.50
Ba	2000	75.3	310	83.7
Cd	20	4.68	5.44	2.7
Cr	100	171	122	214
Hg	4	294	93.1	288
Ni	1000	71.2	84.3	233
Pb	100	473	706	920
Se	20	< 5.0	< 0.47	< 0.50
Tl	18	< 30	< 0.47	< 0.50
Process Metals				
Al	mg/kg	30200	34000	29000
B	mg/kg	9.41	3.47	3.5
Be	mg/kg	10.4	7.22	3.9
Ca	mg/kg	5960	13900	8810
Co	mg/kg	< 1.7	< 2.3	4.5
Cu	mg/kg	86.8	71.4	75
Fe	mg/kg	8400	4010	10900
K	mg/kg	3860	3240	2650
Mg	mg/kg	592	728	2180
Mn	mg/kg	152	270	180
Na	mg/kg	14700	12300	12100
Sb	mg/kg	< 32	< 9.7	< 10
Si	mg/kg	NR	NR	NR
Sr	mg/kg	34	66.2	63.9
Th	mg/kg	6250	10400	4180
U	mg/kg	20500	10600	4350
V	mg/kg	< 5.0	< 2.4	< 2.6
Zn	mg/kg	110	123	102

Table B.10. Tank W-10, GAAT sludge Phase I and Phase II data base (Page 2 of 6)

W-10 SLUDGE	Units	W-10S 226	W-10S 325	W-10S 326
NR=Not Reported				
NC=Not Computed				
Anions by Ion Chromatrography (Water Wash)				
pH		10.6	NR	NR
Bromide	mg/kg	< 46	13	29.8
Chloride	mg/kg	546	571	597
Fluoride	mg/kg	437	364	333
Nitrate	mg/kg	6270	4440	5760
Phosphate	mg/kg	< 455	291	242
Sulphate	mg/kg	2870	1770	1950
Beta/gamma Emitters				
Gross beta	Bq/g	7.6E+06	8.0E+06	1.2E+07
Co-60	Bq/g	7.2E+03	6.6E+03	5.6E+03
Cs-134	Bq/g	NR	NR	NR
Cs-137/Ba-137m	Bq/g	1.7E+06	9.5E+05	7.9E+05
Eu-152	Bq/g	3.4E+03	4.3E+03	3.3E+03
Eu-154	Bq/g	4.6E+03	4.4E+03	3.2E+03
Eu-155	Bq/g	< 1.8E+03	< 1.7E+03	< 1.8E+03
Sr-90/Y-90	Bq/g	2.4E+06	3.0E+06	4.7E+06
Am-241	Bq/g	NR	4.4E+03	5.2E+03
Alpha Emitters (Alpha Spec)				
Gross alpha	Bq/g	81000	44000	57000
Cm-244	Bq/g	50544	31460	49305
Pu-239/Pu-240	Bq/g	7452	3080	3477
Pu-238/Am-241	Bq/g	23004	8140	3876
Th-232+d	Bq/g	NR	NR	NR
U-238+d	Bq/g	NR	NR	NR
U-234	Bq/g	NR	NR	NR
U-238	Bq/g	NR	NR	NR
U-233/U-234	Bq/g	NR	1320	342
Total Pu alpha	Bq/g	16000	11000	8500
Pu-238	Bq/g	10512	6700	2600
Pu-239/Pu-240	Bq/g	5488	4400	5900
Pu-242	Bq/g	NR	< 120	< 100
[Pu-239]	ng/g	2390	NR	NR
Th-232/Pu-239	Bq/g	> 2620	NR	NR

Table B.10. Tank W-10, GAAT sludge Phase I and Phase II data base (Page 3 of 6)

W-10 SLUDGE	Units	W-10S 226	W-10S 325	W-10S 326
NR=Not Reported				
NC=Not Computed				
Uranium Isotopics (Mass Spec)				
U-233	atom %	0.01	0.0357	0.0258
U-234	atom %	< 0.01	0.0048	0.0052
U-235	atom %	0.63	0.5480	0.6340
U-236	atom %	< 0.01	0.0055	0.0041
U-238	atom %	99.35	99.4060	99.3310
U-238/U-235 Ratio		158.0	170.3	150.5
U-235 MS	mg/kg	128	NR	NR
U-235 NAA	mg/kg	126	NR	28
U Activity				
U-233	Bq/g	715.8	1321.4	391.9
U-234	Bq/g	464.2	115.2	51.2
U-235	Bq/g	9.1	4.1	1.9
U-236	Bq/g	4.9	1.4	0.4
U-238	Bq/g	253.4	131.1	53.8
Plutonium Isotopics (Mass Spec)				
Pu-238	atom %	0.85	< 2	0.37
Pu-239	atom %	91.71	87.63	90.05
Pu-240	atom %	6.32	9.14	8.46
Pu-241	atom %	0.14	0.22	0.11
Pu-242	atom %	0.98	1.34	0.96
Pu-244	atom %	< 0.01	0.07	0.05
Pu Activity				
Pu-238	Bq/g	10,721.5	8,621.4	3,877.7
Pu-239	Bq/g	4,209.9	1,718.4	3,434.6
Pu-240	Bq/g	1,065.8	658.4	1,185.4
Pu-241	Bq/g	10,756.5	7,220.9	7,022.2
Pu-242	Bq/g	2.9	1.7	2.3
Pu-244	Bq/g	0.0	0.0	0.0
Pu-239 + Pu-241	ng/g	1840	NR	NR
Th-232/Pu-239 Ratio		3400	NR	NR

Table B.10. Tank W-10, GAAT sludge Phase I and Phase II data base (Page 4 of 6)

W-10 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Physical Properties										
Water	%	3	61.1	67.0	72.8	75.0	77.1	70.3	12%	16.0
Bulk density	g/mL	3	1.13	1.18	1.23	1.24	1.25	1.20	5%	0.12
TIC	mg/kg	3	3430	3490	3550	4325	5100	4027	23%	1670
TC	mg/kg	3	6180	7240	8300	9150	10000	8160	23%	3820
TOC	mg/kg	3	2640	3755	4870	4885	4900	4137	31%	2260
Aroclor 1248	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1254	mg/kg	1	NC	NC	28.0	NC	NC	28.0	NC	28.0
Aroclor 1260	mg/kg	1	NC	NC	6.30	NC	NC	6.30	NC	6.30
RCRA Metals (mg/kg)	Limits									
Ag	100	3	2.1	4.0	5.8	7.1	8.4	5.4	58%	6.3
As	100	0	NC	NC	NC	NC	NC	NC	NC	NC
Ba	2000	3	75.30	79.50	83.70	196.85	310.00	156.33	85%	234.70
Cd	20	3	2.70	3.69	4.68	5.06	5.44	4.27	33%	2.74
Cr	100	3	122	147	171	193	214	169	27%	92
Hg	4	3	93.10	190.55	288.00	291.00	294.00	225.03	51%	200.90
Ni	1000	3	71.2	77.8	84.3	158.7	233	129.5	69%	161.8
Pb	100	3	473.0	589.5	706.0	813.0	920	699.7	32%	447.0
Se	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	18	0	NC	NC	NC	NC	NC	NC	NC	NC
Process Metals										
Al	mg/kg	3	29000	29600	30200	32100	34000	31067	8%	5000
B	mg/kg	3	3.47	3.49	3.50	6.46	9.41	5.46	63%	5.94
Be	mg/kg	3	3.90	5.56	7.22	8.81	10.40	7.17	45%	6.50
Ca	mg/kg	3	5960	7385	8810	11355	13900	9557	42%	7940
Co	mg/kg	1	NC	NC	4.50	NC	NC	4.50	NC	4.50
Cu	mg/kg	3	71.4	73.2	75.0	80.9	86.8	77.7	10%	15.4
Fe	mg/kg	3	4010	6205	8400	9650	10900	7770	45%	6890
K	mg/kg	3	2650	2945	3240	3550	3860	3250	19%	1210
Mg	mg/kg	3	592.0	660.0	728.0	1454.0	2180.0	1166.7	75%	1588.0
Mn	mg/kg	3	152.0	166.0	180.0	225.0	270.0	200.7	31%	118.0
Na	mg/kg	3	12100	12200	12300	13500	14700	13033	11%	2600
Sb	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr	mg/kg	3	34.0	49.0	63.9	65.1	66.2	54.7	33%	32.2
Th	mg/kg	3	4180	5215	6250	8325	10400	6943	46%	6220
U	mg/kg	3	4350	7475	10600	15550	20500	11817	69%	16150
V	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	mg/kg	3	102.0	106.0	110.0	116.5	123.0	111.7	9%	21.0

Table B.10. Tank W-10, GAAT sludge Phase I and Phase II data base (Page 5 of 6)

W-10 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Anions by Ion Chromatrography (Water Wash)										
pH		1	NC	NC	10.6	NC	NC	10.6	NC	10.6
Bromide	mg/kg	2	13	17	21	26	30	21	56%	17
Chloride	mg/kg	3	546	559	571	584	597	571	4%	51
Fluoride	mg/kg	3	333	349	364	401	437	378	14%	104
Nitrate	mg/kg	3	4440	5100	5760	6015	6270	5490	17%	1830
Phosphate	mg/kg	2	242	254	267	279	291	267	13%	49
Sulphate	mg/kg	3	1770	1860	1950	2410	2870	2197	27%	1100
Beta/gamma Emitters										
Gross beta	Bq/g	3	7.6E+06	7.8E+06	8.0E+06	1.0E+07	1.2E+07	9.2E+06	26%	4.40E+06
Co-60	Bq/g	3	5.6E+03	6.1E+03	6.6E+03	6.9E+03	7.2E+03	6.5E+03	12%	1.60E+03
Cs-134	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	Bq/g	3	7.9E+05	8.7E+05	9.5E+05	1.3E+06	1.7E+06	1.1E+06	42%	9.10E+05
Eu-152	Bq/g	3	3.3E+03	3.4E+03	3.4E+03	3.9E+03	4.3E+03	3.7E+03	15%	1.00E+03
Eu-154	Bq/g	3	3.2E+03	3.8E+03	4.4E+03	4.5E+03	4.6E+03	4.1E+03	19%	1.40E+03
Eu-155	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	Bq/g	3	2.4E+06	2.7E+06	3.0E+06	3.9E+06	4.7E+06	3.4E+06	35%	2.30E+06
Am-241	Bq/g	2	4.4E+03	4.6E+03	4.8E+03	5.0E+03	5.2E+03	4.8E+03	12%	8.00E+02
Alpha Emitters Alpha Spec										
Gross alpha	Bq/g	3	44000	50500	57000	69000	81000	60667	31%	37000
Cm-244	Bq/g	3	31460	40383	49305	49925	50544	43770	24%	19084
Pu-239/Pu-240	Bq/g	3	3080	3279	3477	5465	7452	4670	52%	4372
Pu-238/Am-241	Bq/g	3	3876	6008	8140	15572	23004	11673	86%	19128
Th-232+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-238	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-233/U-234	Bq/g	2	342	587	831	1076	1320	831	83%	978
Total Pu alpha	Bq/g	3	8500	9750	11000	13500	16000	11833	32%	7500
Pu-238	Bq/g	3	2600	4650	6700	8606	10512	6604	60%	7912
Pu-239/Pu-240	Bq/g	3	4400	4944	5488	5694	5900	5263	15%	1500
Pu-242	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
[Pu-239]	ng/g	1	NC	NC	2390	NC	NC	2390	NC	2390
Th-232/Pu-239	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC

Table B.10. Tank W-10, GAAT sludge Phase I and Phase II data base (Page 6 of 6)

W-10 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Uranium Isotopics (Mass Spec)										
U-233	atom %	3	0.0100	0.0179	0.0258	0.0308	0.0357	0.0238	54%	0.0257
U-234	atom %	2	0.0048	0.0049	0.0050	0.0051	0.0052	0.0050	6%	0.0004
U-235	atom %	3	0.5480	0.5890	0.6300	0.6320	0.6340	0.6040	8%	0.0860
U-236	atom %	2	0.0041	0.0045	0.0048	0.0052	0.0055	0.0048	21%	0.0014
U-238	atom %	3	99.3310	99.3405	99.3500	99.3780	99.4060	99.3623	0%	0.0750
U-238/U-235 Ratio		3	150.5	154.3	158.0	164.2	170.3	159.6	6%	19.8
U-235 MS	mg/kg	1	NC	NC	128	NC	NC	128	NC	128
U-235 NAA	mg/kg	2	28	53	77	102	126	77	90%	98
U Activity										
U-233	Bq/g	3	391.9	553.8	715.8	1018.6	1321.4	809.7	58%	929.5
U-234	Bq/g	3	51.2	83.2	115.2	289.7	464.2	210.2	106%	413.0
U-235	Bq/g	3	1.9	3.0	4.1	6.6	9.1	5.0	73%	7.1
U-236	Bq/g	3	0.4	0.9	1.4	3.1	4.9	2.2	105%	4.5
U-238	Bq/g	3	53.8	92.4	131.1	192.2	253.4	146.1	69%	199.6
Plutonium Isotopics (Mass Spec)										
Pu-238	atom %	2	0.37	0.49	0.61	0.73	0.85	0.61	56%	0.48
Pu-239	atom %	3	87.63	88.84	90.05	90.88	91.71	89.80	2%	4.08
Pu-240	atom %	3	6.32	7.39	8.46	8.80	9.14	7.97	18%	2.82
Pu-241	atom %	3	0.11	0.13	0.14	0.18	0.22	0.16	36%	0.11
Pu-242	atom %	3	0.96	0.97	0.98	1.16	1.34	1.09	20%	0.38
Pu-244	atom %	2	0.05	0.06	0.06	0.07	0.07	0.06	24%	0.02
Pu Activity										
Pu-238	Bq/g	3	3877.7	6249.6	8621.4	9671.5	10721.5	7740.2	45%	6843.8
Pu-239	Bq/g	3	1718.4	2576.5	3434.6	3822.2	4209.9	3121.0	41%	2491.5
Pu-240	Bq/g	3	658.4	862.1	1065.8	1125.6	1185.4	969.9	28%	526.9
Pu-241	Bq/g	3	7022.2	7121.5	7220.9	8988.7	10756.5	8333.2	25%	3734.3
Pu-242	Bq/g	3	1.7	2.0	2.3	2.6	2.9	2.3	26%	1.2
Pu-244	Bq/g	3	0.0	0.0	0.0	0.0	0.0	0.0	90%	0.0
Pu-239 + Pu-241	ng/g	1	NC	NC	1840.0	NC	NC	1840.0	NC	1840.0
Th-232/Pu-239 Ratio		1	NC	NC	3400.0	NC	NC	3400.0	NC	3400.0

Table B.11. Tank TH-4, GAAT sludge Phase I and Phase II data base (Page 1 of 6)

TH-4 SLUDGE	Units	TH-4S 213	TH-4S 214	TH-4H 215
NR=Not Reported				
NC=Not Computed				
Physical Properties				
Water	%	65.2	65.1	34.5
Bulk density	g/mL	1.3	1.37	NR
TIC	mg/kg	11100	8400	NR
TC	mg/kg	19300	13500	NR
TOC	mg/kg	8300	5100	NR
Aroclor 1248	mg/kg	< 0.13	< 0.13	NR
Aroclor 1254	mg/kg	< 0.27	< 0.27	NR
Aroclor 1260	mg/kg	0.81	0.51	NR
RCRA Metals (mg/kg)	Limits			
Ag	100	< 1.24	< 0.70	< 1.63
As	100	4.16	3.71	4.19
Ba	2000	8.91	9.72	14.5
Cd	20	< 1.49	1.84	<1.95
Cr	100	352	300	191
Hg	4	8.56	7.36	6.37
Ni	1000	52.8	40.7	36.7
Pb	100	< 84	< 48	< 111
Se	20	< 1.2	< 0.70	< 1.6
Tl	18	< 30	< 17	< 55
Process Metals				
Al	mg/kg	3910	3650	1350
B	mg/kg	4.97	2.98	< 3.90
Be	mg/kg	1.83	2.49	0.975
Ca	mg/kg	1620	1390	1550
Co	mg/kg	< 1.73	< 0.98	< 2.28
Cu	mg/kg	16.4	15.8	22.7
Fe	mg/kg	3510	3730	3190
K	mg/kg	1020	871	587
Mg	mg/kg	206	193	557
Mn	mg/kg	27.1	37.9	34.8
Na	mg/kg	29700	27500	30800
Sb	mg/kg	< 32	< 18.3	< 42
Si	mg/kg	282	188	198
Sr	mg/kg	10.1	9.09	15.4
Th	mg/kg	115000	110000	237000
U	mg/kg	24300	24700	67400
V	mg/kg	< 4.95	< 2.81	< 6.50
Zn	mg/kg	18.8	17.8	55.1

Table B.11. Tank TH-4, GAAT sludge Phase I and Phase II data base (Page 2 of 6)

TH-4 SLUDGE	Units	TH-4S 213	TH-4S 214	TH-4H 215
NR=Not Reported				
NC=Not Computed				
Anions by Ion Chromatrography (Water Wash)				
pH		9.0	8.99	NR
Bromide	mg/kg	< 30	< 28	NR
Chloride	mg/kg	< 30	< 28	NR
Fluoride	mg/kg	398	398	NR
Nitrate	mg/kg	19417	19400	NR
Phosphate	mg/kg	251	184	NR
Sulphate	mg/kg	10700	10700	NR
Beta/gamma Emitters				
Gross beta	Bq/g	7.10E+03	6.60E+03	1.90E+04
Co-60	Bq/g	< 3.1E+01	< 2.0E+01	< 2.3E+01
Cs-134	Bq/g	NR	NR	NR
Cs-137/Ba-137m	Bq/g	6.20E+02	6.60E+02	6.40E+02
Eu-152	Bq/g	< 1.7E+02	< 9.0E+01	< 1.1E+02
Eu-154	Bq/g	< 7.0E+01	< 5.0E+01	< 6.0E+01
Eu-155	Bq/g	< 9.0E+01	< 6.0E+01	< 7.0E+01
Sr-90/Y-90	Bq/g	1.20E+03	1.30E+03	2.90E+03
Am-241	Bq/g	NR	NR	NR
Alpha Emitters (Alpha Spec)				
Gross alpha	Bq/g	3300	3300	7400
Cm-244	Bq/g	NR	NR	NR
Pu-239/Pu-240	Bq/g	NR	NR	NR
Pu-238/Am-241	Bq/g	NR	NR	NR
Th-232+d	Bq/g	2657	2719	5506
U-238+d	Bq/g	NR	NR	NR
U-234	Bq/g	508	416	1443
U-238	Bq/g	135	168	696
U-233/U-234	Bq/g	NR	NR	NR
Total Pu alpha	Bq/g	72	65	54
Pu-238	Bq/g	27	NR	20
Pu-239/Pu-240	Bq/g	45	NR	34
Pu-242	Bq/g	NR	NR	NR
[Pu-239]	ng/g	31	28	15
Th-232/Pu-239	Bq/g	> 3.7E+06	> 3.9E+06	> 1.6E+07

Table B.11. Tank TH-4, GAAT sludge Phase I and Phase II data base (Page 3 of 6)

TH-4 SLUDGE	Units	TH-4S 213	TH-4S 214	TH-4H 215
NR=Not Reported				
NC=Not Computed				
Uranium Isotopics (Mass Spec)				
U-233	atom %	< 0.0001	< 0.0001	< 0.0001
U-234	atom %	0.005	0.005	0.005
U-235	atom %	0.732	0.727	0.7298
U-236	atom %	0.0002	0.00015	0.003
U-238	atom %	99.262	99.267	99.2649
U-238/U-235 Ratio		136.0	137.0	136.0
U-235 MS	mg/kg	176	177	486
U-235 NAA	mg/kg	176	180	482
U Activity				
U-233	Bq/g	8.5	8.6	23.5
U-234	Bq/g	275.2	279.7	763.2
U-235	Bq/g	12.5	12.6	34.5
U-236	Bq/g	0.1	0.1	4.8
U-238	Bq/g	300.1	305.1	832.4
Plutonium Isotopics (Mass Spec)				
Pu-238	atom %	NR	NR	NR
Pu-239	atom %	NR	NR	NR
Pu-240	atom %	NR	NR	NR
Pu-241	atom %	NR	NR	NR
Pu-242	atom %	NR	NR	NR
Pu-244	atom %	NR	NR	NR
Pu Activity				
Pu-238	Bq/g	NC	NC	NC
Pu-239	Bq/g	NC	NC	NC
Pu-240	Bq/g	NC	NC	NC
Pu-241	Bq/g	NC	NC	NC
Pu-242	Bq/g	NC	NC	NC
Pu-244	Bq/g	NC	NC	NC
Pu-239 + Pu-241	ng/g	NR	NR	NR
Th-232/Pu-239 Ratio		NR	NR	NR

Table B.11. Tank TH-4, GAAT sludge Phase I and Phase II data base (Page 4 of 6)

TH-4 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Physical Properties										
Water	%	3	34.5	49.8	65.1	65.2	65.2	54.9	32%	30.7
Bulk density	g/mL	2	1.30	1.32	1.34	1.35	1.37	1.34	4%	0.07
TIC	mg/kg	2	8400	9075	9750	10425	11100	9750	20%	2700
TC	mg/kg	2	13500	14950	16400	17850	19300	16400	25%	5800
TOC	mg/kg	2	5100	5900	6700	7500	8300	6700	34%	3200
Aroclor 1248	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1254	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Aroclor 1260	mg/kg	2	0.51	0.59	0.66	0.74	0.81	0.66	32%	0.30
RCRA Metals (mg/kg)	Limits									
Ag	100	0	NC	NC	NC	NC	NC	NC	NC	NC
As	100	3	3.71	3.94	4.16	4.18	4.19	4.02	7%	0.48
Ba	2000	3	8.91	9.32	9.72	12.11	14.50	11.04	27%	5.59
Cd	20	1	NC	NC	1.84	NC	NC	1.84	NC	1.84
Cr	100	3	191	246	300	326	352	281	29%	161
Hg	4	3	6.37	6.87	7.36	7.96	8.56	7.43	15%	2.19
Ni	1000	3	36.7	38.7	40.7	46.8	52.8	43.4	19%	16.1
Pb	100	0	NC	NC	NC	NC	NC	NC	NC	NC
Se	20	0	NC	NC	NC	NC	NC	NC	NC	NC
Tl	18	0	NC	NC	NC	NC	NC	NC	NC	NC
Process Metals										
Al	mg/kg	3	1350	2500	3650	3780	3910	2970	47%	2560
B	mg/kg	2	2.98	3.48	3.98	4.47	4.97	3.98	35%	1.99
Be	mg/kg	3	0.98	1.40	1.83	2.16	2.49	1.77	43%	1.52
Ca	mg/kg	3	1390	1470	1550	1585	1620	1520	8%	230
Co	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Cu	mg/kg	3	15.8	16.1	16.4	19.6	22.7	18.3	21%	6.9
Fe	mg/kg	3	3190	3350	3510	3620	3730	3477	8%	540
K	mg/kg	3	587	729	871	946	1020	826	27%	433
Mg	mg/kg	3	193.0	199.5	206.0	381.5	557.0	318.7	65%	364.0
Mn	mg/kg	3	27.1	31.0	34.8	36.4	37.9	33.3	17%	10.8
Na	mg/kg	3	27500	28600	29700	30250	30800	29333	6%	3300
Sb	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Si	mg/kg	3	188	193	198	240	282	223	23%	94
Sr	mg/kg	3	9.1	9.6	10.1	12.8	15.4	11.5	29%	6.3
Th	mg/kg	3	110000	112500	115000	176000	237000	154000	47%	127000
U	mg/kg	3	24300	24500	24700	46050	67400	38800	64%	43100
V	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Zn	mg/kg	3	17.8	18.3	18.8	37.0	55.1	30.6	70%	37.3

Table B.11. Tank TH-4, GAAT sludge Phase I and Phase II data base (Page 5 of 6)

TH-4 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Anions by Ion Chromatrography (Water Wash)										
pH		2	9.0	9.0	9.0	9.0	9.0	9.0	0%	0
Bromide	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	mg/kg	0	NC	NC	NC	NC	NC	NC	NC	NC
Fluoride	mg/kg	2	398	398	398	398	398	398	0%	0
Nitrate	mg/kg	2	19400	19404	19409	19413	19417	19409	0%	17
Phosphate	mg/kg	2	184	201	218	234	251	218	22%	67
Sulphate	mg/kg	2	10700	10700	10700	10700	10700	10700	0%	0
Beta/gamma Emitters										
Gross beta	Bq/g	3	6.6E+03	6.9E+03	7.1E+03	1.3E+04	1.9E+04	1.1E+04	64%	1.24E+04
Co-60	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-134	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	Bq/g	3	6.2E+02	6.3E+02	6.4E+02	6.5E+02	6.6E+02	6.4E+02	3%	4.00E+01
Eu-152	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-154	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Eu-155	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	Bq/g	3	1.2E+03	1.3E+03	1.3E+03	2.1E+03	2.9E+03	1.8E+03	53%	1.70E+03
Am-241	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Alpha Emitters (Alpha Spec)										
Gross alpha	Bq/g	3	3300	3300	3300	5350	7400	4667	51%	4100
Cm-244	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Th-232+d	Bq/g	3	2657	2688	2719	4112	5506	3627	45%	2849
U-238+d	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	Bq/g	3	416	462	508	976	1443	789	72%	1027
U-238	Bq/g	3	135	152	168	432	696	333	94%	560
U-233/U-234	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Total Pu alpha	Bq/g	3	54	60	65	69	72	64	14%	18
Pu-238	Bq/g	2	20	22	24	25	27	24	20%	7
Pu-239/Pu-240	Bq/g	2	34	37	39	42	45	39	20%	11
Pu-242	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
[Pu-239]	ng/g	3	15	22	28	30	31	25	34%	16
Th-232/Pu-239	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC

Table B.11. Tank TH-4, GAAT sludge Phase I and Phase II data base (Page 6 of 6)

TH-4 SLUDGE	Units	N	Min	X(0.25)	Median	X(0.75)	Max	Average	RSD (%)	Range
NR=Not Reported										
NC=Not Computed										
Uranium Isotopics (Mass Spec)										
U-233	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
U-234	atom %	3	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0%	0.0000
U-235	atom %	3	0.7270	0.7284	0.7298	0.7309	0.7320	0.7296	0%	0.0050
U-236	atom %	3	0.0002	0.0002	0.0002	0.0016	0.0030	0.0011	146%	0.0029
U-238	atom %	3	99.2620	99.2635	99.2649	99.2660	99.2670	99.2646	0%	0.0050
U-238/U-235 Ratio		3	136.0	136.0	136.0	136.5	137.0	136.3	0%	1.0
U-235 MS	mg/kg	3	176	177	177	332	486	280	64%	310
U-235 NAA	mg/kg	3	176	178	180	331	482	279	63%	306
U Activity										
U-233	Bq/g	3	8.5	8.6	8.6	16.1	23.5	13.5	64%	15.0
U-234	Bq/g	3	275.2	277.4	279.7	521.4	763.2	439.3	64%	488.0
U-235	Bq/g	3	12.5	12.6	12.6	23.6	34.5	19.9	64%	22.0
U-236	Bq/g	3	0.1	0.1	0.1	2.5	4.8	1.7	163%	4.7
U-238	Bq/g	3	300.1	302.6	305.1	568.7	832.4	479.2	64%	532.3
Plutonium Isotopics (Mass Spec)										
Pu-238	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-239	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-240	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-241	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-242	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-244	atom %	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu Activity										
Pu-238	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-239	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-240	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-241	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-242	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-244	Bq/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Pu-239 + Pu-241	ng/g	0	NC	NC	NC	NC	NC	NC	NC	NC
Th-232/Pu-239 Ratio		0	NC	NC	NC	NC	NC	NC	NC	NC

Appendix C

SUPERNATE DATA BASE AND SUMMARY STATISTICS

INTRODUCTION

The supernate GAAT TS Phase I data base is presented. The following sample information is provided for W-01, W-02, W-03, W-04, W-05, W-06, W-08, W-09, W-10, W-11, and TH-4:

- Physical properties
- RCRA metals
- Process metals
- Alkalinity
- Anions by ion chromatography (water wash)
- Beta/gamma emitters
- Alpha emitters by alpha spectrometry
- Uranium isotopics by mass spectrometry
- Plutonium isotopics by mass spectrometry

Analytical data for each sample from each tank is presented.

Table C.1. GAAT supernate Phase I data base (Page 1 of 9)

SUPERNATE	Units	W-01L 201	W-01L 231	W-02L 202	W-02L 232	W-03L 203	W-03L 204	W-04L 205
NR = Not Reported								
NC = Not Computed								
Physical properties								
TSS	mg/mL	0.755	NR	0.89	NR	1.47	2.225	2.43
TDS	mg/mL	0.165	NR	0.545	NR	2.72	6.535	7.89
Density	g/mL	1.002	NR	1	NR	1.004	1.006	1.008
TIC	mg/L	29	NR	50	NR	344	543	461
TC	mg/L	33	NR	61	NR	541	876	461
TOC	mg/L	4	NR	11	NR	197	167	< 15
RCRA Metals (mg/L)	Limits							
Ag	5	< 0.006	NR	< 0.006	NR	0.092	0.197	1.07
As	5	< 0.006	NR	< 0.006	NR	< 0.006	< 0.006	< 0.006
Ba	100	0.0704	NR	0.057	NR	0.012	0.022	0.165
Cd	1	< 0.007	NR	< 0.007	NR	< 0.007	< 0.007	< 0.007
Cr	5	< 0.005	NR	< 0.005	NR	4.75	10.5	6.95
Hg	0.2	0.0072	NR	0.003	NR	0.0066	0.0336	0.0036
Ni	5	< 0.011	NR	0.012	NR	0.057	0.096	0.233
Pb	5	< 0.006	NR	0.0066	NR	< 0.006	< 0.006	0.0558
Se	1	< 0.006	NR	< 0.006	NR	0.0096	0.01	0.0128
Tl	0.9	< 0.25	NR	< 0.25	NR	< 0.25	< 0.25	< 0.25
Process Metals								
Al	mg/L	0.247	NR	0.0242	NR	0.886	9.4	2.3
B	mg/L	0.033	NR	0.04	NR	0.175	0.215	0.092
Be	mg/L	< 0.001	NR	< 0.001	NR	< 0.001	< 0.001	< 0.001
Ca	mg/L	42.5	NR	28.2	NR	19.8	11.1	47.1
Co	mg/L	< 0.008	NR	< 0.008	NR	0.016	0.041	0.19
Cu	mg/L	0.0061	NR	0.005	NR	< 0.002	< 0.002	< 0.002
Fe	mg/L	0.187	NR	0.037	NR	0.128	0.327	0.448
K	mg/L	15.4	NR	38.8	NR	18.7	20.8	21.3
Mg	mg/L	5.94	NR	7.85	NR	3.6	0.792	< 0.024
Mn	mg/L	< 0.001	NR	< 0.001	NR	0.016	0.0338	0.173
Na	mg/L	6.56	NR	51.9	NR	1050	2360	2200
Sb	mg/L	< 0.16	NR	< 0.16	NR	< 0.16	< 0.16	< 0.16
Sl	mg/L	5.54	NR	3.86	NR	4.9	5.26	2.36
Sr	mg/L	0.117	NR	0.0953	NR	0.034	0.029	0.262
Th	mg/L	< 0.048	NR	< 0.048	NR	3.31	7.31	39.6
U	mg/L	< 0.084	NR	0.1	NR	127	284	1540
V	mg/L	< 0.024	NR	< 0.024	NR	<0.024	<0.024	< 0.024
Zn	mg/L	< 0.024	NR	< 0.024	NR	<0.024	<0.024	< 0.024

Table C.1. GAAT supernate Phase I data base (Page 2 of 9)

SUPERNATE	Units	W-01L 201	W-01L 231	W-02L 202	W-02L 232	W-03L 203	W-03L 204	W-04L 205
NR = Not Reported								
NC = Not Computed								
Alkalinity								
Hydroxide	Mol/L	< 0.1	NR	< 0.1	NR	< 0.1	< 0.1	< 0.1
Carbonate	Mol/L	< 0.1	NR	< 0.1	NR	< 0.1	< 0.1	< 0.1
Bicarbonate	Mol/L	< 0.1	NR	< 0.1	NR	< 0.1	< 0.1	< 0.1
Anions by Ion Chromotography								
pH		8.29	NR	8.68	NR	9.41	10.59	9.79
Bromide	mg/L	< 0.5	NR	<0.5	NR	< 0.5	< 0.5	< 0 5
Chloride	mg/L	6.9	NR	5.8	NR	7.2	9.5	28 1
Fluoride	mg/L	3	NR	6.4	NR	< 0.5	< 0.5	12 9
Nitrate	mg/L	8	NR	4	NR	< 1.0	2.1	1580
Phosphate	mg/L	< 2.0	NR	2.4	NR	458	674	38 4
Sulphate	mg/L	12.6	NR	12.6	NR	335	529	823
Beta/gamma Emitters								
Gross beta	Bq/mL	420	NR	460	NR	560	960	1,700
Co-60	Bq/mL	< 0.2	NR	< 0.3	NR	< 0.3	< 0.4	< 0 3
Cs-137/Ba-137m	Bq/mL	7	NR	10	NR	470	820	1,100
Eu-152	Bq/mL	< 0.9	NR	< 2	NR	< 2	< 2	< 2
Eu-154	Bq/mL	< 0.5	NR	< 0.8	NR	< 0.8	< 0.7	< 0.8
Eu-155	Bq/mL	< 0.6	NR	< 0.9	NR	< 3	< 3	< 4
Sr-90/Y-90	Bq/mL	180	NR	190	NR	3	3	200
Am-241	Bq/mL	NR	NR	NR	NR	NR	NR	NR
Alpha Emitters by Alpha Spectrometry								
Gross alpha	Bq/mL	3	NR	2.7	NR	6.8	13	37
U-233/U-234	Bq/mL	NR	NR	NR	NR	5.9	10.1	18.7
U-238	Bq/mL	NR	NR	NR	NR	0.9	2.9	18.3
Cm-244	Bq/mL	NR	NR	NR	NR	NR	NR	NR
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR	NR	NR	NR
Pu-238/Am-241	Bq/mL	NR	NR	NR	NR	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR	NR	NR	NR	NR
Np-237	Bq/mL	NR	NR	2.7	NR	NR	NR	NR
Total Pu alpha	Bq/mL	0.025	NR	0.01	NR	0.03	0.37	0.074
Pu-238	Bq/mL	NR	NR	NR	NR	NR	NR	0
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR	NR	NR	100
Pu-242	Bq/mL	NR	NR	NR	NR	NR	NR	0
[Pu-239]	ng/mL	0.011	NR	0.004	NR	0.013	0.16	0.032
Th-232/Pu-239		NR	NR	NR	NR	> 2.5E+05	> 4.6E+04	> 1.2E+06

Table C.1. GAAT supernate Phase I data base (Page 3 of 9)

SUPERNATE	Units	W-01L 201	W-01L 231	W-02L 202	W-02L 232	W-03L 203	W-03L 204	W-04L 205
NR = Not Reported								
NC = Not Computed								
Uranium Isotopics by Mass Spectrometry								
U-233	atom %	0.49	0.53	1.01	1.1	0.0091	0.0104	0.0002
U-234	atom %	0.02	0.03	0.05	0.04	0.0058	0.0056	0.0054
U-235	atom %	1.81	1.87	1.60	1.54	0.7127	0.7088	0.7102
U-236	atom %	0.06	0.07	0.06	0.07	0.0029	0.003	0.0026
U-238	atom %	97.62	97.5	97.28	97.24	99.2695	99.2722	99.2816
U-238/U-235 Ratio		53.9	52.1	60.8	63.1	139.3	140.1	139.8
U-235/MS	mg/L	0	NR	0.002	NR	0.894	1.99	10.8
U-235/NAA	mg/L	0.006	NR	0.003	NR	0.86	1.92	9.76
Uranium Isotopics by Mass Spectrometry								
U-233	Bq/g	NC	NC	0.35	NC	4.04	10.31	1.08
U-234	Bq/g	NC	NC	0.01	NC	1.67	3.60	18.83
U-235	Bq/g	NC	NC	0.00	NC	0.06	0.14	0.77
U-236	Bq/g	NC	NC	0.00	NC	0.01	0.02	0.10
U-238	Bq/g	NC	NC	0.00	NC	1.57	3.51	19.02
Uranium Isotopics by Mass Spectrometry								
U	Og/L	NR	35.7	NR	128.6	NR	NR	NR
U-233	Og/L	NR	0.2	NR	1.4	NR	NR	NR
U-234	Og/L	NR	< 0.1	NR	< 0.1	NR	NR	NR
U-235	Og/L	NR	0.7	NR	2.2	NR	NR	NR
U-236	Og/L	NR	0.1	NR	< 0.1	NR	NR	NR
U-238	Og/L	NR	34.8	NR	125	NR	NR	NR

Table C.1. GAAT supernate Phase I data base (Page 4 of 9)

SUPERNATE	Units	W-05L 218	W-06L 219	W-06L 220	W-08L 223	W-09L 222	W-10L 225
NR = Not Reported							
NC = Not Computed							
Physical properties							
TSS	mg/mL	1.23	0.03	1.27	1.19	0.69	0.36
TDS	mg/mL	11.38	1.26	16.74	15.18	10.66	10.99
Density	g/mL	1.013	1.007	1.02	1.015	1.011	1.013
TIC	mg/L	1006	21	424	493	598	297
TC	mg/L	1083	25	483	600	687	299
TOC	mg/L	77	4	59	107	89	2
RCRA Metals (mg/L)	Limits						
Ag	5	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
As	5	< 0.036	< 0.025	0.032	< 0.025	< 0.025	0.008
Ba	100	0.017	0.005	< 0.001	0.0628	0.118	0.0215
Cd	1	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008
Cr	5	0.621	0.0703	5.06	7.6	4.84	3.86
Hg	0.2	0.0263	0.0031	0.0206	0.328	0.16	0.116
Ni	5	0.105	< 0.011	0.152	0.27	0.289	0.0609
Pb	5	< 0.43	< 0.43	< 0.43	0.472	1.03	< 0.43
Se	1	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025
Tl	0.9	< 0.15	< 0.15	0.554	1.02	2.06	< 0.15
Process Metals							
Al	mg/L	< 0.025	0.0489	5.04	< 0.025	< 0.025	0.968
B	mg/L	0.0531	0.0281	0.179	0.713	0.347	0.323
Be	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Ca	mg/L	6.84	19.8	3.87	29.8	22.1	16.8
Co	mg/L	0.0341	< 0.009	< 0.009	0.138	0.215	0.0116
Cu	mg/L	0.1	0.0029	0.0311	0.586	0.694	0.0961
Fe	mg/L	0.0349	0.05	< 0.004	0.141	0.307	0.0296
K	mg/L	76.3	22.3	151	627	896	819
Mg	mg/L	1.98	2.06	0.611	5.39	3.97	2.81
Mn	mg/L	0.008	< 0.001	< 0.001	0.0766	0.161	0.007
Na	mg/L	4250	361	6440	4370	2640	2800
Sb	mg/L	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16
Sl	mg/L	NR	NR	NR	NR	NR	< 0.02
Sr	mg/L	0.0084	0.0584	0.0071	0.086	0.064	0.0514
Th	mg/L	0.097	< 0.05	0.904	0.809	1.56	< 0.05
U	mg/L	81.9	2.14	37.3	746	1520	78.5
V	mg/L	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025
Zn	mg/L	0.0534	< 0.025	< 0.025	0.0349	0.0529	0.388

Table C.1. GAAT supernate Phase I data base (Page 5 of 9)

SUPERNATE	Units	W-05L 218	W-06L 219	W-06L 220	W-08L 223	W-09L 222	W-10L 225
NR = Not Reported							
NC = Not Computed							
Alkalinity							
Hydroxide	Mol/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Carbonate	Mol/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bicarbonate	Mol/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anions by Ion Chromotography							
pH		9.84	8.35	10.82	9.29	9.92	9.85
Bromide	mg/L	< 10	< 2.5	< 5	< 10	< 5	< 10
Chloride	mg/L	83	20	151	322	133	306
Fluoride	mg/L	458	49	808	61	55	140
Nitrate	mg/L	916	703	6260	2500	868	4140
Phosphate	mg/L	2273	15	963	82	1310	< 40
Sulphate	mg/L	252	51	1610	1770	401	408
Beta/gamma Emitters							
Gross beta	Bq/mL	1,400	8,900	7,630	190,000	31,000	89,000
Co-60	Bq/mL	9	< 6	8	91	17	120
Cs-137/Ba-137m	Bq/mL	1,100	1,000	6,200	160,000	26,000	74,000
Eu-152	Bq/mL	< 16	< 26	< 17	< 3.3E+01	< 2.5E+02	< 2.2E+01
Eu-154	Bq/mL	< 8	< 13	< 10	< 5.6E+01	< 1.5E+01	< 1.8E+01
Eu-155	Bq/mL	< 14	< 19	< 37	< 2.7E+02	< 7.7E+01	< 1.2E+02
Sr-90/Y-90	Bq/mL	4	3,800	150	490	200	780
Am-241	Bq/mL	NR	NR	NR	NR	NR	NR
Alpha Emitters by Alpha Spectrometry							
Gross alpha	Bq/mL	2.6	0.8	0.7	260	56	77
U-233/U-234	Bq/mL	NR	NR	NR	NR	NR	NR
U-238	Bq/mL	NR	NR	NR	NR	NR	NR
Cm-244	Bq/mL	NR	NR	NR	38.7	8.6	NR
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR	NR	NR
Pu-238/Am-241	Bq/mL	NR	NR	NR	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR	221.3	47.4	NR
Np-237	Bq/mL	NR	NR	NR	NR	NR	NR
Total Pu alpha	Bq/mL	0.08	0.039	0.017	4.6	0.12	0.42
Pu-238	Bq/mL	NR	NR	NR	NR	NR	NR
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR	NR	NR
Pu-242	Bq/mL	NR	NR	NR	NR	NR	NR
[Pu-239]	ng/mL	0.035	0.017	0.007	2	0.05	0.18
Th-232/Pu-239		> 2.8E+03	NR	> 2.1E+05	> 410	> 31000	NR

Table C.1. GAAT supernate Phase I data base (Page 6 of 9)

SUPERNATE	Units	W-05L 218	W-06L 219	W-06L 220	W-08L 223	W-09L 222	W-10L 225
NR = Not Reported							
NC = Not Computed							
Uranium Isotopics by Mass Spectrometry							
U-233	atom %	0.0062	0.009	0.005	0.044	0.002	0.021
U-234	atom %	0.0052	0.005	0.007	0.006	0.0052	0.0052
U-235	atom %	0.674	0.70	0.72	0.71	0.69	0.65
U-236	atom %	0.0019	0.002	0.003	0.003	0.001	0.0036
U-238	atom %	99.31	99.28	99.27	99.24	99.3	99.32
U-238/U-235 Ratio		1473.4	141.8	137.9	139.8	143.9	152.8
U-235/MS	mg/L	0.542	0.015	0.265	5.23	10.4	0.504
U-235/NAA	mg/L	0.600	0.016	0.940	5.51	9.96	0.533
Uranium Isotopics by Mass Spectrometry							
U-233	Bq/g	1.78	0.07	0.65	114.62	10.62	5.76
U-234	Bq/g	0.97	0.02	0.59	10.14	17.90	0.92
U-235	Bq/g	0.00	0.00	0.02	0.37	0.74	0.04
U-236	Bq/g	0.00	0.00	0.00	0.05	0.04	0.01
U-238	Bq/g	1.02	0.03	0.46	9.21	18.78	0.97
Uranium Isotopics by Mass Spectrometry							
U	Og/L	NR	NR	NR	NR	NR	NR
U-233	Og/L	NR	NR	NR	NR	NR	NR
U-234	Og/L	NR	NR	NR	NR	NR	NR
U-235	Og/L	NR	NR	NR	NR	NR	NR
U-236	Og/L	NR	NR	NR	NR	NR	NR
U-238	Og/L	NR	NR	NR	NR	NR	NR

Table C.1. GAAT supernate Phase I data base (Page 7 of 9)

SUPERNATE	Units	W-11L 206	W-11L 207	TH-4L 208	TH-4L 210
NR = Not Reported					
NC = Not Computed					
Physical properties					
TSS	mg/mL	0.88	0.825	7.43	14.2
TDS	mg/mL	0.16	0.16	37.2	79.1
Density	g/mL	0.992	0.996	1.031	1.058
TIC	mg/L	< 15	< 15	2082	623
TC	mg/L	< 15	< 15	2195	738
TOC	mg/L	< 15	< 15	114	23
RCRA Metals (mg/L)	Limits				
Ag	5	< 0.006	< 0.006	< 0.063	< 0.063
As	5	< 0.006	< 0.006	< 0.63	< 0.63
Ba	100	0.0236	0.025	0.05	0.0538
Cd	1	< 0.008	< 0.008	< 0.075	< 0.075
Cr	5	0.0139	0.012	1.07	3.08
Hg	0.2	0.0025	0.005	0.0044	0.0069
Ni	5	< 0.011	< 0.011	0.721	0.439
Pb	5	< 0.43	< 0.43	< 0.63	< 0.63
Se	1	< 0.006	< 0.006	< 0.63	< 0.63
Tl	0.9	< 0.15	< 0.15	< 0.63	< 0.63
Process Metals					
Al	mg/L	< 0.025	0.026	0.485	2.64
B	mg/L	0.0203	< 0.015	1.16	0.876
Be	mg/L	< 0.001	< 0.001	< 0.011	< 0.011
Ca	mg/L	23.5	23.8	249	277
Co	mg/L	< 0.009	< 0.009	0.208	0.12
Cu	mg/L	0.003	< 0.003	0.0475	0.08
Fe	mg/L	0.018	0.009	0.535	0.498
K	mg/L	7.63	7.7	192	329
Mg	mg/L	3.8	3.86	8.5	8.01
Mn	mg/L	<0.001	<0.001	0.4	0.395
Na	mg/L	5.18	5.51	10200	18800
Sb	mg/L	< 0.163	< 0.163	< 1.6	< 1.6
Sl	mg/L	2.24	2.25	6.36	7.21
Sr	mg/L	0.078	0.0795	0.383	0.366
Th	mg/L	0.101	< 0.05	55.8	206
U	mg/L	1.92	1.38	3630	12100
V	mg/L	< 0.025	< 0.025	< 0.25	< 0.25
Zn	mg/L	< 0.025	< 0.025	< 0.25	< 0.25

Table C.1. GAAT supernate Phase I data base (Page 8 of 9)

SUPERNATE	Units	W-11L 206	W-11L 207	TH-4L 208	TH-4L 210
NR = Not Reported					
NC = Not Computed					
Alkalinity					
Hydroxide	Mol/L	< 0.1	< 0.1	< 0.1	< 0.1
Carbonate	Mol/L	< 0.1	< 0.1	< 0.1	< 0.1
Bicarbonate	Mol/L	< 0.1	< 0.1	< 0.1	< 0.1
Anions by Ion Chromotography					
pH		8.27	8.3	7.56	7.5
Bromide	mg/L	< 0.1	< 0.1	< 3.0	< 3.0
Chloride	mg/L	3.1	2.9	75	112
Fluoride	mg/L	0.4	0.3	< 1.0	< 1.0
Nitrate	mg/L	19.6	15.8	18300	24100
Phosphate	mg/L	< 0.4	< 0.4	< 10.0	< 10.0
Sulphate	mg/L	14	12.4	6780	10900
Beta/gamma Emitters					
Gross beta	Bq/mL	12	12	320	800
Co-60	Bq/mL	< 0.3	< 0.3	< 0.5	< 0.5
Cs-137/Ba-137m	Bq/mL	1	0	99	170
Eu-152	Bq/mL	< 2	< 2	< 3	< 2
Eu-154	Bq/mL	< 0.9	< 0.6	< 2	< 2
Eu-155	Bq/mL	< 0.5	< 0.4	< 2	< 3
Sr-90/Y-90	Bq/mL	6	6	1	16
Am-241	Bq/mL	NR	NR	NR	NR
Alpha Emitters by Alpha Spectrometry					
Gross alpha	Bq/mL	0.068	0.07	81	260
U-233/U-234	Bq/mL	NR	NR	46.3	149.5
U-238	Bq/mL	NR	NR	34.7	110.5
Cm-244	Bq/mL	NR	NR	NR	NR
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR
Pu-238/Am-241	Bq/mL	NR	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR	NR
Np-237	Bq/mL	NR	NR	NR	NR
Total Pu alpha	Bq/mL	0.004	0.003	0.27	0.62
Pu-238	Bq/mL	NR	NR	NR	NR
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR
Pu-242	Bq/mL	NR	NR	NR	NR
[Pu-239]	ng/mL	0.002	0.001	0.12	0.27
Th-232/Pu-239		> 51000	NR	> 4.7E+05	> 7.6E+05

Table C.1. GAAT supernate Phase I data base (Page 9 of 9)

SUPERNATE	Units	W-11L 206	W-11L 207	TH-4L 208	TH-4L 210
NR = Not Reported					
NC = Not Computed					
Uranium Isotopics by Mass Spectrometry					
U-233	atom %	0.0006	0.0013	< 0.0001	< 0.0001
U-234	atom %	0.0055	0.0062	0.0056	0.0053
U-235	atom %	0.733	0.7423	0.718	0.727
U-236	atom %	0.0009	0.001	< 0.0001	< 0.0001
U-238	atom %	99.2599	99.2492	99.276	99.268
U-238/U-235 Ratio		135.4	133.7	138.3	136.5
U-235/MS	mg/L	0.014	0.01	25.7	86.9
U-235/NAA	mg/L	0.015	0.01	22.4	52.6
Uranium Isotopics by Mass Spectrometry					
U-233	Bq/g	0.00	0.01	1.27	4.23
U-234	Bq/g	0.02	0.02	46.04	145.23
U-235	Bq/g	0.00	0.00	1.83	6.18
U-236	Bq/g	0.00	0.00	0.01	0.03
U-238	Bq/g	0.02	0.02	44.84	149.44
Uranium Isotopics by Mass Spectrometry					
U	Og/L	NR	NR	NR	NR
U-233	Og/L	NR	NR	NR	NR
U-234	Og/L	NR	NR	NR	NR
U-235	Og/L	NR	NR	NR	NR
U-236	Og/L	NR	NR	NR	NR
U-238	Og/L	NR	NR	NR	NR

Appendix D

TECHNICAL APPROACH FOR CURIE LOADINGS

PROCESS FOR ESTIMATION OF UPPER 95% CONFIDENCE LIMITS FOR RADIONUCLIDE CONCENTRATION AND CURIE LOADING

SUMMARY

This appendix contains (1) the technical approach used to compute curie loadings for sludge and supernate in the GAAT, (2) the curie loadings for all GAAT as based upon the technical approach, and (3) the data base used to compute the curie loadings. For reference purposes, this data base is called the "Curie Loading Data Base."

The technical approach provides a probabilistic representation of curie loadings in sludge and supernate for the GAAT. Individual isotope concentrations are used to determine the probability density function (PDF) for the concentrations. An upper 95% confidence limit is computed for the concentration for each isotope. Sludge and supernate volume and density are used to compute the curie loading for the sludge and the supernates in the tanks.

Curie loadings for sludge and supernate in the GAAT are contained in Tables D.1 through D.13. Tanks examined are: W-1, W-2, W-3, W-4, W-5, W-6, W-7, W-8, W-9, W-10, and TH-4. Table D.1 provides a summary of curie loadings for sludge and supernate in the GAAT. Table D.2 provides this information in a percentage form for all tanks within each tank group for all tank groups. Tables D.3 through D.13 identify (1) the GAAT tank examined, (2) the waste form (sludge or supernate), (3) the capacity and the volume of the tank, (4) the maximum reported density, (5) the total and the individual isotope concentration expressed as either the 10%-tile, the median, or the 95%-tile (denoted as 0.10, 0.50, and 0.95, respectively), and (6) the total and the individual isotope curie loading expressed as either the 10%-tile, the median, or the 95%-tile [denoted as Ci(0.10), Ci(0.50), and Ci (0.95), respectively].

The Curie Loading Data Base uses sampling and analysis data from GAAT Phase I sampling (Energy Systems 1995), Phase II sampling (Energy Systems, 1996), and the 1988 sampling (U.S. DOE 1993). This data is presented immediately following the curie loading tables in this appendix.

There are several important points regarding the use of the Curie Loading Data Base:

1. The Curie Loading Data Base is a combination of reported values and computed concentration values. Reported values are those concentrations as reported from either Phase I, Phase II, or 1988 sampling. Computed values represent the more precise concentrations when concentrations are determined by two or more methods. This use of analytical precision as a Curie Loading Data Base screening tool eliminates the potential for double counting of concentrations. Specifically, this requirement is applicable to alpha emitters measured by both alpha spectrometry and mass spectrometry. If an isotope is measured using both techniques, the mass spectrometry reported value used as a raw value, the isotopic concentration is computed (Platfoot 1995), the computed concentration is reported in the data base, and the alpha spectrometry value is reported as "NC." If a value is not reported or is reported less than the detection limits, it is indicated as "NR." If an isotope is measured by only alpha spectrometry, this is the reported value in the data base. Since an isotope is measured initially by alpha spectrometry and then by mass spectrometry, there is no inconsistency in this screening approach.

2. Since the Curie Loading Data Base uses both reported values and computed concentration values, it is unwise to directly compare the GAAT Phase I and Phase II data base with the Curie Loading Data Base. The reason for this is that the GAAT Phase I and Phase II data base addresses GAAT TS issues that extend beyond only curie loading computation, while the Curie Loading Data Base is used only to compute curie loadings for the GAAT.

ASSUMPTIONS OF TECHNICAL APPROACH

The primary assumption is that isotope concentration in sludge or supernate is a random variable described by a triangular probability density function. A conservative estimate for the upper 95% confidence value of concentration for each isotope will always be produced when a Triangular probability density function is used.

Sludge and liquid volumes and densities are represented as deterministic variables, i.e., they are not random variables. There is a small relative standard deviation exhibited in the sample data for individual tank volumes and densities (< 15%). No assumptions are made regarding concentration measurement or estimation error due to sample location (center riser, other location), sample period (Phase I, Phase II, and the 1988 sampling efforts), sample method (sludge tube, clamshell), or analytical method.

INPUTS REQUIRED FOR THE TECHNICAL APPROACH

Individual isotope concentrations are needed to determine the underlying PDF and to compute the upper 95% confidence limit on concentration values. Volumes and densities are needed to compute curie loading.

Concentrations are based upon GAAT Phase I (Energy Systems 1995), Phase II (Energy Systems 1996), and the 1988 sampling (U. S. DOE 1993). This allows taking full advantage of GAAT Phase I, GAAT Phase II data, and 1988 data for concentrations to provide 4 or more observations per tank for sludge or supernate.

Volumes and densities are contained in 1994 Phase I GAAT TS sampling data (Energy Systems 1995 and Bechtel, 1995). Sludge volume is the "Integrated Volume" based upon sludge mapping during Phase II and contained in Bechtel, 1995; or, the volume is as reported in Energy Systems 1995 if sludge mapping was not performed. Liquid volume is contained in Energy Systems 1995. Integrated sludge volumes are computed using at least 20 sludge depth observations (except for W-7, N = 3) in Phase II with a measurement precision of $\pm$ 0.1 foot.

Sludge density is the maximum density as computed using Phase I and Phase II data sets. Sludge density has relatively small variability (4% to 15% of the average density over all tanks). Supernate density is the maximum density as computed using Phase I, Phase II data sets, and the 1988 data sets.

DETAILS OF THE TECHNICAL APPROACH

Verification of Distribution Assumptions

A χ^2 and a Kolmorgrov-Smirnoff Goodness of Fit Test are performed on the concentration data to determine the PDF of the concentration values. In a majority of the isotopes, the hypothesis that the isotope concentration follows a triangular PDF cannot be rejected. However, the hypothesis that the data follows some other distribution (e.g., beta and log-normal) also cannot be rejected. If, during the Goodness of Fit Test, the triangular PDF is one of the top five distributions that describe the data, the triangular PDF is used. If not, the best fitting distribution is used. Since the triangular PDF is a conservative PDF, there is no reason not to use the triangular PDF for the concentration of the isotopes examined.

Verification of Non-Reported Value or Non-Detect Assumptions

The nonreported assumption cannot be verified except by performing a new analysis on a new or the same sample. The non-detect assumption can be verified by determining the proportion of non-detects out of all detects and modeling non-detects as a binomial distribution. This was not performed for this analysis. Instead, non-detects were not included in the calculations. If a nondetect value is substituted for a reported non-detect, this can lead to misleading conclusions.

Verification of Concentration Values to Eliminate Double Counting

The Curie Loading Data Base is a combination of reported values and computed concentration values. Reported values are those concentrations as reported from either Phase I, Phase II, or 1988 sampling. Computed values represent the most precise concentrations when concentrations are determined by two or more methods. This use of analytical precision as a Curie Loading Data Base screening tool eliminates the potential for double counting of concentrations. Specifically, this requirement is applicable to alpha emitters measured by both alpha spectrometry and mass spectrometry. If an isotope is measured using both techniques, the mass spectrometry reported value used as a raw value, the isotopic concentration is computed (Platfoot, 1995), the computed concentration is reported in the data base, and the alpha spectrometry value is reported as "NC." If an isotope is measured by only alpha spectrometry, this is the reported value in the data base. Since an isotope is measured initially by alpha spectrometry and then by mass spectrometry, there is no inconsistency in this screening approach.

Upper 95% Confidence Limit for the Triangular PDF

The triangular PDF is used to represent the underlying distribution of the concentration and, subsequently, the curie loading. The triangular probability function describes a random variable, X, in terms of a PDF and a Cumulative Distribution Function (CDF). Let X represent the random concentration of an isotope in a tank.

The parameters of the distribution are a, b, and c, such that $a < b < c$ and $a < x < c$, where a is the minimum concentration of X, b is the most likely concentration of X, and c is the maximum concentration of X. Let x denote concentration values of X, where, $a < x < c$. A summary of the triangular PDF is:

Mean	$(a+b+c)/3$
Mode	b
Variance	$(a^2+b^2+c^2-ab-ac-bc)/18$

Probability density function (PDF)

$$f(x) = \Pr(X = x) = \begin{cases} \dfrac{2(x-a)}{(b-a)(c-a)} & \text{if } a < x < b \\ \dfrac{2(c-x)}{(c-a)(c-b)} & \text{if } b < x < c \end{cases}$$

Cumulative distribution function (CDF)

$$F(x) = \Pr(X \le x) = \begin{cases} 0 & x < a \\ \dfrac{(x-a)^2}{(b-a)(c-a)} & a < x < b \\ 1 - \dfrac{(c-x)^2}{(c-a)(c-b)} & b < x < c \\ 1 & c > x \end{cases}$$

The upper 95% Confidence Limit for the concentration is determined as follows. Let $F(x) = P(X < x) = 0.95$ in the CDF. Find the value x, denoted as $x_{0.95}$, such that $P(X \le x_{0.95}) = 0.95$. Since $b < x_{0.95} < c$, an analytical representation is obtained:

$$x_{0.95} = c - \sqrt{(1-0.95)(c-a)(c-b)}$$

Estimation of Curie Loading

Given the upper 95% Confidence Limit for the concentration, $x_{0.95}$, the upper 95% Confidence Limit for the curie loading is determined by computing $C_{0.95}$:

$$C_{0.95} = (3.785)(1{,}000)\, x_{0.95} V \rho_{max} / (3.7E{+}10)$$

where volume, V, is measured in gal; density, ρ_{max}, is measured in g/cc or g/ml; and, the constants are such that 3.785L = 1 gal, 1000 cc = 1 L, and 3.7E+10Bq = 1 Ci.

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Table D.1-1. Curie loading for GAAT tanks

		Vol (gal)	Max Density (g/cc, g/mL)	Conc (Bq/g, Bq/mL)			Curies (Ci)		
				0.10	0.50	0.95	0.10	0.50	0.95
W-1	Sludge	0	0.000	0.00E+00	0.00E+00	0.00E+00	0	0	0
	Supernate	2,926	1.002	1.94E+02	2.00E+02	2.04E+02	0	0	0
W-2	Sludge	0	0.000	0.00E+00	0.00E+00	0.00E+00	0	0	0
	Supernate	1,995	1.000	2.08E+02	2.12E+02	2.16E+02	0	0	0
W-11	Sludge	0	0.00	0.00E+00	0.00E+00	0.00E+00	0	0	0
	Supernate	722	1.00	1.36E+01	2.28E+01	8.31E+01	0	0	0
Group 1	Sludge	0		0.00E+00	0.00E+00	0.00E+00	0	0	0
	Supernate	5,643		4.16E+02	4.35E+02	5.03E+02	0	0	0
	Total	5,643		4.16E+02	4.35E+02	5.03E+02	0	0	0
W-3	Sludge	628	1.070	1.49E+05	2.36E+05	5.42E+05	10	16	37
	Supernate	15,688	1.006	6.72E+02	9.08E+02	1.25E+03	1	1	2
W-4	Sludge	1,313	1.275	1.10E+05	1.87E+05	5.20E+05	19	32	89
	Supernate	29,754	1.008	2.43E+03	4.19E+03	2.06E+04	7	13	63
W-5	Sludge	3,422	1.165	4.53E+04	5.95E+04	9.74E+04	18	24	40
	Supernate	27,964	1.013	2.14E+03	3.40E+03	4.95E+03	6	10	14
W-6	Sludge	7,037	1.190	4.32E+05	6.11E+05	1.01E+06	370	523	861
	Supernate	41,479	1.020	3.83E+04	8.41E+04	5.03E+05	166	364	2,178
TH-4	Sludge	5,452	1.07	4.05E+03	6.10E+03	9.50E+03	2	4	6
	Supernate	5,410	1.06	1.93E+02	3.13E+02	4.91E+02	0	0	0
Group 2	Sludge	17,852		7.41E+05	1.10E+06	2.17E+06	420	599	1,033
	Supernate	120,295		4.37E+04	9.29E+04	5.30E+05	180	388	2,258
	Total	138,147		7.85E+05	1.19E+06	2.70E+06	601	988	3,291
W-7	Sludge	8,812	1.350	1.45E+06	1.95E+06	2.84E+06	1,762	2,367	3,461
	Supernate	3,565	1.020	6.41E+05	6.41E+05	6.41E+05	238	238	238
W-8	Sludge	10,309	1.190	2.36E+06	2.96E+06	3.49E+06	2,963	3,714	4,386
	Supernate	64,581	1.015	2.27E+05	3.08E+05	3.74E+05	1,519	2,065	2,511
W-9	Sludge	2,861	1.250	1.99E+06	2.20E+06	2.60E+06	728	803	950
	Supernate	45,616	1.011	3.47E+04	4.50E+04	5.77E+04	164	212	272
W-10	Sludge	9,298	1.230	3.63E+06	5.59E+06	1.60E+07	4,249	6,536	18,764
	Supernate	105,860	1.013	6.31E+04	1.02E+05	2.00E+05	692	1,123	2,197
Group 3	Sludge	31,280		9.43E+06	1.27E+07	2.50E+07	9,701	13,420	27,562
	Supernate	219,622		9.65E+05	1.10E+06	1.27E+06	2,614	3,639	5,219
	Total	250,902		1.04E+07	1.38E+07	2.62E+07	12,315	17,059	32,780
Total	Sludge	49,132		1.02E+07	1.38E+07	2.71E+07	10,122	14,019	28,595
	Supernate	345,560		1.01E+06	1.19E+06	1.80E+06	2,794	4,027	7,476
	Total	394,692		1.12E+07	1.50E+07	2.90E+07	12,916	18,047	36,071

Table D.1-2. Curie loading for GAAT tanks - relative percentages

		Vol (gal)	Max Density (g/cc, g/mL)	Conc (Bq/g, Bq/mL)			Curies (Ci)		
				0.10	0.50	0.95	0.10	0.50	0.95
W-1	Sludge	0%		0%	0%	0%	0%	0%	0%
	Supernate	52%		47%	46%	41%	57%	57%	55%
W-2	Sludge	0%		0%	0%	0%	0%	0%	0%
	Supernate	35%		50%	49%	43%	42%	41%	39%
W-11	Sludge	0%		0%	0%	0%	0%	0%	0%
	Supernate	13%		3%	5%	17%	1%	2%	5%
Group 1	Sludge	0%		0%	0%	0%	0%	0%	0%
	Supernate	2%		0%	0%	0%	0%	0%	0%
	Total	1%		0%	0%	0%	0%	0%	0%
W-3	Sludge	4%		20%	21%	25%	2%	3%	4%
	Supernate	13%		2%	1%	0%	1%	0%	0%
W-4	Sludge	7%		15%	17%	24%	4%	5%	9%
	Supernate	25%		6%	5%	4%	4%	3%	3%
W-5	Sludge	19%		6%	5%	4%	4%	4%	4%
	Supernate	23%		5%	4%	1%	3%	3%	1%
W-6	Sludge	39%		58%	56%	46%	88%	87%	83%
	Supernate	34%		88%	91%	95%	92%	94%	96%
TH-4	Sludge	31%		1%	1%	0%	1%	1%	1%
	Supernate	4%		0%	0%	0%	0%	0%	0%
Group 2	Sludge	36%		7%	8%	8%	4%	4%	4%
	Supernate	35%		4%	8%	29%	6%	10%	30%
	Total	35%		7%	8%	9%	5%	5%	9%
W-7	Sludge	28%		15%	15%	11%	18%	18%	13%
	Supernate	2%		66%	58%	50%	9%	7%	5%
W-8	Sludge	33%		25%	23%	14%	31%	28%	16%
	Supernate	29%		23%	28%	29%	58%	57%	48%
W-9	Sludge	9%		21%	17%	10%	8%	6%	3%
	Supernate	21%		4%	4%	5%	6%	6%	5%
W-10	Sludge	30%		39%	44%	64%	44%	49%	68%
	Supernate	48%		7%	9%	16%	26%	31%	42%
Group 3	Sludge	64%		93%	92%	92%	96%	96%	96%
	Supernate	64%		96%	92%	71%	94%	90%	70%
	Total	64%		93%	92%	91%	95%	95%	91%
Total	Sludge	100%		100%	100%	100%	100%	100%	100%
	Supernate	100%		100%	100%	100%	100%	100%	100%
	Total	100%		100%	100%	100%	100%	100%	100%

Table D.2. Curie loading Tank W-1

Sludge	W-1					
Capacity (gal)	4,800					
Volume (gal)	0		Max Density (g/cc)		0.00	
Total Conc or Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	NC	NC	NC	NC	NC	NC
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	NC	NC	NC	NC	NC	NC
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	NC	NC	NC	NC	NC	NC
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	NC	NC	NC	NC	NC	NC
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-235	NC	NC	NC	NC	NC	NC
U-236	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.2. Curie loading Tank W-1 (continued)

Supernate	W-1					
Capacity (gal)	4,800					
Volume (gal)	2,926		Max Density (g/mL)		1.002	
Total Conc or Ci	1.94E+02	2.00E+02	2.04E+02	5.82E-02	6.00E-02	6.13E-02
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	2.81E+00	3.20E+00	3.68E+00	8.44E-04	9.60E-04	1.10E-03
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	NC	NC	NC	NC	NC	NC
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	1.13E+01	1.68E+01	2.08E+01	3.38E-03	5.04E-03	6.23E-03
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	1.80E+02	1.80E+02	1.80E+02	5.40E-02	5.40E-02	5.40E-02
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	2.50E-02	2.50E-02	2.50E-02	7.50E-06	7.50E-06	7.50E-06
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-235	NC	NC	NC	NC	NC	NC
U-236	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.3. Curie loading Tank W-2

Sludge	W-2					
Capacity (gal)	4,800					
Volume (gal)	0	Max Density (g/cc)		0.00		
Total Conc or Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	NC	NC	NC	NC	NC	NC
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	NC	NC	NC	NC	NC	NC
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	NC	NC	NC	NC	NC	NC
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	NC	NC	NC	NC	NC	NC
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-235	NC	NC	NC	NC	NC	NC
U-236	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.3. Curie loading Tank W-2 (continued)

Supernate	W-2					
Capacity (gal)	4,800					
Volume (gal)	1,995		Max Density (g/mL)		1.000	
Total Conc or Ci	2.08E+02	2.12E+02	2.16E+02	4.25E-02	4.34E-02	4.40E-02
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	1.54E+00	1.60E+00	1.67E+00	3.15E-04	3.27E-04	3.40E-04
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	NC	NC	NC	NC	NC	NC
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	1.35E+01	1.77E+01	2.09E+01	2.75E-03	3.62E-03	4.27E-03
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	1.90E+02	1.90E+02	1.90E+02	3.88E-02	3.88E-02	3.88E-02
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	2.70E+00	2.70E+00	2.70E+00	5.51E-04	5.51E-04	5.51E-04
Pu alpha - Alpha Spec						
Pu-238	1.00E-02	1.00E-02	1.00E-02	2.04E-06	2.04E-06	2.04E-06
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	3.53E-01	3.53E-01	3.53E-01	7.20E-05	7.20E-05	7.20E-05
U-234	1.13E-02	1.13E-02	1.13E-02	2.31E-06	2.31E-06	2.31E-06
U-235	1.12E-04	1.12E-04	1.12E-04	2.29E-08	2.29E-08	2.29E-08
U-236	1.43E-04	1.43E-04	1.43E-04	2.92E-08	2.92E-08	2.92E-08
U-238	1.21E-03	1.21E-03	1.21E-03	2.47E-07	2.47E-07	2.47E-07
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.4. Curie loading Tank W-3

Sludge	W-3					
Capacity (gal)	42,500					
Volume (gal)	628		Max Density (g/cc)		1.07	
Total Conc or Ci	1.49E+05	2.36E+05	5.42E+05	1.03E+01	1.62E+01	3.72E+01
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	2.20E+00	2.20E+00	2.20E+00	1.51E-04	1.51E-04	1.51E-04
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	2.40E+01	2.40E+01	2.40E+01	1.65E-03	1.65E-03	1.65E-03
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	4.42E+04	4.56E+04	4.67E+04	3.04E+00	3.14E+00	3.21E+00
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	7.60E+01	7.60E+01	7.60E+01	5.22E-03	5.22E-03	5.22E-03
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	8.41E+04	1.65E+05	4.63E+05	5.78E+00	1.13E+01	3.18E+01
Am-241	8.02E+02	1.47E+03	2.05E+03	5.51E-02	1.01E-01	1.41E-01
Gross alpha - Alpha Spec						
Cm-244	1.80E+02	1.80E+02	1.80E+02	1.24E-02	1.24E-02	1.24E-02
Pu-239/Pu-240	3.90E+03	3.90E+03	3.90E+03	2.68E-01	2.68E-01	2.68E-01
Pu-238/Am-241	5.69E+02	1.06E+03	1.67E+03	3.91E-02	7.31E-02	1.15E-01
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	4.06E+03	4.06E+03	4.06E+03	2.79E-01	2.79E-01	2.79E-01
U-238	6.16E+02	8.45E+02	1.13E+03	4.23E-02	5.81E-02	7.76E-02
U-233/U-234	1.10E+03	1.10E+03	1.10E+03	7.56E-02	7.56E-02	7.56E-02
Cf-252	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	1.80E+02	1.80E+02	1.80E+02	1.24E-02	1.24E-02	1.24E-02
Pu-239/Pu-240	1.90E+03	1.90E+03	1.90E+03	1.31E-01	1.31E-01	1.31E-01
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	7.85E+02	9.26E+02	1.10E+03	5.39E-02	6.37E-02	7.57E-02
U-234	7.15E+02	1.01E+03	1.37E+03	4.92E-02	6.93E-02	9.41E-02
U-235	3.07E+01	4.29E+01	5.80E+01	2.11E-03	2.95E-03	3.99E-03
U-236	2.10E+00	2.43E+00	2.84E+00	1.44E-04	1.67E-04	1.95E-04
U-238	7.59E+02	1.05E+03	1.41E+03	5.22E-02	7.23E-02	9.72E-02
Pu - Mass Spec						
Pu-238	5.05E+02	8.26E+02	1.22E+03	3.47E-02	5.68E-02	8.41E-02
Pu-239	1.83E+03	2.74E+03	3.86E+03	1.26E-01	1.88E-01	2.65E-01
Pu-240	3.26E+02	3.85E+02	4.58E+02	2.24E-02	2.65E-02	3.15E-02
Pu-241	2.70E+03	4.19E+03	6.04E+03	1.86E-01	2.88E-01	4.15E-01
Pu-242	1.02E-01	1.57E-01	2.25E-01	6.98E-06	1.08E-05	1.54E-05
Pu-244	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table D.4. Curie loading Tank W-3 (continued)

Supernate	W-3					
Capacity (gal)	42,500					
Volume (gal)	15,688		Max Density (g/mL)		1.006	
Total Conc or Ci	6.72E+02	9.08E+02	1.25E+03	1.08E+00	1.47E+00	2.02E+00
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	7.91E-01	9.16E-01	1.04E+00	1.28E-03	1.48E-03	1.68E-03
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	1.36E-01	1.80E-01	2.35E-01	2.19E-04	2.91E-04	3.79E-04
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	6.40E+02	8.51E+02	1.16E+03	1.03E+00	1.37E+00	1.87E+00
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	2.07E+01	4.30E+01	7.52E+01	3.34E-02	6.95E-02	1.21E-01
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	1.06E-01	2.00E-01	3.16E-01	1.71E-04	3.23E-04	5.11E-04
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	5.44E+00	7.17E+00	9.32E+00	8.78E-03	1.16E-02	1.50E-02
U-234	2.10E+00	2.63E+00	3.30E+00	3.39E-03	4.25E-03	5.32E-03
U-235	8.10E-02	1.02E-01	1.29E-01	1.31E-04	1.65E-04	2.08E-04
U-236	1.14E-02	1.46E-02	1.85E-02	1.84E-05	2.35E-05	2.99E-05
U-238	2.00E+00	2.54E+00	3.20E+00	3.23E-03	4.10E-03	5.17E-03
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.5. Curie loading Tank W-4

Sludge	W-4					
Capacity (gal)	42,500					
Volume (gal)	1,313		Max Density (g/cc)		1.28	
Total Conc or Ci	1.10E+05	1.87E+05	5.20E+05	1.88E+01	3.21E+01	8.91E+01
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	7.38E-01	1.65E+00	2.78E+00	1.26E-04	2.83E-04	4.76E-04
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	1.20E+01	1.20E+01	1.20E+01	2.06E-03	2.06E-03	2.06E-03
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	3.95E+04	7.23E+04	2.69E+05	6.77E+00	1.24E+01	4.61E+01
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	5.21E+04	9.30E+04	2.11E+05	8.92E+00	1.59E+01	3.62E+01
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	5.77E+01	1.22E+02	2.02E+02	9.87E-03	2.08E-02	3.46E-02
Pu-239/Pu-240	2.61E+02	3.25E+02	4.04E+02	4.48E-02	5.57E-02	6.91E-02
Pu-238/Am-241	1.26E+01	2.08E+01	3.48E+02	2.16E-03	3.57E-03	5.96E-02
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	9.29E+02	9.29E+02	9.29E+02	1.59E-01	1.59E-01	1.59E-01
U-238	1.17E+03	2.00E+03	2.70E+03	2.00E-01	3.42E-01	4.63E-01
U-233/U-234	2.16E+03	2.35E+03	2.59E+03	3.69E-01	4.02E-01	4.43E-01
Cf-252	6.22E+00	6.50E+00	6.84E+00	1.07E-03	1.11E-03	1.17E-03
Pu alpha - Alpha Spec						
Pu-238	5.16E+03	5.16E+03	5.16E+03	8.84E-01	8.84E-01	8.84E-01
Pu-239/Pu-240	6.70E+01	6.70E+01	6.70E+01	1.15E-02	1.15E-02	1.15E-02
Pu-242	5.10E+03	5.10E+03	5.10E+03	8.73E-01	8.73E-01	8.73E-01
U - Mass Spec						
U-233	1.50E+02	2.44E+02	5.33E+02	2.57E-02	4.18E-02	9.12E-02
U-234	1.25E+03	2.04E+03	2.58E+03	2.15E-01	3.49E-01	4.42E-01
U-235	4.86E+01	7.81E+01	9.97E+01	8.32E-03	1.34E-02	1.71E-02
U-236	4.04E+00	4.61E+00	5.60E+00	6.91E-04	7.89E-04	9.59E-04
U-238	1.19E+03	1.91E+03	2.43E+03	2.05E-01	3.27E-01	4.16E-01
Pu - Mass Spec						
Pu-238	1.00E+02	1.73E+02	4.67E+02	1.71E-02	2.97E-02	7.99E-02
Pu-239	5.42E+02	1.09E+03	7.96E+03	9.28E-02	1.86E-01	1.36E+00
Pu-240	4.16E+01	8.80E+01	9.50E+02	7.12E-03	1.51E-02	1.63E-01
Pu-241	7.96E+01	1.64E+02	6.85E+03	1.36E-02	2.81E-02	1.17E+00
Pu-242	2.77E-03	5.66E-03	2.10E-01	4.75E-07	9.70E-07	3.60E-05
Pu-244	7.50E-07	1.68E-06	2.51E-06	1.28E-10	2.87E-10	4.30E-10

Table D.5. Curie loading Tank W-4 (continued)

Supernate	W-4					
Capacity (gal)	42,500					
Volume (gal)	29,754		Max Density (g/mL)		1.008	
Total Conc or Ci	2.37E+03	4.07E+03	1.90E+04	7.28E+00	1.25E+01	5.84E+01
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	1.20E+00	1.91E+00	2.79E+00	3.69E-03	5.85E-03	8.56E-03
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	2.60E+01	4.68E+01	1.28E+02	7.99E-02	1.44E-01	3.94E-01
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	1.97E+03	3.30E+03	1.58E+04	6.04E+00	1.01E+01	4.85E+01
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	2.73E+02	6.06E+02	2.97E+03	8.38E-01	1.86E+00	9.12E+00
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	5.10E-02	6.58E-02	7.65E-02	1.56E-04	2.02E-04	2.35E-04
Pu-239/Pu-240	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pu-242	1.00E+02	1.00E+02	1.00E+02	3.07E-01	3.07E-01	3.07E-01
U - Mass Spec						
U-233	4.83E-01	9.98E-01	1.54E+00	1.48E-03	3.06E-03	4.72E-03
U-234	1.36E+00	3.01E+00	1.47E+01	4.17E-03	9.23E-03	4.52E-02
U-235	1.58E-02	3.41E-02	5.97E-01	4.86E-05	1.05E-04	1.83E-03
U-236	6.00E-03	1.33E-02	7.47E-02	1.84E-05	4.07E-05	2.29E-04
U-238	1.40E+00	3.10E+00	1.49E+01	4.29E-03	9.50E-03	4.57E-02
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.6. Curie loading Tank W-5

Sludge	W-5					
Capacity (gal)	170,000					
Volume (gal)	3,422		Max Density (g/cc)		1.17	
Total Conc or Ci	4.53E+04	5.95E+04	9.74E+04	1.85E+01	2.43E+01	3.97E+01
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	1.10E+01	1.10E+01	1.10E+01	4.49E-03	4.49E-03	4.49E-03
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	1.44E+02	1.85E+02	2.36E+02	5.85E-02	7.54E-02	9.64E-02
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	1.81E+04	2.20E+04	2.75E+04	7.39E+00	8.96E+00	1.12E+01
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	2.41E+04	3.42E+04	6.61E+04	9.84E+00	1.39E+01	2.70E+01
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	1.65E+02	2.83E+02	5.47E+02	6.73E-02	1.15E-01	2.23E-01
Pu-239/Pu-240	6.20E+02	6.20E+02	6.20E+02	2.53E-01	2.53E-01	2.53E-01
Pu-238/Am-241	7.97E+01	1.11E+02	1.46E+02	3.25E-02	4.54E-02	5.95E-02
Th-232+d	1.09E+02	1.17E+02	1.25E+02	4.46E-02	4.75E-02	5.12E-02
U-238+d	NC	NC	NC	NC	NC	NC
U-234	7.10E+01	7.75E+01	8.54E+01	2.90E-02	3.16E-02	3.48E-02
U-238	5.82E+01	6.15E+01	6.56E+01	2.37E-02	2.51E-02	2.68E-02
U-233/U-234	7.68E+01	1.15E+02	1.46E+02	3.13E-02	4.69E-02	5.95E-02
Cf-252	4.00E+00	4.00E+00	4.00E+00	1.63E-03	1.63E-03	1.63E-03
Pu alpha - Alpha Spec						
Pu-238	3.08E+01	3.30E+01	3.57E+01	1.26E-02	1.35E-02	1.46E-02
Pu-239/Pu-240	3.69E+02	4.05E+02	4.49E+02	1.51E-01	1.65E-01	1.83E-01
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	3.24E+01	3.24E+01	3.24E+01	1.32E-02	1.32E-02	1.32E-02
U-234	2.10E+01	2.10E+01	2.10E+01	8.56E-03	8.56E-03	8.56E-03
U-235	3.51E-01	3.51E-01	3.51E-01	1.43E-04	1.43E-04	1.43E-04
U-236	2.21E-01	2.21E-01	2.21E-01	9.03E-05	9.03E-05	9.03E-05
U-238	1.15E+01	1.15E+01	1.15E+01	4.68E-03	4.68E-03	4.68E-03
Pu - Mass Spec						
Pu-238	1.59E+02	1.59E+02	1.59E+02	6.47E-02	6.47E-02	6.47E-02
Pu-239	3.69E+02	3.69E+02	3.69E+02	1.50E-01	1.50E-01	1.50E-01
Pu-240	5.22E+01	5.22E+01	5.22E+01	2.13E-02	2.13E-02	2.13E-02
Pu-241	7.09E+02	7.09E+02	7.09E+02	2.89E-01	2.89E-01	2.89E-01
Pu-242	5.68E-02	5.68E-02	5.68E-02	2.31E-05	2.31E-05	2.31E-05
Pu-244	1.11E-05	1.11E-05	1.11E-05	4.55E-09	4.55E-09	4.55E-09

Table D.6. Curie loading Tank W-5 (continued)

Supernate	W-5					
Capacity (gal)	170,000					
Volume (gal)	27,964		Max Density (g/mL)		1.013	
Total Conc or Ci	2.14E+03	3.40E+03	4.95E+03	6.19E+00	9.84E+00	1.44E+01
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	1.90E+00	1.90E+00	1.90E+00	5.51E-03	5.51E-03	5.51E-03
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	4.29E+01	8.46E+01	1.36E+02	1.24E-01	2.45E-01	3.95E-01
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	2.08E+03	3.30E+03	4.80E+03	6.04E+00	9.56E+00	1.39E+01
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	4.96E+00	6.40E+00	8.18E+00	1.44E-02	1.85E-02	2.37E-02
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	8.00E-02	8.00E-02	8.00E-02	2.32E-04	2.32E-04	2.32E-04
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	1.78E+00	1.78E+00	1.78E+00	5.17E-03	5.17E-03	5.17E-03
U-234	9.70E-01	9.70E-01	9.70E-01	2.81E-03	2.81E-03	2.81E-03
U-235	3.90E-03	3.90E-03	3.90E-03	1.13E-05	1.13E-05	1.13E-05
U-236	3.74E-03	3.74E-03	3.74E-03	1.08E-05	1.08E-05	1.08E-05
U-238	1.02E+00	1.02E+00	1.02E+00	2.95E-03	2.95E-03	2.95E-03
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.7. Curie loading Tank W-6

Sludge	W-6					
Capacity (gal)	170,000					
Volume (gal)	7,037		Max Density (g/cc)		1.19	
Total Conc or Ci	4.32E+05	6.11E+05	1.01E+06	3.70E+02	5.23E+02	8.61E+02
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	9.20E+00	9.20E+00	9.20E+00	7.88E-03	7.88E-03	7.88E-03
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	6.15E+02	8.18E+02	1.22E+03	5.26E-01	7.01E-01	1.05E+00
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	1.01E+05	1.25E+05	1.63E+05	8.68E+01	1.07E+02	1.40E+02
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	6.03E+02	7.80E+02	9.99E+02	5.17E-01	6.68E-01	8.56E-01
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	3.10E+05	4.59E+05	8.03E+05	2.66E+02	3.93E+02	6.88E+02
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	6.52E+03	9.40E+03	1.87E+04	5.59E+00	8.05E+00	1.60E+01
Pu-239/Pu-240	1.80E+03	1.80E+03	1.80E+03	1.54E+00	1.54E+00	1.54E+00
Pu-238/Am-241	1.53E+03	3.16E+03	4.95E+03	1.31E+00	2.71E+00	4.24E+00
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	2.70E+02	2.70E+02	2.70E+02	2.31E-01	2.31E-01	2.31E-01
Cf-252	8.00E+00	8.00E+00	8.00E+00	6.85E-03	6.85E-03	6.85E-03
Pu alpha - Alpha Spec						
Pu-238	2.89E+02	4.00E+02	5.37E+02	2.48E-01	3.43E-01	4.60E-01
Pu-239/Pu-240	5.57E+03	6.40E+03	7.43E+03	4.77E+00	5.48E+00	6.36E+00
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	3.09E+00	3.09E+00	3.09E+00	2.65E-03	2.65E-03	2.65E-03
U-234	1.40E+02	1.40E+02	1.40E+02	1.20E-01	1.20E-01	1.20E-01
U-235	4.42E+00	4.42E+00	4.42E+00	3.78E-03	3.78E-03	3.78E-03
U-236	4.23E-01	4.23E-01	4.23E-01	3.63E-04	3.63E-04	3.63E-04
U-238	1.09E+02	1.09E+02	1.09E+02	9.38E-02	9.38E-02	9.38E-02
Pu - Mass Spec						
Pu-238	1.64E+03	1.64E+03	1.64E+03	1.41E+00	1.41E+00	1.41E+00
Pu-239	9.39E+02	9.39E+02	9.39E+02	8.05E-01	8.05E-01	8.05E-01
Pu-240	1.18E+02	1.18E+02	1.18E+02	1.01E-01	1.01E-01	1.01E-01
Pu-241	8.20E+02	8.20E+02	8.20E+02	7.02E-01	7.02E-01	7.02E-01
Pu-242	1.07E-01	1.07E-01	1.07E-01	9.14E-05	9.14E-05	9.14E-05
Pu-244	2.84E-05	2.84E-05	2.84E-05	2.43E-08	2.43E-08	2.43E-08

Table D.7. Curie loading Tank W-6 (continued)

Supernate	W-6					
Capacity (gal)	170,000					
Volume (gal)	41,479		Max Density (g/mL)		1.020	
Total Conc or Ci	3.65E+04	8.01E+04	5.03E+05	1.58E+02	3.47E+02	2.18E+03
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	3.65E+00	7.39E+00	1.55E+01	1.58E-02	3.20E-02	6.70E-02
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	7.74E+01	1.63E+02	4.69E+02	3.35E-01	7.05E-01	2.03E+00
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	3.58E+04	7.89E+04	4.99E+05	1.55E+02	3.42E+02	2.16E+03
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	4.55E+02	9.21E+02	3.01E+03	1.97E+00	3.99E+00	1.30E+01
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	8.97E+00	1.96E+01	3.27E+01	3.88E-02	8.47E-02	1.41E-01
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	8.50E+01	8.50E+01	8.50E+01	3.68E-01	3.68E-01	3.68E-01
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	1.17E-01	2.42E-01	3.58E+00	5.08E-04	1.05E-03	1.55E-02
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	2.65E+00	5.85E+00	8.91E+01	1.15E-02	2.53E-02	3.86E-01
U-234	7.81E-01	1.72E+00	7.94E+00	3.38E-03	7.43E-03	3.44E-02
U-235	2.67E-02	5.85E-02	2.91E-01	1.16E-04	2.53E-04	1.26E-03
U-236	3.80E-03	8.38E-03	4.18E-02	1.65E-05	3.63E-05	1.81E-04
U-238	6.58E-01	1.44E+00	7.21E+00	2.85E-03	6.23E-03	3.12E-02
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.8. Curie loading Tank W-7

Sludge	W-7					
Capacity (gal)	170,000					
Volume (gal)	8,812		Max Density (g/cc)		1.35	
Total Conc or Ci	1.45E+06	1.95E+06	2.84E+06	1.76E+03	2.37E+03	3.46E+03
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	9.13E+01	1.02E+02	1.14E+02	1.11E-01	1.24E-01	1.39E-01
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	1.67E+03	2.79E+03	4.30E+03	2.03E+00	3.39E+00	5.23E+00
Cs-134	1.00E+02	1.00E+02	1.00E+02	1.22E-01	1.22E-01	1.22E-01
Cs-137/Ba-137m	1.06E+06	1.26E+06	1.93E+06	1.28E+03	1.53E+03	2.35E+03
Eu-152	1.60E+03	1.60E+03	1.60E+03	1.95E+00	1.95E+00	1.95E+00
Eu-154	6.60E+02	9.20E+02	1.18E+03	8.03E-01	1.12E+00	1.44E+00
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	3.69E+05	6.53E+05	8.70E+05	4.50E+02	7.95E+02	1.06E+03
Am-241	5.70E+02	5.70E+02	5.70E+02	6.94E-01	6.94E-01	6.94E-01
Gross alpha - Alpha Spec						
Cm-244	3.66E+03	7.57E+03	1.35E+04	4.46E+00	9.21E+00	1.64E+01
Pu-239/Pu-240	1.11E+03	1.88E+03	2.41E+03	1.35E+00	2.29E+00	2.93E+00
Pu-238/Am-241	9.38E+02	1.31E+03	2.19E+03	1.14E+00	1.59E+00	2.67E+00
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	1.31E+03	1.59E+03	2.16E+03	1.60E+00	1.93E+00	2.63E+00
U-238	1.01E+03	1.32E+03	1.76E+03	1.23E+00	1.61E+00	2.14E+00
U-233/U-234	7.99E+02	1.12E+03	1.52E+03	9.73E-01	1.36E+00	1.85E+00
Cf-252	6.24E+00	9.00E+00	1.24E+01	7.59E-03	1.10E-02	1.51E-02
Pu alpha - Alpha Spec						
Pu-238	8.58E+02	1.30E+03	1.85E+03	1.04E+00	1.58E+00	2.25E+00
Pu-239/Pu-240	9.35E+02	1.07E+03	1.23E+03	1.14E+00	1.30E+00	1.49E+00
Pu-242	4.84E+00	8.10E+00	1.21E+01	5.89E-03	9.86E-03	1.48E-02
U - Mass Spec						
U-233	2.60E+02	2.65E+02	2.70E+02	3.16E-01	3.22E-01	3.29E-01
U-234	9.69E+02	1.02E+03	1.07E+03	1.18E+00	1.24E+00	1.31E+00
U-235	3.89E+01	4.08E+01	4.32E+01	4.74E-02	4.97E-02	5.26E-02
U-236	9.12E-01	9.56E-01	1.01E+00	1.11E-03	1.16E-03	1.23E-03
U-238	9.44E+02	9.89E+02	1.05E+03	1.15E+00	1.20E+00	1.27E+00
Pu - Mass Spec						
Pu-238	1.96E+03	2.10E+03	2.27E+03	2.38E+00	2.55E+00	2.76E+00
Pu-239	6.72E+02	7.20E+02	7.78E+02	8.18E-01	8.76E-01	9.47E-01
Pu-240	1.25E+02	1.33E+02	1.43E+02	1.52E-01	1.62E-01	1.74E-01
Pu-241	2.15E+03	2.57E+03	3.08E+03	2.62E+00	3.13E+00	3.75E+00
Pu-242	2.79E-01	3.02E-01	3.30E-01	3.40E-04	3.67E-04	4.01E-04
Pu-244	2.06E-04	2.66E-04	3.40E-04	2.50E-07	3.24E-07	4.14E-07

Table D.8. Curie loading Tank W-7 (continued)

Supernate	W-7					
Capacity (gal)	170,000					
Volume (gal)	3,565		Max Density (g/mL)		1.020	
Total Conc or Ci	6.41E+05	6.41E+05	6.41E+05	2.38E+02	2.38E+02	2.38E+02
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	1.90E+01	1.90E+01	1.90E+01	7.07E-03	7.07E-03	7.07E-03
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	2.90E+02	2.90E+02	2.90E+02	1.08E-01	1.08E-01	1.08E-01
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	6.40E+05	6.40E+05	6.40E+05	2.38E+02	2.38E+02	2.38E+02
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	6.00E+02	6.00E+02	6.00E+02	2.23E-01	2.23E-01	2.23E-01
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	4.00E-01	4.00E-01	4.00E-01	1.49E-04	1.49E-04	1.49E-04
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	8.50E+01	8.50E+01	8.50E+01	3.16E-02	3.16E-02	3.16E-02
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-235	NC	NC	NC	NC	NC	NC
U-236	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.9. Curie loading Tank W-8

Sludge	W-8					
Capacity (gal)	170,000					
Volume (gal)	10,309		Max Density (g/cc)		1.19	
Total Conc or Ci	2.36E+06	2.96E+06	3.49E+06	2.96E+03	3.71E+03	4.39E+03
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	1.38E+03	2.60E+03	4.10E+03	1.74E+00	3.26E+00	5.15E+00
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	2.46E+05	4.91E+05	6.84E+05	3.08E+02	6.16E+02	8.59E+02
Eu-152	7.03E+02	1.46E+03	2.18E+03	8.82E-01	1.83E+00	2.74E+00
Eu-154	8.39E+02	1.70E+03	2.29E+03	1.05E+00	2.14E+00	2.88E+00
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	2.08E+06	2.42E+06	2.75E+06	2.61E+03	3.04E+03	3.45E+03
Am-241	1.65E+03	3.43E+03	5.02E+03	2.07E+00	4.31E+00	6.30E+00
Gross alpha - Alpha Spec						
Cm-244	1.22E+04	1.59E+04	1.98E+04	1.54E+01	1.99E+01	2.49E+01
Pu-239/Pu-240	3.20E+03	3.20E+03	3.20E+03	4.02E+00	4.02E+00	4.02E+00
Pu-238/Am-241	2.90E+03	2.90E+03	2.90E+03	3.64E+00	3.64E+00	3.64E+00
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	1.60E+03	1.60E+03	1.60E+03	2.01E+00	2.01E+00	2.01E+00
Cf-252	4.00E+00	4.00E+00	4.00E+00	5.02E-03	5.02E-03	5.02E-03
Pu alpha - Alpha Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	6.09E+02	6.73E+02	7.20E+02	7.64E-01	8.45E-01	9.03E-01
U-234	7.74E+01	7.92E+01	1.06E+02	9.72E-02	9.94E-02	1.33E-01
U-235	2.50E+00	2.65E+00	2.79E+00	3.13E-03	3.32E-03	3.50E-03
U-236	4.85E-01	6.29E-01	1.04E+00	6.09E-04	7.90E-04	1.31E-03
U-238	6.55E+01	6.90E+01	7.20E+01	8.22E-02	8.66E-02	9.03E-02
Pu - Mass Spec						
Pu-238	2.94E+03	3.92E+03	4.62E+03	3.69E+00	4.92E+00	5.80E+00
Pu-239	3.19E+03	3.42E+03	3.61E+03	4.00E+00	4.29E+00	4.52E+00
Pu-240	6.60E+02	7.19E+02	7.60E+02	8.28E-01	9.03E-01	9.54E-01
Pu-241	5.92E+03	5.97E+03	7.64E+03	7.43E+00	7.49E+00	9.59E+00
Pu-242	5.36E-01	5.81E-01	6.96E-01	6.73E-04	7.29E-04	8.73E-04
Pu-244	4.58E-05	1.02E-04	1.87E-04	5.74E-08	1.28E-07	2.35E-07

Table D.9. Curie loading Tank W-8 (continued)

Supernate	W-8					
Capacity (gal)	170,000					
Volume (gal)	64,581		Max Density (g/mL)		1.015	
Total Conc or Ci	2.27E+05	3.08E+05	3.74E+05	1.52E+03	2.07E+03	2.51E+03
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	8.18E+00	8.40E+00	8.67E+00	5.48E-02	5.63E-02	5.82E-02
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	1.93E+02	3.19E+02	5.05E+02	1.29E+00	2.14E+00	3.39E+00
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	2.26E+05	3.07E+05	3.73E+05	1.51E+03	2.06E+03	2.50E+03
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	4.84E+02	5.15E+02	6.19E+02	3.25E+00	3.45E+00	4.15E+00
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	3.87E+01	3.87E+01	3.87E+01	2.60E-01	2.60E-01	2.60E-01
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	4.60E+00	4.60E+00	4.60E+00	3.08E-02	3.08E-02	3.08E-02
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	1.15E+02	1.15E+02	1.15E+02	7.69E-01	7.69E-01	7.69E-01
U-234	1.01E+01	1.01E+01	1.01E+01	6.80E-02	6.80E-02	6.80E-02
U-235	3.72E-01	3.72E-01	3.72E-01	2.49E-03	2.49E-03	2.49E-03
U-236	5.34E-02	5.34E-02	5.34E-02	3.58E-04	3.58E-04	3.58E-04
U-238	9.21E+00	9.21E+00	9.21E+00	6.18E-02	6.18E-02	6.18E-02
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.10. Curie loading Tank W-9

Sludge	W-9					
Capacity (gal)	170,000					
Volume (gal)	2,861		Max Density (g/cc)		1.25	
Total Conc or Ci	1.99E+06	2.20E+06	2.60E+06	7.28E+02	8.03E+02	9.50E+02
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	2.80E+03	5.30E+03	7.01E+03	1.03E+00	1.94E+00	2.57E+00
Cs-134	2.00E+01	2.00E+01	2.00E+01	7.32E-03	7.32E-03	7.32E-03
Cs-137/Ba-137m	1.28E+05	2.60E+05	3.57E+05	4.70E+01	9.51E+01	1.31E+02
Eu-152	1.36E+03	2.75E+03	3.73E+03	4.97E-01	1.01E+00	1.36E+00
Eu-154	1.91E+03	3.74E+03	5.10E+03	7.00E-01	1.37E+00	1.87E+00
Eu-155	5.20E+01	5.20E+01	5.20E+01	1.90E-02	1.90E-02	1.90E-02
Sr-90/Y-90	1.75E+06	1.81E+06	2.09E+06	6.40E+02	6.63E+02	7.66E+02
Am-241	5.40E+03	5.65E+03	6.78E+03	1.98E+00	2.07E+00	2.48E+00
Gross alpha - Alpha Spec						
Cm-244	4.50E+04	4.96E+04	5.55E+04	1.65E+01	1.81E+01	2.03E+01
Pu-239/Pu-240	9.20E+03	9.20E+03	9.20E+03	3.37E+00	3.37E+00	3.37E+00
Pu-238/Am-241	2.20E+04	2.20E+04	2.20E+04	8.05E+00	8.05E+00	8.05E+00
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	3.10E+03	3.10E+03	3.10E+03	1.13E+00	1.13E+00	1.13E+00
Cf-252	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	7.37E+02	7.62E+02	7.83E+02	2.69E-01	2.79E-01	2.87E-01
U-234	1.64E+02	2.01E+02	3.94E+02	6.02E-02	7.36E-02	1.44E-01
U-235	5.91E+00	6.89E+00	8.39E+00	2.16E-03	2.52E-03	3.07E-03
U-236	1.19E+00	1.51E+00	4.03E+00	4.37E-04	5.52E-04	1.47E-03
U-238	1.64E+02	1.84E+02	2.33E+02	5.99E-02	6.74E-02	8.51E-02
Pu - Mass Spec						
Pu-238	9.00E+03	1.08E+04	1.56E+04	3.29E+00	3.95E+00	5.70E+00
Pu-239	1.81E+03	1.89E+03	5.20E+03	6.61E-01	6.90E-01	1.90E+00
Pu-240	6.83E+02	7.73E+02	1.09E+03	2.50E-01	2.83E-01	3.98E-01
Pu-241	7.40E+03	8.35E+03	1.11E+04	2.71E+00	3.05E+00	4.07E+00
Pu-242	1.84E+00	2.16E+00	4.00E+00	6.74E-04	7.90E-04	1.46E-03
Pu-244	7.28E-05	1.63E-04	2.27E-04	2.66E-08	5.95E-08	8.30E-08

Table D.10. Curie loading Tank W-9 (continued)

Supernate	W-9					
Capacity (gal)	170,000					
Volume (gal)	45,616		Max Density (g/mL)		1.011	
Total Conc or Ci	3.47E+04	4.50E+04	5.77E+04	1.64E+02	2.12E+02	2.72E+02
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	1.00E+01	1.00E+01	1.00E+01	4.72E-02	4.72E-02	4.72E-02
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	3.78E+01	6.35E+01	9.53E+01	1.78E-01	3.00E-01	4.50E-01
Cs-134	8.50E+01	8.50E+01	8.50E+01	4.01E-01	4.01E-01	4.01E-01
Cs-137/Ba-137m	3.43E+04	4.45E+04	5.71E+04	1.62E+02	2.10E+02	2.70E+02
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	2.38E+02	2.85E+02	3.43E+02	1.12E+00	1.34E+00	1.62E+00
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	8.57E+00	8.57E+00	8.57E+00	4.04E-02	4.04E-02	4.04E-02
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	1.20E-01	1.20E-01	1.20E-01	5.66E-04	5.66E-04	5.66E-04
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	1.06E+01	1.06E+01	1.06E+01	5.01E-02	5.01E-02	5.01E-02
U-234	1.79E+01	1.79E+01	1.79E+01	8.44E-02	8.44E-02	8.44E-02
U-235	7.37E-01	7.37E-01	7.37E-01	3.47E-03	3.47E-03	3.47E-03
U-236	3.63E-02	3.63E-02	3.63E-02	1.71E-04	1.71E-04	1.71E-04
U-238	1.88E+01	1.88E+01	1.88E+01	8.86E-02	8.86E-02	8.86E-02
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.11. Curie loading Tank W-10

Sludge	W-10					
Capacity (gal)	170,000					
Volume (gal)	9,298		Max Density (g/cc)		1.23	
Total Conc or Ci	3.63E+06	5.59E+06	1.60E+07	4.25E+03	6.54E+03	1.88E+04
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	3.21E+01	7.05E+01	1.18E+02	3.75E-02	8.25E-02	1.38E-01
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	3.86E+03	6.89E+03	1.11E+04	4.51E+00	8.06E+00	1.30E+01
Cs-134	1.40E+03	1.40E+03	1.40E+03	1.64E+00	1.64E+00	1.64E+00
Cs-137/Ba-137m	1.19E+06	1.69E+06	8.73E+06	1.40E+03	1.98E+03	1.02E+04
Eu-152	3.57E+03	3.90E+03	4.38E+03	4.17E+00	4.56E+00	5.12E+00
Eu-154	3.99E+03	4.97E+03	7.08E+03	4.67E+00	5.81E+00	8.29E+00
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	2.35E+06	3.78E+06	7.16E+06	2.75E+03	4.42E+03	8.38E+03
Am-241	4.49E+03	4.60E+03	5.03E+03	5.25E+00	5.38E+00	5.89E+00
Gross alpha - Alpha Spec						
Cm-244	2.50E+04	3.86E+04	4.80E+04	2.92E+01	4.51E+01	5.62E+01
Pu-239/Pu-240	8.83E+03	9.60E+03	1.06E+04	1.03E+01	1.12E+01	1.24E+01
Pu-238/Am-241	1.17E+04	1.79E+04	2.55E+04	1.37E+01	2.09E+01	2.98E+01
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	1.30E+03	1.30E+03	1.30E+03	1.52E+00	1.52E+00	1.52E+00
U-233/U-234	2.10E+03	2.10E+03	2.10E+03	2.46E+00	2.46E+00	2.46E+00
Cf-252	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	5.65E+02	7.80E+02	1.15E+03	6.61E-01	9.12E-01	1.35E+00
U-234	1.03E+02	1.66E+02	3.79E+02	1.20E-01	1.94E-01	4.44E-01
U-235	3.17E+00	4.70E+00	7.73E+00	3.71E-03	5.50E-03	9.05E-03
U-236	1.08E+00	1.90E+00	4.01E+00	1.27E-03	2.22E-03	4.69E-03
U-238	9.31E+01	1.42E+02	2.18E+02	1.09E-01	1.66E-01	2.56E-01
Pu - Mass Spec						
Pu-238	5.68E+03	7.91E+03	9.87E+03	6.64E+00	9.25E+00	1.16E+01
Pu-239	2.37E+03	3.18E+03	3.90E+03	2.78E+00	3.72E+00	4.56E+00
Pu-240	8.05E+02	9.86E+02	1.13E+03	9.42E-01	1.15E+00	1.32E+00
Pu-241	7.29E+03	7.63E+03	9.94E+03	8.53E+00	8.93E+00	1.16E+01
Pu-242	1.97E+00	2.31E+00	2.70E+00	2.30E-03	2.71E-03	3.16E-03
Pu-244	1.48E-04	3.31E-04	4.87E-04	1.73E-07	3.87E-07	5.69E-07

Table D.11. Curie loading Tank W-10 (continued)

Supernate	W-10					
Capacity (gal)	170,000					
Volume (gal)	105,860		Max Density (g/mL)		1.013	
Total Conc or Ci	6.31E+04	1.02E+05	2.00E+05	6.92E+02	1.12E+03	2.20E+03
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	5.17E+01	7.61E+01	1.20E+02	5.67E-01	8.35E-01	1.32E+00
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	5.14E+01	8.04E+01	1.21E+02	5.64E-01	8.82E-01	1.33E+00
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	6.25E+04	1.01E+05	1.99E+05	6.86E+02	1.11E+03	2.18E+03
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	4.45E+02	7.36E+02	1.05E+03	4.89E+00	8.08E+00	1.16E+01
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	2.00E+00	2.00E+00	2.00E+00	2.19E-02	2.19E-02	2.19E-02
Pu-238/Am-241	2.00E+00	2.00E+00	2.00E+00	2.19E-02	2.19E-02	2.19E-02
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	3.00E+00	3.00E+00	3.00E+00	3.29E-02	3.29E-02	3.29E-02
U-233/U-234	7.00E+00	7.00E+00	7.00E+00	7.68E-02	7.68E-02	7.68E-02
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	4.20E-01	4.20E-01	4.20E-01	4.61E-03	4.61E-03	4.61E-03
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	5.76E+00	5.76E+00	5.76E+00	6.31E-02	6.31E-02	6.31E-02
U-234	9.24E-01	9.24E-01	9.24E-01	1.01E-02	1.01E-02	1.01E-02
U-235	3.58E-02	3.58E-02	3.58E-02	3.93E-04	3.93E-04	3.93E-04
U-236	6.75E-03	6.75E-03	6.75E-03	7.40E-05	7.40E-05	7.40E-05
U-238	9.70E-01	9.70E-01	9.70E-01	1.06E-02	1.06E-02	1.06E-02
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.12. Curie loading Tank W-11

Sludge	W-11					
Capacity (gal)	1,500					
Volume (gal)	0	Max Density (g/cc)		0.00		
Total Conc or Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	NC	NC	NC	NC	NC	NC
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	NC	NC	NC	NC	NC	NC
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	NC	NC	NC	NC	NC	NC
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	NC	NC	NC	NC	NC	NC
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-235	NC	NC	NC	NC	NC	NC
U-236	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.12. Curie loading Tank W-11 (continued)

Supernate	W-11					
Capacity (gal)	1,500					
Volume (gal)	722		Max Density (g/mL)		0.996	
Total Conc or Ci	1.36E+01	2.28E+01	8.31E+01	1.00E-03	1.68E-03	6.11E-03
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	5.00E-01	5.00E-01	4.67E+01	3.68E-05	3.68E-05	3.44E-03
C-14	5.14E-02	1.02E-01	1.69E-01	3.78E-06	7.54E-06	1.24E-05
Beta/Gamma						
Co-60	NC	NC	NC	NC	NC	NC
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	2.73E-01	3.75E-01	5.01E-01	2.01E-05	2.76E-05	3.69E-05
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	1.28E+01	2.18E+01	3.57E+01	9.40E-04	1.60E-03	2.62E-03
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	NC	NC	NC	NC	NC	NC
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	3.22E-03	3.50E-03	3.84E-03	2.37E-07	2.57E-07	2.83E-07
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	4.52E-03	5.14E-03	5.91E-03	3.33E-07	3.78E-07	4.35E-07
U-234	2.04E-02	2.16E-02	2.32E-02	1.50E-06	1.59E-06	1.71E-06
U-235	7.79E-04	8.54E-04	9.46E-04	5.73E-08	6.28E-08	6.96E-08
U-236	3.48E-05	3.71E-05	3.99E-05	2.56E-09	2.73E-09	2.94E-09
U-238	1.85E-02	2.04E-02	2.27E-02	1.36E-06	1.50E-06	1.67E-06
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.13. Curie loading Tank TH-4

Sludge	TH-4					
Capacity (gal)	14,000					
Volume (gal)	5,452		Max Density (g/cc)		1.07	
Total Conc or Ci	4.05E+03	6.10E+03	9.50E+03	2.42E+00	3.64E+00	5.67E+00
NC = Not Computed	Conc (Bq/g)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	1.50E+01	1.75E+01	2.06E+01	8.96E-03	1.04E-02	1.23E-02
C-14	NC	NC	NC	NC	NC	NC
Beta/Gamma						
Co-60	3.34E+00	3.75E+00	4.26E+00	1.99E-03	2.24E-03	2.54E-03
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	4.69E+02	5.66E+02	6.37E+02	2.80E-01	3.38E-01	3.80E-01
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90/Y-90	1.54E+03	1.97E+03	2.61E+03	9.22E-01	1.18E+00	1.56E+00
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	6.17E+01	8.60E+01	1.16E+02	3.68E-02	5.13E-02	6.93E-02
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	1.27E+03	2.73E+03	4.63E+03	7.57E-01	1.63E+00	2.76E+00
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	2.18E+01	2.36E+01	2.59E+01	1.30E-02	1.41E-02	1.55E-02
Pu-239/Pu-240	3.63E+01	3.94E+01	4.32E+01	2.16E-02	2.35E-02	2.58E-02
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	8.94E+00	9.51E+00	2.02E+01	5.34E-03	5.68E-03	1.20E-02
U-234	2.90E+02	3.08E+02	6.55E+02	1.73E-01	1.84E-01	3.91E-01
U-235	1.30E+01	1.36E+01	2.96E+01	7.76E-03	8.14E-03	1.77E-02
U-236	2.03E-01	3.44E-01	3.77E+00	1.21E-04	2.05E-04	2.25E-03
U-238	3.16E+02	3.36E+02	7.14E+02	1.89E-01	2.01E-01	4.26E-01
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.13. Curie loading Tank TH-4 (continued)

Supernate	TH-4					
Capacity (gal)	14,000					
Volume (gal)	5,410		Max Density (g/mL)		1.058	
Total Conc or Ci	1.93E+02	3.13E+02	4.91E+02	1.13E-01	1.83E-01	2.88E-01
NC = Not Computed	Conc (Bq/mL)			Curies		
Analysis and Isotope	0.10	0.50	0.95	Ci(10)	Ci(50)	Ci(95)
Scintillation Counting						
H-3	1.43E-02	2.82E-02	4.31E-02	8.35E-06	1.65E-05	2.53E-05
C-14	5.00E-03	5.00E-03	5.00E-03	2.93E-06	2.93E-06	2.93E-06
Beta/Gamma						
Co-60	2.54E-01	2.95E-01	3.46E-01	1.48E-04	1.73E-04	2.03E-04
Cs-134	NC	NC	NC	NC	NC	NC
Cs-137/Ba-137m	4.91E+01	1.09E+02	1.99E+02	2.87E-02	6.39E-02	1.16E-01
Eu-152	NC	NC	NC	NC	NC	NC
Eu-154	NC	NC	NC	NC	NC	NC
Eu-155	NC	NC	NC	NC	NC	NC
Sr-90	1.66E+00	3.68E+00	1.95E+01	9.75E-04	2.16E-03	1.14E-02
Am-241	NC	NC	NC	NC	NC	NC
Gross alpha - Alpha Spec						
Cm-244	NC	NC	NC	NC	NC	NC
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-238/Am-241	NC	NC	NC	NC	NC	NC
Th-232+d	1.30E-01	1.30E-01	1.30E-01	7.61E-05	7.61E-05	7.61E-05
U-238+d	NC	NC	NC	NC	NC	NC
U-234	NC	NC	NC	NC	NC	NC
U-238	NC	NC	NC	NC	NC	NC
U-233/U-234	NC	NC	NC	NC	NC	NC
Cf-252	NC	NC	NC	NC	NC	NC
Np-237	NC	NC	NC	NC	NC	NC
Pu alpha - Alpha Spec						
Pu-238	3.48E-01	4.45E-01	5.65E-01	2.04E-04	2.61E-04	3.31E-04
Pu-239/Pu-240	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
U - Mass Spec						
U-233	1.93E+00	2.75E+00	3.76E+00	1.13E-03	1.61E-03	2.20E-03
U-234	6.82E+01	9.56E+01	1.30E+02	3.99E-02	5.60E-02	7.59E-02
U-235	2.80E+00	4.00E+00	5.49E+00	1.64E-03	2.34E-03	3.21E-03
U-236	1.32E-02	1.88E-02	2.57E-02	7.72E-06	1.10E-05	1.50E-05
U-238	6.82E+01	9.71E+01	1.33E+02	3.99E-02	5.69E-02	7.78E-02
Pu - Mass Spec						
Pu-238	NC	NC	NC	NC	NC	NC
Pu-239	NC	NC	NC	NC	NC	NC
Pu-240	NC	NC	NC	NC	NC	NC
Pu-241	NC	NC	NC	NC	NC	NC
Pu-242	NC	NC	NC	NC	NC	NC
Pu-244	NC	NC	NC	NC	NC	NC

Table D.14. Tank W-3, Sludge Curie Loading Data Base

SLUDGE		W-3			
Isotope \ Sample	Units	W3/S19	W-03S 212	W-03S 309	W-03S 310
Scintillation Counting					
H-3	Bq/g	2.20E+00	NR	NR	NR
C-14	Bq/g	NR	NR	NR	NR
Beta/Gamma					
Co-60	Bq/g	2.40E+01	< 5.0E+01	< 1.2E+02	< 1.5E+02
Cs-134	Bq/g	NR	NR	< 2.2E+02	< 2.1E+02
Cs-137/Ba-137m	Bq/g	4.70E+04	4.60E+04	4.70E+04	4.30E+04
Eu-152	Bq/g	NR	< 2.2E+02	< 8.8E+02	< 7.8E+02
Eu-154	Bq/g	7.60E+01	< 1.3E+02	< 3.4E+02	< 4.9E+02
Eu-155	Bq/g	NR	< 4.5E+02	< 6.4E+02	< 5.9E+02
Sr-90/Y-90	Bq/g	1.50E+05	5.80E+05	3.90E+04	1.90E+04
Am-241	Bq/g	2.60E+02	NR	1.70E+03	2.30E+03
Gross alpha - Alpha Spec					
Cm-244	Bq/g	< 1.0E+04	1.80E+02	NR	NR
Pu-239/Pu-240	Bq/g	3.90E+03	NR	NR	NR
Pu-238/Am-241	Bq/g	1.70E+02	NR	1.96E+03	NR
Th-232+d	Bq/g	NR	NR	NR	NR
U-238+d	Bq/g	NR	NR	NR	NR
U-234	Bq/g	NR	NR	4.06E+03	NR
U-238	Bq/g	4.30E+02	NR	1.26E+03	NR
U-233/U-234	Bq/g	1.10E+03	NR	NR	NR
Cf-252	Bq/g	< 1.0E+01	NR	NR	NR
Pu alpha - Alpha Spec					
Pu-238	Bq/g	NR	NR	1.80E+02	NR
Pu-239/Pu-240	Bq/g	NR	NR	1.90E+03	NR
Pu-242	Bq/g	NR	NR	NR	NR
U - Mass Spec					
U-233	Bq/g	NC	6.70E+02	NC	1.18E+03
U-234	Bq/g	NC	1.54E+03	NC	4.79E+02
U-235	Bq/g	NC	6.50E+01	NC	2.08E+01
U-236	Bq/g	NC	1.83E+00	NC	3.03E+00
U-238	Bq/g	NC	1.58E+03	NC	5.23E+02
Pu - Mass Spec					
Pu-238	Bq/g	NC	2.45E+02	NC	1.41E+03
Pu-239	Bq/g	NC	4.38E+03	NC	1.10E+03
Pu-240	Bq/g	NC	2.78E+02	NC	4.92E+02
Pu-241	Bq/g	NC	1.49E+03	NC	6.90E+03
Pu-242	Bq/g	NC	5.71E-02	NC	2.56E-01
Pu-244	Bq/g	NC	0.00E+00	NC	0.00E+00

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.15. Tank W-4, Sludge Curie Loading Data Base

SLUDGE		W-4					
Isotope \ Sample	Units	W4/S24	W4/H26	W-04S 216	W-04H 217	W-04S 306	W-04S 307
Scintillation Counting							
H-3	Bq/g	0.00E+00	3.30E+00	NR	NR	NR	NR
C-14	Bq/g	NR	NR	NR	NR	NR	NR
Beta/Gamma							
Co-60	Bq/g	1.20E+01	NR	< 2.3E+01	< 2.7E+01	< 1.4E+02	< 1.4E+02
Cs-134	Bq/g	NR	NR	NR	NR	< 2.6E+02	< 4.8E+02
Cs-137/Ba-137m	Bq/g	3.10E+04	1.30E+04	3.80E+04	2.00E+04	8.50E+04	3.40E+05
Eu-152	Bq/g	NR	NR	< 1.4E+02	< 1.5E+02	< 1.2E+03	< 2.3E+03
Eu-154	Bq/g	NR	NR	< 6.4E+01	< 6.7E+01	< 4.8E+02	< 3.4E+02
Eu-155	Bq/g	NR	NR	< 2.2E+02	< 1.5E+02	< 9.6E+02	< 1.5E+03
Sr-90/Y-90	Bq/g	8.90E+04	2.10E+04	4.00E+04	1.90E+04	2.60E+05	1.70E+05
Am-241	Bq/g	NR	NR	NR	NR	< 2.0+E03	< 3.1E+03
Gross alpha - Alpha Spec							
Cm-244	Bq/g	7.00E+00	6.00E+00	2.34E+02	2.39E+02	NR	NR
Pu-239/Pu-240	Bq/g	4.40E+02	2.10E+02	NR	NR	NR	NR
Pu-238/Am-241	Bq/g	6.00E+00	7.00E+00	NR	NR	4.46E+02	NR
Th-232+d	Bq/g	NR	NR	NR	NR	NR	NR
U-238+d	Bq/g	NR	NR	NR	NR	NR	NR
U-234	Bq/g	NR	NR	NR	NR	9.29E+02	NR
U-238	Bq/g	2.30E+03	3.00E+03	NR	NR	4.97E+02	NR
U-233/U-234	Bq/g	2.00E+03	2.70E+03	NR	NR	NR	NR
Cf-252	Bq/g	6.00E+00	7.00E+00	NR	NR	NR	NR
Pu alpha - Alpha Spec							
Pu-238	Bq/g	NR	NR	NR	NR	5.16E+03	NR
Pu-239/Pu-240	Bq/g	NR	NR	NR	NR	6.70E+01	NR
Pu-242	Bq/g	NR	NR	NR	NR	5.10E+03	NR
U - Mass Spec							
U-233	Bq/g	NC	NC	7.37E+01	6.50E+02	NC	1.74E+02
U-234	Bq/g	NC	NC	2.72E+03	2.53E+03	NC	6.22E+02
U-235	Bq/g	NC	NC	1.07E+02	9.40E+01	NC	2.47E+01
U-236	Bq/g	NC	NC	6.05E+00	4.44E+00	NC	3.57E+00
U-238	Bq/g	NC	NC	2.61E+03	2.30E+03	NC	6.16E+02
Pu - Mass Spec							
Pu-238	Bq/g	NC	NC	4.09E+01	1.06E+02	NC	5.79E+02
Pu-239	Bq/g	NC	NC	2.93E+02	1.00E+02	NC	1.02E+04
Pu-240	Bq/g	NC	NC	1.56E+01	4.06E+00	NC	1.22E+03
Pu-241	Bq/g	NC	NC	1.66E+01	1.13E+01	NC	8.82E+03
Pu-242	Bq/g	NC	NC	6.36E-04	4.34E-04	NC	2.70E-01
Pu-244	Bq/g	NC	NC	2.87E-06	1.96E-06	NC	0.00E+00

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.16. Tank W-5, Sludge Curie Loading Data Base

SLUDGE		W-5			
Isotope \ Sample	Units	W5/S75	W-05S 230	W-05S 314	W-05S 315
Scintillation Counting					
H-3	Bq/g	1.10E+01	NR	NR	NR
C-14	Bq/g	NR	NR	NR	NR
Beta/Gamma					
Co-60	Bq/g	2.60E+02	2.30E+02	1.40E+02	1.10E+02
Cs-134	Bq/g	NR	NR	NR	NR
Cs-137/Ba-137m	Bq/g	3.00E+04	2.40E+04	1.50E+04	1.90E+04
Eu-152	Bq/g	NR	< 3.4E+02	< 4.4E+02	< 4.6E+02
Eu-154	Bq/g	NR	< 3.0E+02	< 3.5E+02	< 3.0E+02
Eu-155	Bq/g	NR	< 3.5E+02	< 3.3E+02	< 3.4E+02
Sr-90/Y-90	Bq/g	2.90E+04	7.90E+04	2.40E+04	1.60E+04
Am-241	Bq/g	NR	NR	NR	NR
Gross alpha - Alpha Spec					
Cm-244	Bq/g	3.50E+02	6.61E+02	9.72E+01	6.96E+01
Pu-239/Pu-240	Bq/g	6.20E+02	NR	NR	NR
Pu-238/Am-241	Bq/g	5.40E+01	NR	1.15E+02	1.62E+02
Th-232+d	Bq/g	NR	NR	1.30E+02	1.03E+02
U-238+d	Bq/g	NR	NR	NR	NR
U-234	Bq/g	NR	NR	8.91E+01	6.58E+01
U-238	Bq/g	NR	NR	6.75E+01	5.55E+01
U-233/U-234	Bq/g	4.60E+01	NR	1.58E+02	1.31E+02
Cf-252	Bq/g	4.00E+00	NR	NR	NR
Pu alpha - Alpha Spec					
Pu-238	Bq/g	NR	NR	3.70E+01	2.90E+01
Pu-239/Pu-240	Bq/g	NR	NR	3.40E+02	4.70E+02
Pu-242	Bq/g	NR	NR	< 4.1	< 5.5
U - Mass Spec					
U-233	Bq/g	NC	3.24E+01	NC	NC
U-234	Bq/g	NC	2.10E+01	NC	NC
U-235	Bq/g	NC	3.51E-01	NC	NC
U-236	Bq/g	NC	2.21E-01	NC	NC
U-238	Bq/g	NC	1.15E+01	NC	NC
Pu - Mass Spec					
Pu-238	Bq/g	NC	1.59E+02	NC	NC
Pu-239	Bq/g	NC	3.69E+02	NC	NC
Pu-240	Bq/g	NC	5.22E+01	NC	NC
Pu-241	Bq/g	NC	7.09E+02	NC	NC
Pu-242	Bq/g	NC	5.68E-02	NC	NC
Pu-244	Bq/g	NC	1.11E-05	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.17. Tank W-6, Sludge Curie Loading Data Base

SLUDGE		W-6			
Isotope \ Sample	Units	W6/S80	W-06S221	W-06S311	W-06S312
Scintillation Counting					
H-3	Bq/g	9.20E+00	NR	NR	NR
C-14	Bq/g	NR	NR	NR	NR
Beta/Gamma					
Co-60	Bq/g	9.10E+02	5.60E+02	1.40E+03	4.50E+02
Cs-134	Bq/g	NR	NR	NR	NR
Cs-137/Ba-137m	Bq/g	8.20E+04	9.00E+04	1.50E+05	1.80E+05
Eu-152	Bq/g	NR	< 3.7E+02	< 1.3E+03	< 1.2E+03
Eu-154	Bq/g	NR	4.60E+02	1.10E+03	< 4.8E+02
Eu-155	Bq/g	NR	< 5.8E+01	< 1.2E+03	< 8.4E+02
Sr-90/Y-90	Bq/g	3.60E+05	1.90E+05	9.50E+05	4.00E+05
Am-241	Bq/g	NR	NR	NR	NR
Gross alpha - Alpha Spec					
Cm-244	Bq/g	4.20E+03	6.89E+03	2.24E+04	7.44E+03
Pu-239/Pu-240	Bq/g	1.80E+03	NR	NR	NR
Pu-238/Am-241	Bq/g	2.10E+02	NR	5.78E+03	3.34E+03
Th-232+d	Bq/g	NR	NR	NR	NR
U-238+d	Bq/g	NR	NR	NR	NR
U-234	Bq/g	NR	NR	NR	NR
U-238	Bq/g	NR	NR	NR	NR
U-233/U-234	Bq/g	2.70E+02	NR	NR	NR
Cf-252	Bq/g	8.00E+00	NR	NR	NR
Pu alpha - Alpha Spec					
Pu-238	Bq/g	NR	NR	6.00E+02	2.00E+02
Pu-239/Pu-240	Bq/g	NR	NR	4.90E+03	7.90E+03
Pu-242	Bq/g	NR	NR	NR	NR
U - Mass Spec					
U-233	Bq/g	NC	3.09E+00	NC	NC
U-234	Bq/g	NC	1.40E+02	NC	NC
U-235	Bq/g	NC	4.42E+00	NC	NC
U-236	Bq/g	NC	4.23E-01	NC	NC
U-238	Bq/g	NC	1.09E+02	NC	NC
Pu - Mass Spec					
Pu-238	Bq/g	NC	1.64E+03	NC	NC
Pu-239	Bq/g	NC	9.39E+02	NC	NC
Pu-240	Bq/g	NC	1.18E+02	NC	NC
Pu-241	Bq/g	NC	8.20E+02	NC	NC
Pu-242	Bq/g	NC	1.07E-01	NC	NC
Pu-244	Bq/g	NC	2.84E-05	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.18. Tank W-7, Sludge Curie Loading Data Base

SLUDGE		W-7						
Isotope \ Sample	Units	W7/S84	W7/H85	W-07S 228	W-07S 229	W-07H 301	W-07S 302	W-07S 304
Scintillation Counting								
H-3	Bq/g	1.20E+02	8.30E+01	NR	NR	NR	NR	NR
C-14	Bq/g	NR	NR	NR	NR	NR	NR	NR
Beta/Gamma								
Co-60	Bq/g	5.00E+03	2.00E+03	2.70E+03	3.10E+03	2.90E+03	1.40E+03	7.60E+02
Cs-134	Bq/g	1.00E+02	NR	NR	NR	< 1.6E+03	< 1.5E+03	< 2.2E+03
Cs-137/Ba-137m	Bq/g	1.20E+06	1.00E+06	1.10E+06	1.40E+06	1.10E+06	8.90E+05	2.20E+06
Eu-152	Bq/g	1.60E+03	NR	< 8.3E+02	1.60E+03	< 7.9E+03	< 7.4E+03	< 1.2E+04
Eu-154	Bq/g	1.30E+03	4.50E+02	1.20E+03	7.40E+02	< 1.9E+03	< 1.3E+03	< 1.2E+03
Eu-155	Bq/g	NR	NR	< 1.2E+03	< 1.9E+03	< 5.2E+03	< 4.8E+03	< 6.9E+03
Sr-90/Y-90	Bq/g	8.10E+05	3.10E+05	7.90E+05	8.70E+05	9.50E+05	6.80E+05	1.40E+05
Am-241	Bq/g	5.70E+02	NR	NR	NR	< 1.1E+04	< 9.7E+03	< 1.5E+04
Gross alpha - Alpha Spec								
Cm-244	Bq/g	4.20E+03	2.50E+03	1.22E+04	1.62E+04	9.49E+03	6.85E+03	5.04E+02
Pu-239/Pu-240	Bq/g	2.40E+03	4.80E+02	NR	NR	2.52E+03	NR	NR
Pu-238/Am-241	Bq/g	1.10E+03	6.40E+02	NR	NR	2.57E+03	2.26E+03	6.82E+02
Th-232+d	Bq/g	NR	NR	NR	NR	NR	NR	NR
U-238+d	Bq/g	NR	NR	NR	NR	NR	NR	NR
U-234	Bq/g	NR	NR	NR	NR	1.46E+03	1.09E+03	2.41E+03
U-238	Bq/g	NR	1.60E+03	NR	NR	9.69E+02	7.56E+02	1.96E+03
U-233/U-234	Bq/g	5.40E+02	1.70E+03	NR	NR	NR	NR	NR
Cf-252	Bq/g	1.40E+01	4.00E+00	NR	NR	NR	NR	NR
Pu alpha - Alpha Spec								
Pu-238	Bq/g	NR	NR	NR	NR	NR	2.10E+03	5.00E+02
Pu-239/Pu-240	Bq/g	NR	NR	NR	NR	NR	8.30E+02	1.30E+03
Pu-242	Bq/g	NR	NR	NR	NR	NR	1.40E+01	2.20E+00
U - Mass Spec								
U-233	Bq/g	NC	NC	2.56E+02	2.73E+02	NC	NC	NC
U-234	Bq/g	NC	NC	9.31E+02	1.10E+03	NC	NC	NC
U-235	Bq/g	NC	NC	3.74E+01	4.43E+01	NC	NC	NC
U-236	Bq/g	NC	NC	8.76E-01	1.04E+00	NC	NC	NC
U-238	Bq/g	NC	NC	9.07E+02	1.07E+03	NC	NC	NC
Pu - Mass Spec								
Pu-238	Bq/g	NC	NC	1.85E+03	2.35E+03	NC	NC	NC
Pu-239	Bq/g	NC	NC	6.34E+02	8.06E+02	NC	NC	NC
Pu-240	Bq/g	NC	NC	1.19E+02	1.47E+02	NC	NC	NC
Pu-241	Bq/g	NC	NC	1.82E+03	3.32E+03	NC	NC	NC
Pu-242	Bq/g	NC	NC	2.61E-01	3.43E-01	NC	NC	NC
Pu-244	Bq/g	NC	NC	1.57E-04	3.75E-04	NC	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.19. Tank W-8, Sludge Curie Loading Data Base

SLUDGE		W-8			
Isotope \ Sample	Units	W8/S88	W-08S 224	W-08S 320	W-08S 321
Scintillation Counting					
H-3	Bq/g	0.00E+00	NR	NR	NR
C-14	Bq/g	NR	NR	NR	NR
Beta/Gamma					
Co-60	Bq/g	4.00E+02	4.80E+03	3.30E+03	1.90E+03
Cs-134	Bq/g		NR	< 4.2E+02	< 3.6E+02
Cs-137/Ba-137m	Bq/g	4.70E+04	7.60E+05	6.90E+05	5.10E+05
Eu-152	Bq/g	9.00E+01	2.50E+03	2.00E+03	1.30E+03
Eu-154	Bq/g	1.40E+02	2.40E+03	2.30E+03	< 6.3E+03
Eu-155	Bq/g	NR	< 1.4E+03	< 1.5E+03	< 1.3E+03
Sr-90/Y-90	Bq/g	2.80E+06	2.90E+06	2.20E+06	1.80E+06
Am-241	Bq/g	2.00E+02	NR	5.70E+03	4.00E+03
Gross alpha - Alpha Spec					
Cm-244	Bq/g	1.50E+04	2.16E+04	1.77E+04	9.29E+03
Pu-239/Pu-240	Bq/g	3.20E+03	NR	NR	NR
Pu-238/Am-241	Bq/g	2.90E+03	NR	NR	NR
Th-232+d	Bq/g		NR	NR	NR
U-238+d	Bq/g		NR	NR	NR
U-234	Bq/g		NR	NR	NR
U-238	Bq/g		NR	NR	NR
U-233/U-234	Bq/g	1.60E+03	NR	NR	NR
Cf-252	Bq/g	4.00E+00	NR	NR	NR
Pu alpha - Alpha Spec					
Pu-238	Bq/g	NR	NR	NR	NR
Pu-239/Pu-240	Bq/g	NR	NR	NR	NR
Pu-242	Bq/g	NR	NR	< 90	< 80
U - Mass Spec					
U-233	Bq/g	NC	7.08E+02	7.35E+02	5.57E+02
U-234	Bq/g	NC	1.15E+02	7.60E+01	7.65E+01
U-235	Bq/g	NC	2.37E+00	2.69E+00	2.85E+00
U-236	Bq/g	NC	1.21E+00	5.30E-01	3.68E-01
U-238	Bq/g	NC	6.26E+01	7.03E+01	7.32E+01
Pu - Mass Spec					
Pu-238	Bq/g	NC	4.84E+03	4.48E+03	2.15E+03
Pu-239	Bq/g	NC	3.50E+03	3.00E+03	3.68E+03
Pu-240	Bq/g	NC	7.58E+02	6.12E+02	7.69E+02
Pu-241	Bq/g	NC	8.15E+03	5.89E+03	5.88E+03
Pu-242	Bq/g	NC	7.44E-01	5.54E-01	5.01E-01
Pu-244	Bq/g	NC	0.00E+00	9.26E-05	2.26E-04

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.20. Tank W-9, Sludge Curie Loading Data Base

SLUDGE		W-9			
Isotope \ Sample	Units	W9/S92	W-09S 227	W-09S 323	W-09S 324
Scintillation Counting					
H-3	Bq/g	0.00E+00	NR	NR	NR
C-14	Bq/g	NR	NR	NR	NR
Beta/Gamma					
Co-60	Bq/g	7.80E+02	7.30E+03	7.00E+03	7.10E+03
Cs-134	Bq/g	2.00E+01	NR	< 3.1E+02	< 3.0E+02
Cs-137/Ba-137m	Bq/g	2.20E+04	3.90E+05	3.30E+05	3.30E+05
Eu-152	Bq/g	2.30E+02	3.40E+03	3.80E+03	4.00E+03
Eu-154	Bq/g	4.40E+02	5.60E+03	4.60E+03	4.70E+03
Eu-155	Bq/g	5.20E+01	< 9.6E+02	< 1.2E+03	< 1.2E+03
Sr-90/Y-90	Bq/g	2.20E+06	1.70E+06	1.70E+06	1.80E+06
Am-241	Bq/g	7.20E+03	NR	5.40E+03	5.20E+03
Gross alpha - Alpha Spec					
Cm-244	Bq/g	5.40E+04	5.83E+04	4.12E+04	4.48E+04
Pu-239/Pu-240	Bq/g	9.20E+03	NR	NR	NR
Pu-238/Am-241	Bq/g	2.20E+04	NR	NR	NR
Th-232+d	Bq/g	NR	NR	NR	NR
U-238+d	Bq/g	NR	NR	NR	NR
U-234	Bq/g	NR	NR	NR	NR
U-238	Bq/g	NR	NR	NR	NR
U-233/U-234	Bq/g	3.10E+03	NR	NR	NR
Cf-252	Bq/g	NR	NR	NR	NR
Pu alpha - Alpha Spec					
Pu-238	Bq/g	NR	NR	NR	NR
Pu-239/Pu-240	Bq/g	NR	NR	NR	NR
Pu-242	Bq/g	NR	NR	< 130	< 110
U - Mass Spec					
U-233	Bq/g	NC	7.92E+02	7.73E+02	7.16E+02
U-234	Bq/g	NC	1.62E+02	1.35E+02	4.64E+02
U-235	Bq/g	NC	6.71E+00	5.12E+00	9.07E+00
U-236	Bq/g	NC	1.10E+00	9.38E-01	4.89E+00
U-238	Bq/g	NC	1.73E+02	1.47E+02	2.53E+02
Pu - Mass Spec					
Pu-238	Bq/g	NC	1.76E+04	9.64E+03	7.56E+03
Pu-239	Bq/g	NC	6.19E+03	1.75E+03	1.74E+03
Pu-240	Bq/g	NC	1.21E+03	6.09E+02	6.99E+02
Pu-241	Bq/g	NC	1.23E+04	6.63E+03	7.67E+03
Pu-242	Bq/g	NC	4.66E+00	1.59E+00	1.80E+00
Pu-244	Bq/g	NC	0.00E+00	2.29E-04	2.31E-04

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.21. Tank W-10, Sludge Curie Loading Data Base

SLUDGE		W-10				
Isotope \ Sample	Units	W10/H120	W10/S96	W-10S 226	W-10S 325	W-10S 326
Scintillation Counting						
H-3	Bq/g	9.90E-01	1.40E+02	NR	NR	NR
C-14	Bq/g	NR	NR	NR	NR	NR
Beta/Gamma						
Co-60	Bq/g	1.40E+03	1.30E+04	7.20E+03	6.60E+03	5.60E+03
Cs-134	Bq/g	1.40E+03	NR	NR	NR	NR
Cs-137/Ba-137m	Bq/g	1.10E+07	8.60E+05	1.70E+06	9.50E+05	7.90E+05
Eu-152	Bq/g	NR	4.60E+03	3.40E+03	4.30E+03	3.30E+03
Eu-154	Bq/g	NR	8.00E+03	4.60E+03	4.40E+03	3.20E+03
Eu-155	Bq/g	NR	NR	< 1.8E+03	< 1.7E+03	< 1.8E+03
Sr-90/Y-90	Bq/g	1.20E+06	8.60E+06	2.40E+06	3.00E+06	4.70E+06
Am-241	Bq/g	NR	4.50E+03	NR	4.40E+03	5.20E+03
Gross alpha - Alpha Spec						
Cm-244	Bq/g	1.40E+04	4.70E+04	5.05E+04	3.15E+04	4.93E+04
Pu-239/Pu-240	Bq/g	1.10E+04	8.20E+03	NR	NR	NR
Pu-238/Am-241	Bq/g	6.70E+03	2.90E+04	NR	NR	NR
Th-232+d	Bq/g	NR	NR	NR	NR	NR
U-238+d	Bq/g	NR	NR	NR	NR	NR
U-234	Bq/g	NR	NR	NR	NR	NR
U-238	Bq/g	1.30E+03	NR	NR	NR	NR
U-233/U-234	Bq/g	2.10E+03	< 5.0E+01	NR	NR	NR
Cf-252	Bq/g	< 2.5E+01	< 5.0E+01	NR	NR	NR
Pu alpha - Alpha Spec						
Pu-238	Bq/g	NR	NR	NR	NR	NR
Pu-239/Pu-240	Bq/g	NR	NR	NR	NR	NR
Pu-242	Bq/g	NR	NR	NR	< 120	< 100
U - Mass Spec						
U-233	Bq/g	NC	NC	7.16E+02	1.32E+03	3.92E+02
U-234	Bq/g	NC	NC	4.64E+02	1.15E+02	5.12E+01
U-235	Bq/g	NC	NC	9.07E+00	4.08E+00	1.94E+00
U-236	Bq/g	NC	NC	4.89E+00	1.39E+00	4.26E-01
U-238	Bq/g	NC	NC	2.53E+02	1.31E+02	5.38E+01
Pu - Mass Spec						
Pu-238	Bq/g	NC	NC	1.07E+04	8.62E+03	3.88E+03
Pu-239	Bq/g	NC	NC	4.21E+03	1.72E+03	3.43E+03
Pu-240	Bq/g	NC	NC	1.07E+03	6.58E+02	1.19E+03
Pu-241	Bq/g	NC	NC	1.08E+04	7.22E+03	7.02E+03
Pu-242	Bq/g	NC	NC	2.88E+00	1.68E+00	2.35E+00
Pu-244	Bq/g	NC	NC	0.00E+00	3.97E-04	5.52E-04

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.22. Tank TH-4, Sludge Curie Loading Data Base

SLUDGE		TH-4				
Isotope \ Sample	Units	TH4/S58	TH4/S59	TH-4S 213	TH-4S 214	TH-4H 215
Scintillation Counting						
H-3	Bq/g	1.30E+01	2.20E+01	NR	NR	NR
C-14	Bq/g	NR	NR	NR	NR	NR
Beta/Gamma						
Co-60	Bq/g	3.00E+00	4.50E+00	< 3.1E+01	< 2.0E+01	< 2.3E+01
Cs-134	Bq/g	NR	NR	NR	NR	NR
Cs-137/Ba-137m	Bq/g	3.90E+02	4.20E+02	6.20E+02	6.60E+02	6.40E+02
Eu-152	Bq/g	NR	NR	< 1.7E+02	< 9.0E+01	< 1.1E+02
Eu-154	Bq/g	NR	NR	< 7.0E+01	< 5.0E+01	< 6.0E+01
Eu-155	Bq/g	NR	NR	< 9.0E+01	< 6.0E+01	< 7.0E+01
Sr-90/Y-90	Bq/g	1.90E+03	2.20E+03	1.20E+03	1.30E+03	2.90E+03
Am-241	Bq/g	NR	NR	NR	NR	NR
Gross alpha - Alpha Spec						
Cm-244	Bq/g	< 5.5E+01	< .24E+02	NR	NR	NR
Pu-239/Pu-240	Bq/g	4.20E+01	1.30E+02	NR	NR	NR
Pu-238/Am-241	Bq/g	< 1.58E+02	< 2.0E+00	NR	NR	NR
Th-232+d	Bq/g	9.00E+01	4.40E+02	2.66E+03	2.72E+03	5.51E+03
U-238+d	Bq/g	NR	NR	NR	NR	NR
U-234	Bq/g	NR	NR	NR	NR	NR
U-238	Bq/g	NR	NR	NR	NR	NR
U-233/U-234	Bq/g	NR	NR	NR	NR	NR
Cf-252	Bq/g	< 2.39E+02	< 3.1E+02	NR	NR	NR
Pu alpha - Alpha Spec						
Pu-238	Bq/g	NR	NR	2.70E+01	NR	2.03E+01
Pu-239/Pu-240	Bq/g	NR	NR	4.50E+01	NR	3.38E+01
Pu-242	Bq/g	NR	NR	NR	NR	NR
U - Mass Spec						
U-233	Bq/g	NC	NC	8.49E+00	8.63E+00	2.35E+01
U-234	Bq/g	NC	NC	2.75E+02	2.80E+02	7.63E+02
U-235	Bq/g	NC	NC	1.25E+01	1.26E+01	3.45E+01
U-236	Bq/g	NC	NC	1.16E-01	8.85E-02	4.83E+00
U-238	Bq/g	NC	NC	3.00E+02	3.05E+02	8.32E+02
Pu - Mass Spec						
Pu-238	Bq/g	NC	NC	NC	NC	NC
Pu-239	Bq/g	NC	NC	NC	NC	NC
Pu-240	Bq/g	NC	NC	NC	NC	NC
Pu-241	Bq/g	NC	NC	NC	NC	NC
Pu-242	Bq/g	NC	NC	NC	NC	NC
Pu-244	Bq/g	NC	NC	NC	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.23. Tank W-1, Supernate Curie Loading Data Base

SUPERNATE		W-1			
Isotope \ Sample	Units	W1/L7	W/L8	W-01L 201	W-01L 231
Scintillation Counting					
H-3	Bq/mL	3.90E+00	2.50E+00	NR	NR
C-14	Bq/mL	NR	NR	NR	NR
Beta/Gamma					
Co-60	Bq/mL	< 1.0E+01	< 1.0E+01	< 0.2	NR
Cs-134	Bq/mL	NR	NR	NR	NR
Cs-137/Ba-137m	Bq/mL	2.20E+01	2.00E+01	6.80E+00	NR
Eu-152	Bq/mL	NR	NR	< 0.9	NR
Eu-154	Bq/mL	NR	NR	< 0.5	NR
Eu-155	Bq/mL	NR	NR	< 0.6	NR
Sr-90	Bq/mL	NR	NR	1.80E+02	NR
Am-241	Bq/mL	NR	NR	NR	NR
Gross alpha - Alpha Spec					
Cm-244	Bq/mL	NR	NR	NR	NR
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR
Pu-238/Am-241	Bq/mL	NR	NR	NR	NR
Th-232+d	Bq/mL	NR	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR	NR
U-234	Bq/mL	NR	NR	NR	NR
U-238	Bq/mL	NR	NR	NR	NR
U-233/U-234	Bq/mL	NR	NR	NR	NR
Cf-252	Bq/mL	NR	NR	NR	NR
Np-237	Bq/mL	NR	NR	NR	NR
Pu alpha - Alpha Spec					
Pu-238	Bq/mL	NR	NR	2.50E-02	NR
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR
Pu-242	Bq/mL	NR	NR	NR	NR
U - Mass Spec					
U-233	Bq/mL	NC	NC	NC	NC
U-234	Bq/mL	NC	NC	NC	NC
U-235	Bq/mL	NC	NC	NC	NC
U-236	Bq/mL	NC	NC	NC	NC
U-238	Bq/mL	NC	NC	NC	NC
Pu - Mass Spec					
Pu-238	Bq/mL	NC	NC	NC	NC
Pu-239	Bq/mL	NC	NC	NC	NC
Pu-240	Bq/mL	NC	NC	NC	NC
Pu-241	Bq/mL	NC	NC	NC	NC
Pu-242	Bq/mL	NC	NC	NC	NC
Pu-244	Bq/mL	NC	NC	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.24. Tank W-2, Supernate Curie Loading Data Base

SUPERNATE		W-2			
Isotope \ Sample	Units	W2/L11	W2/L118	W-02L 202	W-02L 232
Scintillation Counting					
H-3	Bq/mL	1.50E+00	1.70E+00	NR	NR
C-14	Bq/mL	NR	NR	NR	NR
Beta/Gamma					
Co-60	Bq/mL	< 1.0E+01	< 1.0E+01	< 0.3	NR
Cs-134	Bq/mL	NR	NR	NR	NR
Cs-137/Ba-137m	Bq/mL	2.20E+01	2.00E+01	1.00E+01	NR
Eu-152	Bq/mL	NR	NR	< 2	NR
Eu-154	Bq/mL	NR	NR	< 0.8	NR
Eu-155	Bq/mL	NR	NR	< 0.9	NR
Sr-90	Bq/mL	NR	NR	1.90E+02	NR
Am-241	Bq/mL	NR	NR	NR	NR
Gross alpha - Alpha Spec					
Cm-244	Bq/mL	NR	NR	NR	NR
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR
Pu-238/Am-241	Bq/mL	NR	NR	NR	NR
Th-232+d	Bq/mL	NR	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR	NR
U-234	Bq/mL	NR	NR	NR	NR
U-238	Bq/mL	NR	NR	NR	NR
U-233/U-234	Bq/mL	NR	NR	NR	NR
Cf-252	Bq/mL	NR	NR	NR	NR
Np-237	Bq/mL	NR	NR	2.70E+00	NR
Pu alpha - Alpha Spec					
Pu-238	Bq/mL	NR	NR	1.00E-02	NR
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR
Pu-242	Bq/mL	NR	NR	NR	NR
U - Mass Spec					
U-233	Bq/mL	NC	NC	3.53E-01	NC
U-234	Bq/mL	NC	NC	1.13E-02	NC
U-235	Bq/mL	NC	NC	1.12E-04	NC
U-236	Bq/mL	NC	NC	1.43E-04	NC
U-238	Bq/mL	NC	NC	1.21E-03	NC
Pu - Mass Spec					
Pu-238	Bq/mL	NC	NC	NC	NC
Pu-239	Bq/mL	NC	NC	NC	NC
Pu-240	Bq/mL	NC	NC	NC	NC
Pu-241	Bq/mL	NC	NC	NC	NC
Pu-242	Bq/mL	NC	NC	NC	NC
Pu-244	Bq/mL	NC	NC	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.25. Tank W-3, Supernate Curie Loading Data Base

SUPERNATE		W-3				
Isotope \ Sample	Units	W3/L16	W3/L17	W3/L18	W-03L 203	W-03L 204
Scintillation Counting						
H-3	Bq/mL	6.90E-01	9.40E-01	1.10E+00	NR	NR
C-14	Bq/mL	NR	NR	NR	NR	NR
Beta/Gamma						
Co-60	Bq/mL	< 1.0E+01	1.00E-01	2.60E-01	< 0.3	< 0.4
Cs-134	Bq/mL	NR	NR	NR	NR	NR
Cs-137/Ba-137m	Bq/mL	5.80E+02	8.40E+02	1.30E+03	4.70E+02	8.20E+02
Eu-152	Bq/mL	NR	NR	NR	< 2	< 2
Eu-154	Bq/mL	NR	NR	NR	< 0.8	< 0.7
Eu-155	Bq/mL	NR	NR	NR	< 3	< 3
Sr-90	Bq/mL	4.00E+01	6.40E+01	9.00E+01	2.60E+00	2.90E+00
Am-241	Bq/mL	NR	NR	NR	NR	NR
Gross alpha - Alpha Spec						
Cm-244	Bq/mL	< 5.0E+00	< 5.0E+00	< 5.0E+00	NR	NR
Pu-239/Pu-240	Bq/mL	< 5.0E+00	< 5.0E+00	< 5.0E+00	NR	NR
Pu-238/Am-241	Bq/mL	< 5.0E+00	< 5.0E+00	< 5.0E+00	NR	NR
Th-232+d	Bq/mL	NR	NR	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR	NR	NR
U-234	Bq/mL	NR	NR	NR	NR	NR
U-238	Bq/mL	NR	NR	NR	NR	NR
U-233/U-234	Bq/mL	< 5.0E+00	< 5.0E+00	< 5.0E+00	NR	NR
Cf-252	Bq/mL	< 5.0E+00	< 5.0E+00	< 5.0E+00	NR	NR
Np-237	Bq/mL	NR	NR	NR	NR	NR
Pu alpha - Alpha Spec						
Pu-238	Bq/mL	NR	NR	NR	3.00E-02	3.70E-01
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR	NR
Pu-242	Bq/mL	NR	NR	NR	NR	NR
U - Mass Spec						
U-233	Bq/mL	NC	NC	NC	4.04E+00	1.03E+01
U-234	Bq/mL	NC	NC	NC	1.67E+00	3.60E+00
U-235	Bq/mL	NC	NC	NC	6.36E-02	1.41E-01
U-236	Bq/mL	NC	NC	NC	8.79E-03	2.03E-02
U-238	Bq/mL	NC	NC	NC	1.57E+00	3.51E+00
Pu - Mass Spec						
Pu-238	Bq/mL	NC	NC	NC	NC	NC
Pu-239	Bq/mL	NC	NC	NC	NC	NC
Pu-240	Bq/mL	NC	NC	NC	NC	NC
Pu-241	Bq/mL	NC	NC	NC	NC	NC
Pu-242	Bq/mL	NC	NC	NC	NC	NC
Pu-244	Bq/mL	NC	NC	NC	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.26. Tank W-4, Supernate Curie Loading Data Base

SUPERNATE		W-4			
Isotope \ Sample	Units	W4/L22	W4/L119	W4/L23	W-04L 205
Scintillation Counting					
H-3	Bq/mL	1.20E+00	2.00E+00	2.10E+00	NR
C-14	Bq/mL	NR	NR	NR	NR
Beta/Gamma					
Co-60	Bq/mL	< 1.0E+01	< 1.0E+01	< 1.3E+01	< 0.3
Cs-134	Bq/mL	NR	NR	NR	NR
Cs-137/Ba-137m	Bq/mL	8.90E+02	1.40E+03	2.10E+03	1.10E+03
Eu-152	Bq/mL	NR	NR	NR	< 2
Eu-154	Bq/mL	NR	NR	NR	< 0.8
Eu-155	Bq/mL	NR	NR	NR	< 4
Sr-90	Bq/mL	NR	NR	2.90E+02	2.00E+02
Am-241	Bq/mL	NR	NR	NR	NR
Gross alpha - Alpha Spec					
Cm-244	Bq/mL	NR	NR	NR	NR
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR
Pu-238/Am-241	Bq/mL	NR	NR	NR	NR
Th-232+d	Bq/mL	NR	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR	NR
U-234	Bq/mL	NR	NR	NR	NR
U-238	Bq/mL	NR	NR	NR	NR
U-233/U-234	Bq/mL	NR	NR	NR	NR
Cf-252	Bq/mL	NR	NR	NR	NR
Np-237	Bq/mL	NR	NR	NR	NR
Pu alpha - Alpha Spec					
Pu-238	Bq/mL	NR	NR	NR	7.40E-02
Pu-239/Pu-240	Bq/mL	NR	NR	NR	0.00E+00
Pu-242	Bq/mL	NR	NR	NR	1.00E+02
U - Mass Spec					
U-233	Bq/mL	NC	NC	NC	1.08E+00
U-234	Bq/mL	NC	NC	NC	1.88E+01
U-235	Bq/mL	NC	NC	NC	7.68E-01
U-236	Bq/mL	NC	NC	NC	9.56E-02
U-238	Bq/mL	NC	NC	NC	1.90E+01
Pu - Mass Spec					
Pu-238	Bq/mL	NC	NC	NC	NC
Pu-239	Bq/mL	NC	NC	NC	NC
Pu-240	Bq/mL	NC	NC	NC	NC
Pu-241	Bq/mL	NC	NC	NC	NC
Pu-242	Bq/mL	NC	NC	NC	NC
Pu-244	Bq/mL	NC	NC	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.27. Tank W-5, Supernate Curie Loading Data Base

SUPERNATE		W-5	
Isotope \ Sample	Units	W5/L73	W-05L 218
Scintillation Counting			
H-3	Bq/mL	1.90E+00	NR
C-14	Bq/mL	NR	NR
Beta/Gamma			
Co-60	Bq/mL	1.60E+02	9.20E+00
Cs-134	Bq/mL	NR	NR
Cs-137/Ba-137m	Bq/mL	5.50E+03	1.10E+03
Eu-152	Bq/mL	NR	< 16
Eu-154	Bq/mL	NR	< 8
Eu-155	Bq/mL	NR	< 14
Sr-90	Bq/mL	9.00E+00	3.80E+00
Am-241	Bq/mL	NR	NR
Gross alpha - Alpha Spec			
Cm-244	Bq/mL	< 4.0E-01	NR
Pu-239/Pu-240	Bq/mL	< 4.0E+00	NR
Pu-238/Am-241	Bq/mL	< 2.0E+00	NR
Th-232+d	Bq/mL	NR	NR
U-238+d	Bq/mL	NR	NR
U-234	Bq/mL	NR	NR
U-238	Bq/mL	NR	NR
U-233/U-234	Bq/mL	NR	NR
Cf-252	Bq/mL	< 2.0E-02	NR
Np-237	Bq/mL	NR	NR
Pu alpha - Alpha Spec			
Pu-238	Bq/mL	NR	8.00E-02
Pu-239/Pu-240	Bq/mL	NR	NR
Pu-242	Bq/mL	NR	NR
U - Mass Spec			
U-233	Bq/mL	NC	1.78E+00
U-234	Bq/mL	NC	9.70E-01
U-235	Bq/mL	NC	3.90E-03
U-236	Bq/mL	NC	3.74E-03
U-238	Bq/mL	NC	1.02E+00
Pu - Mass Spec			
Pu-238	Bq/mL	NC	NC
Pu-239	Bq/mL	NC	NC
Pu-240	Bq/mL	NC	NC
Pu-241	Bq/mL	NC	NC
Pu-242	Bq/mL	NC	NC
Pu-244	Bq/mL	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.28. Tank W-6, Supernate Curie Loading Data Base

SUPERNATE		W-6				
Isotope \ Sample	Units	W6/L77	W6/L78	W6/L79	W-06L 219	W-06L 220
Scintillation Counting						
H-3	Bq/mL	6.30E-01	1.40E+00	3.20E+00	NR	NR
C-14	Bq/mL	NR	NR	NR	NR	NR
Beta/Gamma						
Co-60	Bq/mL	1.30E+01	2.80E+01	9.00E+01	< 6	8.30E+00
Cs-134	Bq/mL	NR	NR	NR	NR	NR
Cs-137/Ba-137m	Bq/mL	1.60E+03	5.60E+03	2.20E+04	1.00E+03	6.20E+03
Eu-152	Bq/mL	NR	NR	NR	< 26	< 17
Eu-154	Bq/mL	NR	NR	NR	< 13	< 10
Eu-155	Bq/mL	NR	NR	NR	< 19	< 37
Sr-90	Bq/mL	3.10E+02	7.80E+01	1.90E+02	3.80E+03	1.50E+02
Am-241	Bq/mL	NR	NR	NR	NR	NR
Gross alpha - Alpha Spec						
Cm-244	Bq/mL	< 4.0E-01	< 4.0E-01	< 4.0E-01	NR	NR
Pu-239/Pu-240	Bq/mL	< 4.0E+00	< 4.0E+00	< 4.0E+00	NR	NR
Pu-238/Am-241	Bq/mL	< 2.0E+00	< 2.0E+00	< 2.0E+00	NR	NR
Th-232+d	Bq/mL	NR	NR	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR	NR	NR
U-234	Bq/mL	NR	NR	NR	NR	NR
U-238	Bq/mL	NR	NR	NR	NR	NR
U-233/U-234	Bq/mL	NR	NR	NR	NR	NR
Cf-252	Bq/mL	< 2.0E-01	< 2.0E-01	< 2.0E-01	NR	NR
Np-237	Bq/mL	NR	NR	NR	NR	NR
Pu alpha - Alpha Spec						
Pu-238	Bq/mL	NR	NR	NR	3.90E-02	1.70E-02
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR	NR
Pu-242	Bq/mL	NR	NR	NR	NR	NR
U - Mass Spec						
U-233	Bq/mL	NC	NC	NC	6.73E-02	6.51E-01
U-234	Bq/mL	NC	NC	NC	2.42E-02	5.91E-01
U-235	Bq/mL	NC	NC	NC	1.05E-03	1.89E-02
U-236	Bq/mL	NC	NC	NC	1.02E-04	2.67E-03
U-238	Bq/mL	NC	NC	NC	2.64E-02	4.61E-01
Pu - Mass Spec						
Pu-238	Bq/mL	NC	NC	NC	NC	NC
Pu-239	Bq/mL	NC	NC	NC	NC	NC
Pu-240	Bq/mL	NC	NC	NC	NC	NC
Pu-241	Bq/mL	NC	NC	NC	NC	NC
Pu-242	Bq/mL	NC	NC	NC	NC	NC
Pu-244	Bq/mL	NC	NC	NC	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.29. Tank W-7, Supernate Curie Loading Data Base

SUPERNATE		W-7
Isotope \ Sample	Units	W7/L82
Scintillation Counting		
H-3	Bq/mL	1.90E+01
C-14	Bq/mL	NR
Beta/Gamma		
Co-60	Bq/mL	2.90E+02
Cs-134	Bq/mL	NR
Cs-137/Ba-137m	Bq/mL	6.40E+05
Eu-152	Bq/mL	NR
Eu-154	Bq/mL	NR
Eu-155	Bq/mL	NR
Sr-90	Bq/mL	6.00E+02
Am-241	Bq/mL	NR
Gross alpha - Alpha Spec		
Cm-244	Bq/mL	4.00E-01
Pu-239/Pu-240	Bq/mL	< 4.0E+00
Pu-238/Am-241	Bq/mL	< 2.0E+00
Th-232+d	Bq/mL	8.50E+01
U-238+d	Bq/mL	NR
U-234	Bq/mL	NR
U-238	Bq/mL	NR
U-233/U-234	Bq/mL	NR
Cf-252	Bq/mL	< 2.0E-01
Np-237	Bq/mL	NR
Pu alpha - Alpha Spec		
Pu-238	Bq/mL	NR
Pu-239/Pu-240	Bq/mL	NR
Pu-242	Bq/mL	NR
U - Mass Spec		
U-233	Bq/mL	NC
U-234	Bq/mL	NC
U-235	Bq/mL	NC
U-236	Bq/mL	NC
U-238	Bq/mL	NC
Pu - Mass Spec		
Pu-238	Bq/mL	NC
Pu-239	Bq/mL	NC
Pu-240	Bq/mL	NC
Pu-241	Bq/mL	NC
Pu-242	Bq/mL	NC
Pu-244	Bq/mL	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.30. Tank W-8, Supernate Curie Loading Data Base

SUPERNATE		W-8		
Isotope \ Sample	Units	W8/L86	W8/L87	W-08L 223
Scintillation Counting				
H-3	Bq/mL	8.00E+00	8.80E+00	NR
C-14	Bq/mL	NR	NR	NR
Beta/Gamma				
Co-60	Bq/mL	3.00E+02	5.90E+02	9.10E+01
Cs-134	Bq/mL	NR	NR	NR
Cs-137/Ba-137m	Bq/mL	3.40E+05	4.00E+05	1.60E+05
Eu-152	Bq/mL	NR	NR	< 3.3E+01
Eu-154	Bq/mL	NR	NR	< 5.6E+01
Eu-155	Bq/mL	NR	NR	< 2.7E+02
Sr-90	Bq/mL	6.60E+02	4.60E+02	4.90E+02
Am-241	Bq/mL	NR	NR	NR
Gross alpha - Alpha Spec				
Cm-244	Bq/mL	< 2.0E+00	< 2.0E+00	3.87E+01
Pu-239/Pu-240	Bq/mL	< 2.0E+00	< 2.0E+00	NR
Pu-238/Am-241	Bq/mL	< 2.0E+00	< 2.0E+00	NR
Th-232+d	Bq/mL	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR
U-234	Bq/mL	NR	NR	NR
U-238	Bq/mL	NR	NR	NR
U-233/U-234	Bq/mL	NR	NR	NR
Cf-252	Bq/mL	< 2.0E+00	< 2.0E+00	NR
Np-237	Bq/mL	NR	NR	NR
Pu alpha - Alpha Spec				
Pu-238	Bq/mL	NR	NR	4.60E+00
Pu-239/Pu-240	Bq/mL	NR	NR	NR
Pu-242	Bq/mL	NR	NR	NR
U - Mass Spec				
U-233	Bq/mL	NC	NC	1.15E+02
U-234	Bq/mL	NC	NC	1.01E+01
U-235	Bq/mL	NC	NC	3.72E-01
U-236	Bq/mL	NC	NC	5.34E-02
U-238	Bq/mL	NC	NC	9.21E+00
Pu - Mass Spec				
Pu-238	Bq/mL	NC	NC	NC
Pu-239	Bq/mL	NC	NC	NC
Pu-240	Bq/mL	NC	NC	NC
Pu-241	Bq/mL	NC	NC	NC
Pu-242	Bq/mL	NC	NC	NC
Pu-244	Bq/mL	NC	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.31. Tank W-9, Supernate Curie Loading Data Base

SUPERNATE		W-9	
Isotope \ Sample	Units	W9/L90	W-09L 222
Scintillation Counting			
H-3	Bq/mL	1.00E+01	NR
C-14	Bq/mL	NR	NR
Beta/Gamma			
Co-60	Bq/mL	1.10E+02	1.70E+01
Cs-134	Bq/mL	8.50E+01	NR
Cs-137/Ba-137m	Bq/mL	6.30E+04	2.60E+04
Eu-152	Bq/mL	NR	< 2.5E+02
Eu-154	Bq/mL	NR	< 1.5E+01
Eu-155	Bq/mL	NR	< 7.7E+01
Sr-90	Bq/mL	3.70E+02	2.00E+02
Am-241	Bq/mL	NR	NR
Gross alpha - Alpha Spec			
Cm-244	Bq/mL	< 3.0E+00	8.57E+00
Pu-239/Pu-240	Bq/mL	< 3.0E+00	NR
Pu-238/Am-241	Bq/mL	< 3.0E+00	NR
Th-232+d	Bq/mL	NR	NR
U-238+d	Bq/mL	NR	NR
U-234	Bq/mL	NR	NR
U-238	Bq/mL	NR	NR
U-233/U-234	Bq/mL	< 3.0E+00	NR
Cf-252	Bq/mL	< 3.0E+00	NR
Np-237	Bq/mL	NR	NR
Pu alpha - Alpha Spec			
Pu-238	Bq/mL	NR	1.20E-01
Pu-239/Pu-240	Bq/mL	NR	NR
Pu-242	Bq/mL	NR	NR
U - Mass Spec			
U-233	Bq/mL	NC	1.06E+01
U-234	Bq/mL	NC	1.79E+01
U-235	Bq/mL	NC	7.37E-01
U-236	Bq/mL	NC	3.63E-02
U-238	Bq/mL	NC	1.88E+01
Pu - Mass Spec			
Pu-238	Bq/mL	NC	NC
Pu-239	Bq/mL	NC	NC
Pu-240	Bq/mL	NC	NC
Pu-241	Bq/mL	NC	NC
Pu-242	Bq/mL	NC	NC
Pu-244	Bq/mL	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.32. Tank W-10, Supernate Curie Loading Data Base

SUPERNATE		W-10			
Isotope \ Sample	Units	W10/L93	W10/L94	W10/L95	W-10L 225
Scintillation Counting					
H-3	Bq/mL	3.20E+01	6.80E+01	1.40E+02	NR
C-14	Bq/mL	NR	NR	NR	NR
Beta/Gamma					
Co-60	Bq/mL	2.80E+01	3.40E+01	1.40E+02	1.20E+02
Cs-134	Bq/mL	NR	NR	NR	NR
Cs-137/Ba-137m	Bq/mL	3.10E+04	8.30E+04	2.40E+05	7.40E+04
Eu-152	Bq/mL	NR	NR	NR	< 2.2E+01
Eu-154	Bq/mL	NR	NR	NR	< 1.8E+01
Eu-155	Bq/mL	NR	NR	NR	< 1.2E+02
Sr-90	Bq/mL	1.20E+03	7.60E+02	2.10E+02	7.80E+02
Am-241	Bq/mL	NR	NR	NR	NR
Gross alpha - Alpha Spec					
Cm-244	Bq/mL	< 3.0E+00	< 3.0E+00	< 3.0E+00	NR
Pu-239/Pu-240	Bq/mL	< 2.0E+00	< 2.0E+00	2.00E+00	NR
Pu-238/Am-241	Bq/mL	< 2.0E+00	< 2.0E+00	2.00E+00	NR
Th-232+d	Bq/mL	NR	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR	NR
U-234	Bq/mL	NR	NR	NR	NR
U-238	Bq/mL	< 2.0E+00	< 2.0E+00	3.00E+00	NR
U-233/U-234	Bq/mL	< 2.0E+00	< 2.0E+00	7.00E+00	NR
Cf-252	Bq/mL	< 2.0E+00	< 2.0E+00	< 2.0E+00	NR
Np-237	Bq/mL	NR	NR	NR	NR
Pu alpha - Alpha Spec					
Pu-238	Bq/mL	NR	NR	NR	4.20E-01
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR
Pu-242	Bq/mL	NR	NR	NR	NR
U - Mass Spec					
U-233	Bq/mL	NC	NC	NC	5.76E+00
U-234	Bq/mL	NC	NC	NC	9.24E-01
U-235	Bq/mL	NC	NC	NC	3.58E-02
U-236	Bq/mL	NC	NC	NC	6.75E-03
U-238	Bq/mL	NC	NC	NC	9.70E-01
Pu - Mass Spec					
Pu-238	Bq/mL	NC	NC	NC	NC
Pu-239	Bq/mL	NC	NC	NC	NC
Pu-240	Bq/mL	NC	NC	NC	NC
Pu-241	Bq/mL	NC	NC	NC	NC
Pu-242	Bq/mL	NC	NC	NC	NC
Pu-244	Bq/mL	NC	NC	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.33. Tank W-11, Supernate Curie Loading Data Base

SUPERNATE		W-11				
Isotope \ Sample	Units	W11/L3	W11/L115	W11/L114	W-11L 206	W-11L 207
Scintillation Counting						
H-3	Bq/mL	6.00E+01	5.00E-01	5.00E-01	NR	NR
C-14	Bq/mL	2.00E-01	1.00E-02	1.00E-01	NR	NR
Beta/Gamma						
Co-60	Bq/mL	< 2.0E+01	<2.0E+01	<2.0E+01	< 0.3	< 0.3
Cs-134	Bq/mL	NC	NC	NC	NR	NR
Cs-137/Ba-137m	Bq/mL	< 2.0E+01	<2.0E+01	<2.0E+01	5.60E-01	1.90E-01
Eu-152	Bq/mL	NC	NC	NC	< 2	< 2
Eu-154	Bq/mL	NC	NC	NC	< 0.9	< 0.6
Eu-155	Bq/mL	NC	NC	NC	< 0.5	< 0.4
Sr-90	Bq/mL	2.00E+01	4.20E+01	2.10E+01	5.50E+00	6.10E+00
Am-241	Bq/mL	NR	NR	NR	NR	NR
Gross alpha - Alpha Spec						
Cm-244	Bq/mL	NR	NR	NR	NR	NR
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR	NR
Pu-238/Am-241	Bq/mL	NR	NR	NR	NR	NR
Th-232+d	Bq/mL	NR	NR	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR	NR	NR
U-234	Bq/mL	NR	NR	NR	NR	NR
U-238	Bq/mL	NR	NR	NR	NR	NR
U-233/U-234	Bq/mL	NR	NR	NR	NR	NR
Cf-252	Bq/mL	NR	NR	NR	NR	NR
Np-237	Bq/mL	NR	NR	NR	NR	NR
Pu alpha - Alpha Spec						
Pu-238	Bq/mL	NR	NR	NR	4.00E-03	3.00E-03
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR	NR
Pu-242	Bq/mL	NR	NR	NR	NR	NR
U - Mass Spec						
U-233	Bq/mL	NC	NC	NC	4.02E-03	6.26E-03
U-234	Bq/mL	NC	NC	NC	2.39E-02	1.94E-02
U-235	Bq/mL	NC	NC	NC	9.88E-04	7.19E-04
U-236	Bq/mL	NC	NC	NC	4.13E-05	3.30E-05
U-238	Bq/mL	NC	NC	NC	2.37E-02	1.70E-02
Pu - Mass Spec						
Pu-238	Bq/mL	NC	NC	NC	NC	NC
Pu-239	Bq/mL	NC	NC	NC	NC	NC
Pu-240	Bq/mL	NC	NC	NC	NC	NC
Pu-241	Bq/mL	NC	NC	NC	NC	NC
Pu-242	Bq/mL	NC	NC	NC	NC	NC
Pu-244	Bq/mL	NC	NC	NC	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting
NC = Not Calculated

Table D.34. Tank TH-4, Supernate Curie Loading Data Base

SUPERNATE		TH-4						
Isotope \ Sample	Units	TH4/L116	TH4/L55	TH4/L117	TH4/L56	TH4/L57	TH-4L 208	TH-4L 210
Scintillation Counting								
H-3	Bq/mL	3.00E-03	3.00E-02	NR	5.00E-02	NR	NR	NR
C-14	Bq/mL	NR	5.00E-03	NR	NR	NR	NR	NR
Beta/Gamma								
Co-60	Bq/mL	< 2.0E+01	< 2.0E+01	< 2.0E+01	2.20E-01	3.70E-01	< 0.5	< 0.5
Cs-134	Bq/mL	NR	NR	NR	NR	NR	< 0.5	< 0.5
Cs-137/Ba-137m	Bq/mL	5.40E-01	7.40E+00	3.60E+00	1.80E+02	2.40E+02	9.90E+01	1.70E+02
Eu-152	Bq/mL	NR	NR	NR	NR	NR	< 3	< 2
Eu-154	Bq/mL	NR	NR	NR	NR	NR	< 2	< 2
Eu-155	Bq/mL	NR	NR	NR	NR	NR	< 2	< 3
Sr-90	Bq/mL	3.00E-02	1.40E-01	4.60E-01	2.50E+01	2.00E+01	1.10E+00	1.60E+01
Am-241	Bq/mL	NR	NR	NR	NR	NR	NR	NR
Gross alpha - Alpha Spec								
Cm-244	Bq/mL	< 2.0E-01	< 2.0E-01	< 2.0E-01	< 2.0E-01	< 2.0E-01	NR	NR
Pu-239/Pu-240	Bq/mL	< 2.0E-01	< 2.0E-01	< 2.0E-01	< 3.0E-01	< 4.0E-01	NR	NR
Pu-238/Am-241	Bq/mL	< 2.0E-01	< 2.0E-01	< 2.0E-01	< 3.0E-01	< 4.0E-01	NR	NR
Th-232+d	Bq/mL	1.30E-01	NR	1.30E-01	NR	NR	NR	NR
U-238+d	Bq/mL	NR	NR	NR	NR	NR	NR	NR
U-234	Bq/mL	NR	NR	NR	NR	NR	NR	NR
U-238	Bq/mL	NR	NR	NR	NR	NR	NR	NR
U-233/U-234	Bq/mL	< 2.0E-01	< 2.0E-01	< 2.0E-01	< 3.0E-01	< 4.0E-01	NR	NR
Cf-252	Bq/mL	< 2.0E-01	< 2.0E-01	< 2.0E-01	< 3.0E-01	< 4.0E-01	NR	NR
Np-237	Bq/mL	NR	NR	NR	NR	NR	NR	NR
Pu alpha - Alpha Spec								
Pu-238	Bq/mL	NR	NR	NR	NR	NR	2.70E-01	6.20E-01
Pu-239/Pu-240	Bq/mL	NR	NR	NR	NR	NR	NR	NR
Pu-242	Bq/mL	NR	NR	NR	NR	NR	NR	NR
U - Mass Spec								
U-233	Bq/mL	NC	NC	NC	NC	NC	1.27E+00	4.23E+00
U-234	Bq/mL	NC	NC	NC	NC	NC	4.60E+01	1.45E+02
U-235	Bq/mL	NC	NC	NC	NC	NC	1.83E+00	6.18E+00
U-236	Bq/mL	NC	NC	NC	NC	NC	8.67E-03	2.89E-02
U-238	Bq/mL	NC	NC	NC	NC	NC	4.48E+01	1.49E+02
Pu - Mass Spec								
Pu-238	Bq/mL	NC	NC	NC	NC	NC	NC	NC
Pu-239	Bq/mL	NC	NC	NC	NC	NC	NC	NC
Pu-240	Bq/mL	NC	NC	NC	NC	NC	NC	NC
Pu-241	Bq/mL	NC	NC	NC	NC	NC	NC	NC
Pu-242	Bq/mL	NC	NC	NC	NC	NC	NC	NC
Pu-244	Bq/mL	NC	NC	NC	NC	NC	NC	NC

NR = Not Reported or Not Included to Eliminate Double Counting

NC = Not Calculated

Appendix E

SUMMARY OF STATISTICAL METHODS

Statistical methods are used for GAAT data analysis to describe sample data and account for variability from numerous physical, chemical, or operational sources. Common statistical methods include:

Summary (descriptive) statistics	Calculate mean (average), standard deviation, relative standard deviation, minimum, maximum, median, 25%-tile, 75%-tile, and range for the data
Exploratory methods	Examine the summary statistics and determine any outliers
Empirical distribution function	Plot the ordered raw data versus cumulative percentage of occurrence
Goodness of fit tests	Determine what probability function best describes the sample data. Use this information to compute confidence intervals for selected summary statistics.
Analysis of variance	Examine the differences in variability between two samples
Correlation	Examine degree of association between constituents within a tank or the association between tanks for selected constituents.

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