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7. Abstract This report documents the statistical analyses performed on core data from Single-Shell Tank 241-T-107		
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LIST OF TERMS

95% LL	lower limit of a 95% confidence interval on the mean
95% UL	upper limit of a 95% confidence interval on the mean
ANOVA	analysis of variance
AT	total alpha
T-107	tank 241-T-107
CI	confidence interval
df	degrees of freedom
.dir	direct
DL	detection limit
GEA	gamma energy analysis
HSD	Tukey's Honestly Significant Difference multiple comparison procedure
IC	ion chromatography
ICP	inductively coupled plasma
ICP.a.	inductively coupled plasma analysis on an acid digested sample
ICP.f.	inductively coupled plasma analysis on a fusion digested sample
ICP.w.	inductively coupled plasma analysis on a water leached sample
IS	insufficient sample
KOH/Ni	Potassium Hydroxide/Nickel
Mean/DL	the mean of two sample results (sample and duplicate) divided by the detection limit
mL	milliliters
NA	not available
NR	not required
RAD.f.	radiochemistry analysis of a fusion digested sample
REML	Restricted Maximum Likelihood Estimation Method
RS	residual solids from water digestion
SST	single-shell tank
TB	total beta
TGA	thermal gravimetric analysis
TIC	total inorganic carbon
TOC	total organic carbon
$\bar{y}$	weighted mean of the concentration data
σ^2	variance
$\hat{\sigma}^2$	estimated variance
$\mu\text{Ci/L}$	microcuries per liter
$\mu\text{g/g}$	micrograms per gram

**STATISTICAL CHARACTERIZATION REPORT
FOR
SINGLE-SHELL TANK 241-T-107**

1.0 SUMMARY

This report contains the results of the statistical analysis of data from three core samples obtained from single-shell tank 241-T-107 (T-107). Four specific topics are addressed. They are summarized below.

Section 3.0 contains mean concentration estimates of analytes found in T-107. The estimates of "error" associated with the concentration estimates are given as 95% confidence intervals (CI) on the mean. The results given are based on three types of samples: core composite samples, core segment samples, and drainable liquid samples.

Section 4.0 contains estimates of the spatial variability (variability between cores and between segments) and the analytical variability (variability between the primary and the duplicate analysis). Statistical tests were performed to test the hypothesis that the between cores and the between segments spatial variability is zero. The results of the tests¹ are as follows. Based on the core composite data, the between cores variance is significantly different from zero for 35 out of 74 analytes; i.e., for 53% of the analytes there is no statistically significant difference between the concentration means for two cores. Based on core segment data, the between segments variance is significantly different from zero for 22 out of 24 analytes and the between cores variance is significantly different from zero for 4 out of 24 analytes; i.e., for 8% of the analytes there is no statistically significant difference between segment means and for 83% of the analytes there is no difference between the means from the three cores. Based on the drainable liquid data from three cores, the between cores variance is significantly different from zero for 36 out of 39 analytes; i.e., for 8% of the analytes there is no statistically significant difference between the drainable liquid means from the three cores.

Section 5.0 contains the results of the application of multiple comparison methods to the core composite data, the core segment data, and the drainable liquid data. These comparisons are based on the analytical error only. This section contains graphical comparisons of the mean concentrations,

Section 6.0 contains the results of a statistical test conducted to determine the 222-S Analytical Laboratory's ability to homogenize solid core segments. For 17 out of 18 analytes, the variability between subsamples taken from different locations could not be distinguished from zero. Based on the results of this statistical test, it is generally concluded that the 222-S Analytical Laboratory can satisfactorily homogenize core segments.

¹ The statistical tests were performed at the $\alpha = 0.05$ level of significance.

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2.0 INTRODUCTION

Three core samples (cores 50, 51, and 52) were taken from T-107. Cores 50, 51, and 52 were obtained from risers 2, 5, and 3, respectively. The location of the risers is presented in Figure 2-1. Each core was expected to consist of four segments. The top segment was expected to be one-quarter full.

Figure 2-1. Riser Location.

The core sampler, for core 50, segment 1 remained in the tank riser for more than 48 hours; consequently, it was not chemically analyzed. A second segment from the same location was obtained.

The segment recoveries for each core are given in Table 2-1. This table also lists the proportion of each segment that consisted of solid material and drainable liquid.

Core 50, segments 1R and 4 had only partial recovery. The percent recovery values from segments 1R, 2, 3, and 4 of core 50 were 34%, 94%, 96%, and 67%, respectively. For core 51 no sample was obtained from segment 1, segment 2 had 64% recovery, and there was 100% recovery for segments 3 and 4. The percent recovery from segments 1, 2, 3, and 4 of core 52 were 43%, 56%, 95%, and 60%, respectively.

Table 2-1. Core Segment Sample Recovery.

Core	Segment	Recovery	Solid	Liquid	Comment
50	1	36%	72%	28%	Not used
50	1R	34%	70%	30%	Single-segment sample
50	2	94%	100%	0%	Single-segment sample
50	3	96%	5%	95%	Single-segment sample
50	4	67%	1%	99%	Single-segment sample
51	1	0%	0%	0%	No sample
51	2	64%	40%	60%	Single-segment sample
51	3	100%	100%	0%	Two half-segment samples
51	4	100%	100%	0%	Two half-segment samples
52	1	43%	100%	0%	Single-segment sample
52	2	56%	100%	0%	Single-segment sample
52	3	95%	100%	0%	Two half-segment samples
52	4	60%	3%	97%	Single-segment sample

Due to the incomplete core sample recovery, the concentration estimates given in this report are biased. The magnitude of the bias is unknown.

Segments 3 and 4 from core 51 were divided into half segments, denoted by U (upper) and L (lower). Segment 3 from core 52 was also divided into upper and lower half segments. These individual half segments were homogenized and chemically analyzed.

Core composite samples were constructed from the segments in cores 51 and 52 only. No composite sample was formed for core 50.

For each core, the drainable liquids were combined into a single sample and submitted for chemical analysis. Segment 4 from both cores 50 and 52 consisted of almost 100% drainable liquid. There is no data representing the solid fraction of these two segments.

A chemical analysis for each of the half segment, core composite, and drainable liquid samples was performed on two subsamples, giving a primary and duplicate result. These results are listed in the data package (Svancara and Pool 1993). The data package contains a more complete description of the core samples and chemical analyses performed on the core samples.

The chemical analysis of the primary and duplicate samples consisted of the following routine analytical methods and sample preparations (the notation for the method and preparation is also listed):

- inductively coupled plasma (ICP) analysis of an acid digested sample (ICP.a)
- ICP of a potassium hydroxide/nickel (KOH/Ni) fused sample (ICP.f)

- ICP analysis of a water leached sample (ICP.w)
- ion chromatography (IC) of a water leached sample (IC.w)
- radiochemistry
- gamma energy analysis (GEA).

Whenever appropriate, the data given here are identified using the notation in the above list. For example, the notation ICP.a.A1 refers to the A1 concentration from an ICP analysis of an acid digested sample. However, it needs to be noted that, occasionally, other analytical methods are used. The results from such methods are also given in the tables in Sections 3.0, 4.0, and 5.0 and the tables in Appendix A.

Appendix A contains the analyte concentration data given in the data package (Svancara and Pool 1993). The core composite sample results are in Table A-1. The corresponding segment data for cores 50, 51, and 52 are given in Tables A-2, A-3, and A-4, respectively. The drainable liquid data is in Table A-5. The data from the homogenization test is given in Table A-6. Ratios of the mean of each primary and duplicate result divided by the detection limit (DL) for that pair are also included in Tables A-1 to A-6. The ratios are provided to show how large the analyte concentrations are relative to the DL.

A complete report of the sample results, along with the laboratory quality control data, is contained in Addendum 1A of the data package (Svancara and Pool 1993). The core composite results, the core segment results, and the drainable liquid results, for each analyte, are illustrated in the figures provided in Appendix B. Figures illustrating the results are not included for analytes that were eliminated from the statistical analyses.

Analysis of variance (ANOVA) models were fit to the data for all analytes that did not have any "less than" values. All of the data available for statistical analysis, including the analytes with at least one "less than" value, are reported in Tables A-1 to A-5.

Analytical Evaluation and Reporting personnel, within the Tank Waste Remediation System Information Management Systems, requested that ANOVA models be fit to the data for analytes whose concentrations were greater than ten times the DL. In addition, they identified a list of "special analytes," given in Table 2-2. For this list, they requested that the ANOVA models be fit to the data, provided the concentration values were greater than three times the DL.

Table 2-2. Special Analyte List.

Aluminum	Nitrate
Bismuth	Nitrite
Calcium	Phosphate
Chromium	Carbonate
Iron	Fluoride
Silicon	Chloride
Sodium	Total Organic Carbon
Zirconium	Cyanide

The analytes in the tables in Sections 3.0 and 4.0 and in Appendix A are denoted by a "•" or a "★" whenever a concentration is less than three times or ten times the DL. The results for such analytes are to be used with caution.

There were several instances where the quality control criteria associated with the chemical analyses were not met. When this occurred, the samples were reanalyzed and in some cases the quality control criteria were again not met. Such cases are described in the narrative given in the data package (Svancara and Pool 1993). When this occurred, there was no apparent difference between the two sets of data. In such cases, the first set of data was used in the results reported here.

A close examination of the figures given in Appendix B reveal several potential anomalies in the data. In the core composite data, Figure B-1

- ICP.a.Fe Large differences between cores
- ICP.a.P Large differences between duplicate observations
- ICP.w.Na Large differences between cores
- IC.P04 The concentrations are larger than for other anions.

In the core segment data, Figure B-2

- ICP.f.Al Core 52, segment 1 concentrations are about twice as large as any of the other observations
- ICP.f.Ca Core 52, segment 1 concentrations are about three times as large as any of the other observations
- ICP.f.Mn Core 52, segment 1 concentrations are about twice as large as any of the other observations.

There is no direct evidence that the results noted above are due to analytical measurement errors. Consequently, the statistical analysis was performed on the data as it is reported in Tables A-1 to A-5.

3.0 MEAN CONCENTRATION ESTIMATES

One of the tasks outlined in the Tank Waste Characterization Plan, Section 5.1.1.2 (Bell 1993), is to estimate the analyte inventories in the waste. The inventories are estimated by computing mean concentration and 95% CIs on the mean concentration for each analyte. The estimate of the inventory and CI on the inventory of an analyte in the tank are equal to the corresponding mean concentration estimates and CI multiplied by the volume of waste in the tank. The estimates of the tank inventory are not given in this document.

Three types of analyte inventories are given in this section. The first inventory, given in Table 3-1, is based on the core composite data. Table A-1 contains the core composite data used to compute the mean concentration estimates and the CIs. The second inventory, given in Table 3-2, is based on the core segment data. Tables A-2, A-3, and A-4 contain the data used to compute these concentration estimates. The third inventory, given in Table 3-3, is based on the results from a chemical analysis of the drainable liquid. Table A-5 contains the drainable liquid data.

3.1 STATISTICAL METHODS

The concentration estimates are given in the form of 95% CIs on the mean concentration. It is assumed that each primary sample and its duplicate are analyzed independently of one another. The two analytical results are used to estimate the analytical measurement variability. Due to the hierarchical structure of the data, the analytical measurement variance alone is not the appropriate variance needed to estimate the variance of the mean for the CIs. A linear combination of the analytical measurement variance and the spatial variance is the appropriate variance of the mean for the CIs (Snedecor and Cochran 1980).

Appendix C contains a description of the statistical models and formulas used to calculate estimates of the mean, variance of the mean, and the CI on the mean. The statistical models for the core composite data and the drainable liquid data are identical. The statistical model for the core and segment data is more complicated.

The summary statistics are as follows:

$\bar{y}$	mean of the concentration data
$\hat{\sigma}^2(\bar{y})$	estimated variance of $\bar{y}$
df	degrees of freedom
95% LL	lower limit of the 95% CI on the mean
95% UL	upper limit of the 95% CI on the mean.

For some analytes the lower confidence limit (95% LL) was negative. Since concentrations are greater than or equal to zero, any negative 95% LL values were set equal to zero.

3.2 STATISTICAL RESULTS: CORE COMPOSITE DATA

Table 3-1 contains the summary statistics, by analyte, for ICP acid digestion, ICP water leach, ICP KOH/Ni fusion dissolution, radiochemistry, IC analyses, and some miscellaneous methods. These values are based on the core composite data.

Since there were only two core composite samples, representing cores 51 and 52, the CIs on the mean concentration are very wide relative to the range of the data. The CIs were based on only one degree of freedom.

Table 3-1. Core Composite Data Concentration Estimate Statistics.
(sheet 1 of 3)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)					
Analyte	$\bar{y}$	$s^2(\bar{y})$	df	95% LL	95% UL
ICP.a.Ag	7.37E+00	NA	1	NA	NA
ICP.a.Al	1.44E+04	4.19E+08	1	0.00	2.74E+05
ICP.a.B*	1.70E+01	2.68E+02	1	0.00	2.25E+02
ICP.a.Bi	1.09E+04	3.35E+07	1	0.00	8.44E+04
ICP.a.Ca	7.23E+02	6.76E+04	1	0.00	4.03E+03
ICP.a.Cd*	6.40E+00	2.64E+00	1	0.00	2.70E+01
ICP.a.Cr	3.54E+02	3.19E+03	1	0.00	1.07E+03
ICP.a.FE	3.15E+04	1.12E+07	1	0.00	7.40E+04
ICP.a.K	2.34E+02	3.42E+02	1	0.00	4.69E+02
ICP.a.Li*	5.48E+00	8.67E+00	1	0.00	4.29E+01
ICP.a.Mg	2.14E+02	9.41E+03	1	0.00	1.45E+03
ICP.a.Mn	2.22E+02	3.61E+02	1	0.00	4.63E+02
ICP.a.Na	1.30E+05	1.56E+08	1	0.00	2.89E+05
ICP.a.Nd*	7.29E+01	5.21E+03	1	0.00	9.90E+02
ICP.a.Ni	2.92E+02	6.25E+02	1	0.00	6.10E+02
ICP.a.P	3.00E+04	4.90E+05	1	2.11E+04	3.89E+04
ICP.a.Pb	7.96E+02	3.81E+05	1	0.00	8.64E+03
ICP.a.S	3.05E+03	1.06E+06	1	0.00	1.61E+04
ICP.a.Si	8.75E+02	2.34E+06	1	0.00	2.03E+04
ICP.a.Sm	2.85E+02	1.28E+05	1	0.00	4.84E+03
ICP.a.Sr	9.62E+02	3.09E+05	1	0.00	8.02E+03
ICP.a.Zr	7.16E+01	9.01E+03	1	0.00	1.28E+03

*: Analytes with a portion of the data below ten times the DL.

NA: Not available.

Table 3-1. Core Composite Data Concentration Estimate Statistics.
(sheet 2 of 3)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)					
Analyte	$\bar{y}$	$\sigma^2(\bar{y})$	df	95% LL	95% UL
ICP.w.Al	6.51E+02	1.10E+05	1	0.00	4.86E+03
ICP.w.B	3.26E+02	3.86E+05	1	0.00	8.22E+03
ICP.w.Bi	2.43E+02	8.84E+04	1	0.00	4.02E+03
ICP.w.Ca	2.71E+02	1.68E+05	1	0.00	5.48E+03
ICP.w.Cr	2.11E+02	6.00E+02	1	0.00	5.22E+02
ICP.w.Fe	3.56E+02	2.79E+04	1	0.00	2.48E+03
ICP.w.K	3.16E+02	7.29E+04	1	0.00	3.75E+03
ICP.w.Mg	9.83E+00	2.72E-02	1	7.74E+00	1.19E+01
ICP.w.Mo*	7.88E+00	2.66E+00	1	0.00	2.86E+01
ICP.w.Na	1.08E+05	2.72E+09	1	0.00	7.71E+05
ICP.w.S	3.54E+03	7.40E+05	1	0.00	1.45E+04
ICP.w.Se*	6.67E+01	7.73E+02	1	0.00	4.20E+02
ICP.w.Sr*	5.53E+00	6.40E-03	1	4.51E+00	6.55E+00
ICP.w.Zr*	6.07E+00	5.64E+01	1	0.00	1.02E+02
ICP.f.Al	1.63E+04	4.50E+08	1	0.00	2.86E+05
ICP.f.Bi	1.20E+04	5.34E+07	1	0.00	1.05E+05
ICP.f.Ca	7.61E+02	1.44E+03	1	2.78E+02	1.24E+03
ICP.f.Cr	3.60E+02	1.00E+02	1	2.33E+02	4.87E+02
ICP.f.Fe	2.92E+04	2.97E+07	1	0.00	9.84E+04
ICP.f.Mg	2.26E+02	1.10E+02	1	9.28E+01	3.60E+02
ICP.f.Mn	2.13E+02	2.26E+03	1	0.00	8.17E+02
ICP.f.Na	1.17E+05	1.32E+08	1	0.00	2.63E+05
ICP.f.Ni	2.64E+03	1.11E+06	1	0.00	1.60E+04
ICP.f.P	3.21E+04	2.72E+06	1	1.11E+04	5.30E+04
ICP.f.Pb	6.49E+02	2.42E+04	1	0.00	2.62E+03
ICP.f.S	3.28E+03	3.36E+05	1	0.00	1.06E+04
ICP.f.Si	6.06E+03	5.69E+06	1	0.00	3.64E+04
ICP.f.Sr	8.78E+02	2.30E+04	1	0.00	2.80E+03
ICP.f.Zr	9.32E+01	1.19E+03	1	0.00	5.31E+02

*: Analytes with a portion of the data below ten times the DL.

Table 3-1. Core Composite Data Concentration Estimate Statistics.
(sheet 3 of 3)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)					
Analyte	$\bar{y}$	$s^2(\bar{y})$	df	95% LL	95% UL
Total Dissolved Solids (wt%)	3.95E-01	1.00E-04	1	2.68E-01	5.22E-01
RS (wt%)	2.87E+01	3.08E+01	1	0.00	9.92E+01
CN	6.88E+01	2.10E+03	1	0.00	6.51E+02
IC.F	1.14E+04	1.91E+07	1	0.00	6.70E+04
IC.Cl	5.41E+02	8.01E+04	1	0.00	4.14E+03
IC.NO2	1.17E+04	5.13E+07	1	0.00	1.03E+05
IC.NO3	7.45E+04	1.34E+09	1	0.00	5.39E+05
IC.PO4	1.14E+05	1.44E+09	1	0.00	5.96E+05
IC.SO4	9.89E+03	3.06E+07	1	0.00	8.01E+04
Spec.w.NO2	1.11E+04	3.94E+07	1	0.00	9.08E+04
TIC	4.23E+03	8.41E+06	1	0.00	4.11E+04
TOC	1.70E+03	2.76E+05	1	0.00	8.37E+03
AT	2.70E-03	1.90E-05	1	0.00	5.81E-02
TB	1.34E+01	3.79E+01	1	0.00	9.17E+01
C-14	1.81E-04	8.21E-09	1	0.00	1.33E-03
H-3	1.24E-03	6.50E-08	1	0.00	4.48E-03
GEA.Cs-137	9.25E+00	3.04E+01	1	0.00	7.93E+01
RS.GEA.Cs-137	1.20E+01	1.18E+02	1	0.00	1.50E+02
RS.GEA.Co-60	1.85E-02	4.41E-04	1	0.00	2.85E-01
RS.GEA.Eu-154	1.33E-01	9.00E-06	1	9.49E-02	1.71E-01
RS.GEA.K-40	3.76E-02	4.27E-07	1	2.93E-02	4.59E-02
% Solids	5.02E+01	1.72E+01	1	0.00	1.03E+02
pH	1.15E+01	4.00E-02	1	8.96E+00	1.40E+01
CN.dir	7.61E+01	1.56E+03	1	0.00	5.77E+02

*: Analytes with a portion of the data below ten times the DL.

RS: Residual solids from water digestion.

TIC: Total inorganic carbon.

TOC: Total organic carbon.

3.3 STATISTICAL RESULTS: CORE SEGMENT DATA

Table 3-2 contains the summary statistics, by analyte, for ICP KOH/Ni fusion dissolution, radiochemistry, and some other special analyses. These values are based on a chemical analysis of the segments from each core.

There were segment data from the three core samples taken from T-107. The CIs computed from the segment data were based on two degrees of freedom. The CIs in the previous section were based on one degree of freedom.

Table 3-2. Core Segment Data Concentration Estimate Statistics.

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)					
Analyte	$\bar{y}$	$s^2(\bar{y})$	df	95% LL	95% UL
ICP.f.Al	3.88E+04	4.34E+08	2	0.00	1.28E+05
ICP.f.Bi	9.01E+03	5.71E+06	2	0.00	1.93E+04
ICP.f.Ca	1.92E+03	7.16E+05	2	0.00	5.56E+03
ICP.f.Cd**	9.87E+00	6.79E+00	2	0.00	2.11E+01
ICP.f.Cr	3.17E+02	1.15E+03	2	1.71E+02	4.63E+02
ICP.f.Fe	2.60E+04	7.86E+06	2	1.39E+04	3.80E+04
ICP.f.Mg	2.61E+02	1.25E+03	2	1.09E+02	4.12E+02
ICP.f.Mn	4.27E+02	4.27E+04	2	0.00	1.32E+03
ICP.f.Na	9.55E+04	9.06E+07	2	5.46E+04	1.36E+05
ICP.f.Ni	5.19E+03	1.59E+06	2	0.00	1.06E+04
ICP.f.P	2.13E+04	1.80E+07	2	3.04E+03	3.96E+04
ICP.f.Pb*	7.17E+02	2.96E+04	2	0.00	1.46E+03
ICP.f.S	2.91E+03	2.55E+05	2	7.36E+02	5.08E+03
ICP.f.Si	5.39E+03	1.05E+06	2	9.82E+02	9.80E+03
ICP.f.Sr	7.93E+02	3.47E+04	2	0.00	1.59E+03
ICP.f.Ti	4.68E+01	5.92E+02	2	0.00	1.51E+02
ICP.f.Zr**	5.52E+01	1.09E+03	2	0.00	1.97E+02
Sr-90	1.24E+02	8.42E+02	2	0.00	2.49E+02
GEA.Cs-137	1.70E+01	7.35E+01	2	0.00	5.38E+01
GEA.Eu-154	4.66E-01	9.54E-02	2	0.00	1.79E+00
TGA.H2O	4.60E+01	3.07E+01	2	2.22E+01	6.98E+01
% Solids	5.77E+01	4.82E+01	2	2.79E+01	8.76E+01
pH	1.11E+01	1.94E-02	2	1.05E+01	1.17E+01
CN ($\mu\text{g/g}$)	6.33E+01	2.02E+02	2	2.24E+00	1.24E+02

*: Analytes with a portion of the data below ten times the DL.

**: Analytes with a portion of the data below three times the DL.

3.4 STATISTICAL RESULTS: DRAINABLE LIQUID DATA

Table 3-3 contains the summary statistics, by analyte, for ICP, IC, radiochemistry, and several special analyses of acidified drainable liquid samples. These values are based on a chemical analysis of a drainable liquid sample from each of the three cores.

Drainable liquid sample data was available from each of the three core samples taken from T-107. The CIs computed from the drainable liquid data were based on two degrees of freedom.

Table 3-3. Drainable Liquid Composite Data Concentration
Estimate Statistics. (sheet 1 of 2)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)					
Analyte	$\bar{y}$	$s^2(\bar{y})$	df	95% LL	95% UL
ICP.Al*	2.12E+01	1.82E+02	2	0.00	7.92E+01
ICP.B	2.13E+01	3.94E+01	2	0.00	4.83E+01
ICP.Ca	4.40E+00	9.26E-02	2	3.09E+00	5.71E+00
ICP.Cr	1.69E+02	4.41E+03	2	0.00	4.55E+02
ICP.Fe	2.43E+01	1.56E+02	2	0.00	7.79E+01
ICP.K	1.84E+02	9.08E+03	2	0.00	5.94E+02
ICP.Mg	6.81E-01	7.81E-02	2	0.00	1.88E+00
ICP.Mo	8.90E+00	4.55E+01	2	0.00	3.79E+01
ICP.Na	5.40E+04	5.47E+08	2	0.00	1.55E+05
ICP.Ni	6.87E+00	2.12E+01	2	0.00	2.67E+01
ICP.P	1.80E+03	2.82E+05	2	0.00	4.09E+03
ICP.S	3.39E+03	2.24E+06	2	0.00	9.83E+03
ICP.Si	7.07E+01	7.31E+01	2	3.39E+01	1.07E+02
ICP.Sr*	7.07E-01	3.04E-01	2	0.00	3.08E+00
ICP.Zr*	8.26E-01	2.11E-01	2	0.00	2.80E+00
CN	6.84E+01	1.80E+03	2	0.00	2.51E+02
IC.F	5.57E+02	3.87E+04	2	0.00	1.40E+03
IC.Cl	7.99E+02	1.10E+05	2	0.00	2.23E+03
IC.NO2	1.28E+04	5.79E+07	2	0.00	4.55E+04
IC.PO4	5.42E+03	2.45E+06	2	0.00	1.22E+04
IC.SO4	1.03E+04	1.25E+07	2	0.00	2.55E+04
IC.NO3	8.52E+04	1.12E+09	2	0.00	2.30E+05
Spec.w.NO2	7.57E+03	8.04E+06	2	0.00	1.98E+04
TIC	1.80E+03	1.89E+06	2	0.00	7.71E+03
TOC	8.57E+02	6.36E+04	2	0.00	1.94E+03

*: Analytes with a portion of the data below ten times the DL.

TIC: Total inorganic carbon.

TOC: Total organic carbon.

Table 3-3. Drainable Liquid Composite Data Concentration
Estimate Statistics. (sheet 2 of 2)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)					
Analyte	$\bar{y}$	$\sigma^2(\bar{y})$	df	95% LL	95% UL
AT	6.01E-03	2.81E-05	2	0.00	2.88E-02
U	2.41E+02	3.03E+04	2	0.00	9.90E+02
U-238	8.10E-05	3.42E-09	2	0.00	3.33E-04
Am-241	1.15E-04	1.99E-09	1	0.00	6.82E-04
TB	1.18E+01	4.74E+01	2	0.00	4.14E+01
Sr-90	5.94E-02	1.09E-03	2	0.00	2.02E-01
Tc-99	2.70E-02	3.66E-04	2	0.00	1.09E-01
C-14	2.03E-04	2.50E-08	2	0.00	8.84E-04
H-3	2.57E-03	4.79E-06	2	0.00	1.20E-02
GEA.Cs-137	8.43E+00	2.56E+01	2	0.00	3.02E+01

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4.0 COMPARISON OF THE VARIANCE COMPONENT ESTIMATES

Using the hierarchical structure of the core composite data and the drainable liquid data, the spatial variability (between core composite samples), and the analytical measurement variability can be separated from each other. For the core segment data, the spatial variability can be separated into two components; i.e., the variability between cores and the variability between segments. For each of the three sets of data, the analytical measurement variance includes the variability due to segment homogenization, due to sample handling, and due to the chemical analysis method. This variance is a measure of the difference between the analytical results from the primary and duplicate samples.

The estimate of the variance of the mean is a linear function of the spatial and analytical measurement variances. To evaluate the magnitude of these variance components, explicit estimates of each variance component are given in Table 4-1, 4-2, and 4-3.

4.1 STATISTICAL METHODS

Estimates of the spatial variances (between cores $\hat{\sigma}^2(C)$ and between segments $\hat{\sigma}^2(S)$) and the analytical measurement variance [$\hat{\sigma}^2(A)$] were obtained for each analyte using Restricted Maximum Likelihood Estimation (REML) methods. This method is discussed in Harville (1977).

To test the significance of the variance components, an ANOVA was computed for the hierarchical statistical models used to describe the data (the models are described in Appendix C). An F-test, from the ANOVA, was used to test the hypothesis that the between cores spatial variance [$\sigma^2(C)$] is equal to zero; i.e., there is no difference between core mean concentrations. When applicable, another F-test, also from the ANOVA, was used to test the hypothesis that the between segments spatial variance [$\sigma^2(S)$] is equal to zero; i.e., there is no significant difference between segment mean concentrations.

The between cores variance [$\sigma^2(C)$] is a measure of the horizontal variability within the waste. The between segments variance [$\sigma^2(S)$] is a measure of the vertical variability within the waste. If $\sigma^2(C)$ and $\sigma^2(S)$ are significantly different from zero, then the waste in T-107 is (statistically) heterogeneous.

The p-values associated with the various F-tests are reported in Tables 4-1 through 4-3. The p-value is the attained level of significance of the statistical test. If a p-value is less than 0.05, the variance component is significantly different from zero. The p-values were computed using the ANOVA results, not from the REML results.

4.2 STATISTICAL RESULTS: CORE COMPOSITE DATA

Table 4-1 lists the REML estimates for the spatial variability (between cores) and the analytical variability for the core composite data. The table also gives the p-values for the test of the hypothesis that the spatial variance [$\sigma^2(C)$] is equal to zero. The spatial variability is significantly

different from zero for 35 out of 74 analytes (47% of the cases). This implies that for a majority of the analytes (53%) the mean concentrations from cores 51 and 52 cannot be distinguished from each other.

Table 4-1. Core Composite Data Variance
Component Estimates. (sheet 1 of 3)

Analyte	$\sigma^2(C)$	Test: $\sigma^2(C) = 0$ p-value	$\sigma^2(A)$
ICP.a.Al	2.09E+08	0.001	5.02E+05
ICP.a.B*	4.67E+01	0.458	2.06E+02
ICP.a.Bi	1.65E+07	0.013	4.51E+05
ICP.a.Ca	3.15E+04	0.061	4.53E+03
ICP.a.Cd*	5.65E-02	0.414	2.53E+00
ICP.a.Cr	1.46E+03	0.076	2.73E+02
ICP.a.Fe	1.79E-31	0.763	6.65E+07
ICP.a.K	1.71E-13	0.534	5.25E+02
ICP.a.Li*	4.13E+00	0.044	4.05E-01
ICP.a.Mg	4.67E+03	0.008	7.30E+01
ICP.a.Mn	2.31E-20	0.846	5.07E+03
ICP.a.Na	3.85E+07	0.295	7.93E+07
ICP.a.Nd*	2.60E+03	0.002	1.08E+01
ICP.a.Ni	2.91E+02	0.062	4.25E+01
ICP.a.P	2.47E-25	0.906	1.84E+07
ICP.a.Pb	1.80E+05	0.051	2.13E+04
ICP.a.S	5.29E+05	0.003	3.20E+03
ICP.a.Si	1.15E+06	0.014	3.45E+04
ICP.a.Sm	6.40E+04	0.003	3.43E+02
ICP.a.Sr	1.54E+05	0.002	4.80E+02
ICP.a.Zr	4.50E+03	0.001	6.56E+00

*: Analytes with a portion of the data below ten times the DL.

Table 4-1. Core Composite Data Variance
Component Estimates. (sheet 2 of 3)

Analyte	$\sigma^2(C)$	Test: $\sigma^2(C) = 0$ p-value	$\sigma^2(A)$
ICP.W.Al	4.42E+04	0.150	2.11E+04
ICP.W.B	1.92E+05	0.002	8.71E+02
ICP.W.Bi	4.39E+04	0.005	4.65E+02
ICP.W.Ca	3.14E+04	0.334	1.05E+05
ICP.W.Cr	1.71E+02	0.268	2.59E+02
ICP.W.Fe	1.30E+04	0.063	1.95E+03
ICP.W.K	1.73E+04	0.302	3.84E+04
ICP.W.Mg	5.88E-32	0.952	4.02E+00
ICP.W.Mo*	1.32E+00	0.004	1.17E-02
ICP.W.Na	1.33E+09	0.023	6.41E+07
ICP.W.S	3.30E+05	0.093	7.94E+04
ICP.W.Se*	5.64E+02	0.104	2.11E+01
ICP.W.Sr*	1.82E-42	0.948	7.77E-01
ICP.W.Zr*	4.11E+01	0.107	1.62E+00
ICP.f.Al	2.24E+08	0.006	2.64E+06
ICP.f.Bi	2.53E+07	0.048	2.74E+06
ICP.f.Ca	3.55E-21	0.462	1.66E+03
ICP.f.Cr	6.95E-23	0.721	4.28E+02
ICP.f.Fe	1.60E-17	0.667	8.91E+07
ICP.f.Mg	1.11E-20	0.775	7.26E+02
ICP.f.Mn	2.95E-19	0.597	4.63E+03
ICP.f.Na	5.20E+07	0.163	2.83E+07
ICP.f.Ni	8.11E+04	0.392	9.51E+05
ICP.f.P	2.22E-19	0.608	5.90E+06
ICP.f.Pb	8.77E-18	0.566	4.27E+04
ICP.f.S	1.63E+05	0.032	1.13E+04
ICP.f.Si	2.83E+06	0.006	3.28E+04
ICP.f.Sr	9.95E+03	0.111	3.05E+03

*: Analytes with a portion of the data below ten times the DL.

Table 4-1. Core Composite Data Variance Component Estimates. (sheet 3 of 3)

Analyte	$\sigma^2(C)$	Test: $\sigma^2(C) = 0$ p-value	$\sigma^2(A)$
ICP.f.Zr	4.09E+02	0.215	3.69E+02
Total Dissolved Solids (wt%)	1.75E-28	0.553	1.67E-04
RS (wt%)	1.36E+01	0.099	3.55E+00
CN	1.05E+03	0.001	2.32E+00
IC.F	9.25E+06	0.032	6.43E+05
IC.Cl	3.87E+04	0.031	2.60E+03
IC.NO2	2.56E+07	0.004	1.84E+05
IC.NO3	6.60E+08	0.011	1.51E+07
IC.PO4	6.66E+08	0.070	1.13E+08
IC.SO4	1.52E+07	0.005	1.42E+05
Spec.w.NO2	1.94E+07	0.016	6.33E+05
TIC	4.18E+06	0.006	4.75E+04
TOC	1.33E+05	0.031	8.83E+03
AT	9.31E-06	0.020	3.85E-07
TB	1.87E+01	0.015	5.96E-01
C-14	4.90E-09	0.271	1.68E-09
H-3	1.11E-08	0.344	4.29E-08
GEA.Cs-137	1.51E+01	0.006	1.70E-01
RS.GEA.Cs-137	5.84E+01	0.007	8.64E-01
RS.GEA.Co-60	2.20E-04	0.003	1.36E-06
RS.GEA.Eu-154	1.20E-42	0.868	1.71E-04
RS.GEA.K-40	8.00E-08	0.454	3.20E-07
% Solids	8.49E+00	0.014	2.53E-01
pH	2.00E-02	0.000	4.99E-11
CN.dir	7.65E+02	0.016	2.53E+01

RS: Residual solids from water digestion.

TIC: Total inorganic carbon.

TOC: Total organic carbon.

4.3 STATISTICAL RESULTS: CORE SEGMENT DATA

Table 4-2 lists the REML estimates for the between cores spatial variance [$\sigma^2(C)$], the between segments spatial variance [$\sigma^2(S)$], and the analytical variability [$\sigma^2(A)$] for the core segment data. The table also gives the p-values for the test of the hypotheses that the between segments variance [$\sigma^2(S)$] is equal to zero and that the between cores variance [$\sigma^2(C)$] is equal to zero. The between segments spatial variability is significantly different from zero for 22 out of 24 analytes (92% of the cases). This variability is not significantly different from zero for ICP.f.Zr and GEA.Eu-154. On the

other hand, the between cores variability is significantly different from zero for only 4 out of 24 analytes (17% of the cases). This indicates that the waste in T-107 is, statistically, vertically heterogeneous but horizontally homogeneous.

Table 4-2. Core Segment Data Variance Component Estimates.

Analyte	$\sigma^2(C)$	Test: $\sigma^2(C) = 0$ p-value	$\sigma^2(S)$	Test: $\sigma^2(S) = 0$ p-value	$\sigma^2(A)$
ICP.f.Al	3.82E+08	0.314	3.52E+09	0.000	3.76E+06
ICP.f.Bi	1.88E-02	0.496	6.53E+07	0.000	5.26E+05
ICP.f.Ca	8.15E-20	0.587	7.65E+06	0.000	1.16E+06
ICP.f.Cd**	3.42E-23	0.697	6.57E+01	0.001	2.45E+01
ICP.f.Cr	3.57E+02	0.389	1.17E+04	0.000	3.03E+02
ICP.f.Fe	9.10E+06	0.245	4.98E+07	0.000	1.12E+07
ICP.f.Mg	4.48E+02	0.388	1.25E+04	0.000	2.21E+02
ICP.f.Mn	3.26E-17	0.547	4.48E+05	0.000	8.58E+04
ICP.f.Na	2.79E-18	0.926	1.03E+09	0.000	2.56E+07
ICP.f.Ni	2.46E-28	0.954	1.60E+07	0.000	9.30E+05
ICP.f.P	2.44E-10	0.675	2.03E+08	0.000	8.03E+06
ICP.f.Pb*	1.02E+04	0.365	2.63E+05	0.001	7.55E+04
ICP.f.S	5.93E+05	0.038	6.48E+05	0.000	1.51E+04
ICP.f.Si	3.78E-16	0.565	1.20E+07	0.000	1.31E+05
ICP.f.Sr	6.19E+04	0.133	1.60E+05	0.000	2.33E+03
ICP.f.Ti	4.46E-31	0.927	3.90E+03	0.005	1.18E+03
ICP.f.Zr**	2.03E+03	0.012	1.50E+03	0.134	1.97E+03
Sr-90	1.13E+03	0.223	5.30E+03	0.000	6.68E+01
GEA.Cs-137	5.89E+01	0.323	6.19E+02	0.000	1.27E+00
GEA.Eu-154	2.57E-01	0.005	2.77E-02	0.136	1.19E-02
TGA.H2O	5.24E+01	0.150	1.50E+02	0.000	2.81E+00
% Solids	9.51E+01	0.105	1.56E+02	0.000	3.74E-01
pH	1.40E-22	0.845	2.21E-01	0.000	1.67E-03
CN ($\mu\text{g/g}$)	5.37E+02	0.005	2.60E+02	0.000	8.37E+00

*: Analytes with a portion of the data below ten times the DL.

•: Analytes with a portion of the data below three times the DL.

4.4 STATISTICAL RESULTS: DRAINABLE LIQUID DATA

Table 4-3 lists the REML estimates for the spatial variability (between cores) and the analytical variability for the drainable liquid data. The table also gives the p-values for the test of the hypothesis that the spatial variance [$\sigma^2(C)$] is equal to zero. The spatial variability is significantly different from zero for 36 out of 39 analytes (92% of the cases). This implies that, for a majority of the analytes (92%), the drainable liquid mean concentrations from cores 50, 51, and 52 are significantly different from each other. For Ca, Si, and H-3 the spatial variabilities cannot be distinguished from zero. These results are consistent with similar results given in Section 5.3.

Table 4-3. Drainable Liquid Composite Data Variance Component Estimates. (sheet 1 of 2)

Analyte	$\sigma^2(C)$	Test: $\sigma^2(C) = 0$ p-value	$\sigma^2(A)$
ICP.Al*	5.45E+02	0.000	3.47E-01
ICP.B	1.17E+02	0.002	2.40E+00
ICP.Ca	5.41E-27	0.844	2.08E+00
ICP.Cr	1.32E+04	0.000	5.39E+00
ICP.Fe	4.67E+02	0.000	1.85E-01
ICP.K	2.72E+04	0.000	3.33E+01
ICP.Mg	2.29E-01	0.006	1.10E-02
ICP.Mo	1.37E+02	0.000	2.88E-02
ICP.Na	1.64E+09	0.000	5.33E+05
ICP.Ni	6.35E+01	0.000	1.61E-02
ICP.P	8.47E+05	0.000	1.10E+03
ICP.S	6.72E+06	0.000	4.45E+02
ICP.Si	1.91E+02	0.066	5.71E+01
ICP.Sr*	9.12E-01	0.000	7.28E-05
ICP.Zr*	6.31E-01	0.000	2.85E-03
TGA	1.15E+02	0.001	1.43E+00
SPG	8.07E-03	0.001	8.33E-05
Total Dissolved Solids	1.03E+02	0.000	4.22E-01
pH	2.95E-01	0.000	1.67E-05

*: Analytes with a portion of the data below ten times the DL.

Table 4-3. Drainable Liquid Composite Data Variance Component Estimates. (sheet 2 of 2)

Analyte	$\sigma^2(C)$	$\sigma^2_{Test}(C) = 0$ p-value	$\sigma^2(A)$
CN	5.41E+03	0.000	
IC.F	1.16E+05	0.000	2.55E+01
IC.Cl	3.30E+05	0.000	6.00E+01
IC.NO2	1.74E+08	0.000	1.79E+04
IC.PO4	7.33E+06	0.000	8.60E+03
IC.SO4	3.74E+07	0.000	1.67E+01
IC.NO3	3.37E+09	0.000	1.67E+05
Spec.w.NO2	2.40E+07	0.001	2.23E+05
TIC	5.66E+06	0.000	8.60E+02
TOC	1.90E+05	0.001	1.96E+03
AT	8.41E-05	0.000	1.70E-07
U	9.07E+04	0.000	3.24E+02
U-238	1.02E-08	0.000	3.76E-11
Am-241	8.96E-09	0.018	9.25E-12
TB	1.42E+02	0.000	1.70E-01
Sr-90	3.27E-03	0.000	1.38E-05
Tc-99	1.82E-03	0.000	2.16E-07
C-14	6.87E-08	0.038	1.28E-08
H-3	1.14E-05	0.115	5.94E-06
GEA.Cs-137	7.68E+01	0.000	1.01E-01

TIC: Total inorganic carbon.

TOC: Total organic carbon.

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5.0 MULTIPLE COMPARISONS

A group of statistical methods known as multiple comparisons can be used to determine whether or not there are significant differences between core composite samples, between segment samples, and between drainable liquid samples. These differences will help determine the heterogeneity or existence of layers within the waste. In addition, if there are significant differences these comparisons will help explain the extreme width of the CIs; i.e, it will help explain the large spatial variability.

The multiple comparison procedure known as Tukey's Honestly Significant Difference (HSD) was used. The results from this procedure are presented graphically. The HSD procedure was applied to a subset of the core composite data, the core segment data, and the drainable liquid data. The analytes selected were those used for similar comparisons using data from tank 241-C-109 (Simpson, Borshiem, and Jensen 1993).

5.1 COMPARISON BETWEEN CORE COMPOSITE SAMPLES

Tukey's HSD was used to compare the core means using the core composite data. The results, given in Table 5-1, are a graphical comparison of core composite means from cores 51 and 52. The data are given in Table A-1.

Since there are only two means, the multiple comparison procedure is equivalent to an ordinary one-way ANOVA. For each analyte, the means from cores 51 and 52 are represented by letters, an "A" or a "B." If the two means are significantly different from each other, the two letters, one for each core, are different (the letter A denotes the smaller of the two means). Otherwise the two letters are the same. The two core means are significantly different in 13 out of 27 comparisons.

An interesting observation from Table 5-1 is the following. For the ICP data, except for ICP.a.Al, ICP.w.Na, and ICP.f.Al, the mean concentration in the two cores cannot be distinguished from each other. For the other analytes, except IC.P04, the mean concentrations in the two cores are significantly different from each other.

Table 5-1. Core Composite Data, Multiple Comparison of Means.

Analyte	Core 51	Core 52	Analyte	Core 51	Core 52
ICP.a.Al	A	B	ICP.f.P	A	A
ICP.a.Ca	A	A	ICP.f.Pb	A	A
ICP.a.Fe	A	A	CN	B	A
ICP.a.Na	A	A	IC.F	A	B
ICP.a.P	A	A	IC.Cl	B	A
ICP.a.Pb	A	A	IC.NO2	B	A
ICP.w.Al	A	A	IC.NO3	B	A
ICP.w.Ca	A	A	IC.PO4	A	A
ICP.w.Fe	A	A	IC.SO4	B	A
ICP.w.Na	B	A	Spec.w.NO2	B	A
ICP.f.Al	A	B	GEA.Cs-137	B	A
ICP.f.Ca	A	A	RS.GEA.Cs-137	B	A
ICP.f.Fe	A	A	CN.dir	B	A
ICP.f.Na	A	A			

5.2 COMPARISON BETWEEN CORE SEGMENT SAMPLES

Due to the incomplete core recovery, data are available for only some segments (half segments) within a core. Table 5-2 gives the relative location of the segments (half segments) within cores 50, 51, and 52.

Table 5-2. Position of Segments Within Cores.

Core	50	51	52
Segment	1R 2 3 - - -	- 2 3U 3L 4U 4L	1 2 3U 3L - -

-: Missing value.

U: Upper half segment.

L: Lower half segment.

The HSD comparisons were made between the means of the segment (half segment) samples. These comparisons are given in Table 5-3 (the relative location of the subsegments is given by Table 5-2). The letters A, B, etc. are used to represent groupings. The means with letters in common cannot be distinguished from each other. Subsegment means with different letters are significantly different from each other. The letter A is used for the smallest mean, B the next smallest, etc. The mean analyte concentrations and one relative standard deviation (RSD) are also given. (The RSD is the percent standard deviation relative to the mean.) The HSD comparisons do not

incorporate the spatial variability. They are a function of the analytical measurement variance only.

The comparisons between means can be complicated, except for Ca and Ni. For Ca, all subsegments (except for segment 1 from core 52) cannot be distinguished from each other. For Ni, all subsegments (except segment 1R from core 50, segments 2 and 4L from core 51, and segment 3L from core 52) cannot be distinguished from each other; i.e., these segments have the letter A or AB. For the other analytes, there are no obvious patterns between the cores or between the subsegments.

Table 5-3. Core Segment Data, Tukey's HSD Comparisons.

	Group			Mean ($\mu\text{g/g}$)			
Core	50	51	52	50	51	52	RSD
ICP.f.Al	BC F D - - -	- C A A AB BC	G E ABC CD - -	9810 92900 20750 - - -	- 12000 1245 688 2270 9215	213500 43050 8170 15400 - -	5.4%
ICP.f.Ca	A A A - - -	- A A A A A	B A A A - -	1050 822 1005 - - -	- 2095 961 988 1430 2435	10900 771 801 422 - -	54.6%
ICP.f.Fe	A A ABC - - -	- CD ABCD BCD CD A	D AB ABC A - -	19000 20350 23800 - - -	- 36650 28500 34250 35050 19650	40550 21050 23400 19000 - -	12.5%
ICP.f.Na	EF B DEF - - -	- CB ED C C DEF	A D F D - -	127500 55200 122500 - - -	- 71100 108000 77900 82450 122000	27250 105250 131000 107000 - -	5.4%
ICP.f.Ni	CD AB AB - - -	- D AB A A D	< AB AB D - -	8925 3970 4575 - - -	- 12100 1334 853.5 860.5 9345	< 2915 2250 9415 - -	19.7%
ICP.f.P	CE A E - - -	- A CD A AB EC	< C C C - -	30550 3840 42650 - - -	- 5330 25100 7615 9715 32450	< 25650 36850 25950 - -	13.9%
ICP.f.Pb	AB ABC ABC - - -	- BCD CD ABCD ABCD AB	D ABC ABC A - -	241 530 496 - - -	- 1330 1500 987 1002 263	1840 419 451 131 - -	35.8%

--: Missing value.

<: Less than value.

5.3 COMPARISON BETWEEN DRAINABLE LIQUID SAMPLES

The HSD comparisons between the results from the drainable liquid samples from the three cores are given in Table 5-4. The comparisons given here are easy to interpret. For 15 out of 16 comparisons, the three core means have three different letters (A, B, and C). This implies that, except for Ca, the three core means are significantly different from each other. For Ca the three core means cannot be distinguished from each other. These results are in agreement with the results given in Section 4.4.

Table 5-4. Drainable Liquid, Tukey's HSD Comparison.

Analyte	Core 50	Core 51	Core 52
ICP.Al	A	B	C
ICP.Ca	A	A	A
ICP.Fe	A	C	B
ICP.Na	A	C	B
ICP.P	A	B	C
CN	A	C	B
IC.F	A	C	B
IC.Cl	A	C	B
IC.NO2	A	C	B
IC.PO4	A	B	C
IC.SO4	A	C	B
IC.NO3	A	C	B
Spec.w.NO2	A	C	B
U	A	B	A
Sr-90	A	C	B
GEA.Cs-137	A	C	B

6.0 HOMOGENIZATION TEST

A task in complying with the Tank Waste Characterization Plan (Bell 1993) was to evaluate the 222-S Analytical Laboratory's ability to homogenize segments. This section provides the results of a statistical analysis of the homogenization test data.

Two homogenization tests were done on solid segment material from cores 50, 51, and 52. There were analytical difficulties associated with the results from the first test (Svancara and Pool 1993). This test data was not statistically analyzed. In the second test, the data from core 51 was incomplete. Consequently, the results reported here are from a statistical analysis of the data from the second test performed on material from cores 50 and 52. The core 50 test material was from segment 2 and the core 52 material from segment 3L.

In the homogenization tests, material from the segments were homogenized and arbitrarily divided into two parts. One subsample was obtained from each part. Two aliquots were taken from each subsample and prepared for chemical analysis. The aliquots were chemically analyzed using ICP acid digestion method. The data from the homogenization tests are given in Table A-6. Plots of the data are given in Figure B-4.

6.1 STATISTICAL METHODS AND RESULTS

Due to the nested structure (subsamples within segments, aliquots within subsamples) of the data, a hierarchical statistical model was fit to the data. This model is used to estimate different components of variability in the data and is explicitly described in Section 5.3 of Jensen and Remund (1993).

The ANOVA is used to fit the hierarchical model to the data. The total variability in the data is separated into three components: one due to the variability between the segments, one due to the variability between samples taken from different locations [$\sigma^2(L)$], and one due to the analytical measurement variability.

The variance component $\sigma^2(L)$ is of interest. It is used to measure the ability of laboratory to homogenize material. If this variance is not significantly different from zero, then this is evidence supporting the ability of the laboratory to homogenize the waste samples. The rationale behind this statement is that if $\sigma^2(L)=0$, then there is no difference between the mean concentrations of an analyte at the two locations; i.e., the waste has been homogenized.

The analytical measurement variance accounts for the differences between aliquots taken from the same location. It is used to test the significance of $\sigma^2(L)$. The variability between segments is not used.

The F-test is used to determine whether or not $\sigma^2(L)$ is significantly different from zero. The p-values from these tests are given in Table 6-1. P-values less than 0.05 indicate that $\sigma^2(L)$ was significantly different from zero at the 0.05 significance level. In this test, ICP.a.Bi was the only analyte, out of a total of 18, with a p-value less than 0.05.

For 17 out of 18 analytes the variability due to differences in location was not significantly different from zero. Hence, relative to the observed analytical variability, the laboratory is able to homogenize core segment material.

Table 6-1. Homogenization Test, Statistical Results.

Analyte	Test: $\sigma^2(L) = 0$ p-value
ICP.a.Al	0.980
ICP.a.Bi	0.011
ICP.a.Ca	0.642
ICP.a.Cd*	0.745
ICP.a.Cr	0.273
ICP.a.Fe	0.496
ICP.a.K	0.899
ICP.a.Li*	0.846
ICP.a.Mg	0.551
ICP.a.Mn	0.365
ICP.a.Mo	0.963
ICP.a.Na	0.466
ICP.a.Ni	0.499
ICP.a.P	0.703
ICP.a.Pb	0.823
ICP.a.S	0.143
ICP.a.Sm	0.709
ICP.a.Sr	0.583

*: Analytes with a portion of the data below ten times the DL.

7.0 REFERENCES

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APPENDIX A
ANALYTICAL TEST DATA

WHC-SD-WM-TI-645, Rev. 0

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Table A-1. Core Composite Data. (sheet 1 of 5)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)						
Core result	51 1	51 2	Mean/DL	52 1	52 2	Mean/DL
ICP.a.Ag	6.79E+00	7.94E+00	1.47E+01	<8.98E-01	<8.91E-01	NA
ICP.a.Al	4.03E+03	4.25E+03	1.12E+03	2.39E+04	2.53E+04	4.82E+03
ICP.a.As*	<2.99E+01	<2.98E+01	NA	4.63E+00	3.95E+00	1.10E+00
ICP.a.B*	3.38E+01	1.35E+01	2.37E+01	3.59E+00	<9.90E-01	3.59E+00
ICP.a.Be	<2.99E+00	<2.98E+00	NA	<2.99E-01	<2.97E-01	NA
ICP.a.Bi	7.79E+03	8.13E+03	1.26E+03	1.31E+04	1.44E+04	1.50E+03
ICP.a.Ca	8.08E+02	8.97E+02	9.48E+02	5.42E+02	6.43E+02	1.18E+03
ICP.a.Cd*	7.93E+00	6.50E+00	1.20E+01	4.17E+00	7.01E+00	7.99E+00
ICP.a.Ce	<6.78E+01	<6.75E+01	NA	1.80E+02	1.85E+02	1.43E+01
ICP.a.Cr	3.83E+02	3.81E+02	4.24E+02	3.09E+02	3.42E+02	2.17E+02
ICP.a.Fe	3.34E+04	3.29E+04	2.21E+04	2.01E+04	3.95E+04	1.86E+04
ICP.a.K	2.67E+02	2.20E+02	2.10E+01	2.33E+02	2.17E+02	1.52E+01
ICP.a.La	<1.69E+01	<1.69E+01	NA	<2.00E+00	<1.98E+00	NA
ICP.a.Li*	7.59E+00	6.32E+00	1.74E+01	3.97E+00	4.05E+00	6.68E+00
ICP.a.Mg	2.65E+02	2.59E+02	8.73E+02	1.57E+02	1.73E+02	5.50E+02
ICP.a.Mn	2.36E+02	2.26E+02	7.70E+02	1.26E+02	2.98E+02	7.07E+02
ICP.a.Mo*	<5.98E+00	<5.95E+00	NA	5.57E+00	7.26E+00	7.12E+00
ICP.a.Na	1.42E+05	1.31E+05	2.21E+04	1.31E+05	1.17E+05	3.10E+04
ICP.a.Nd*	1.06E+02	1.12E+02	1.33E+01	3.55E+01	3.82E+01	4.72E+00
ICP.a.Ni	3.08E+02	3.01E+02	2.34E+02	2.74E+02	2.85E+02	1.86E+02
ICP.a.P	3.39E+04	2.54E+04	6.43E+03	3.34E+04	2.73E+04	4.34E+03
ICP.a.Pb	1.17E+03	1.04E+03	1.77E+02	3.57E+02	6.18E+02	6.24E+01
ICP.a.S	3.60E+03	3.52E+03	1.08E+03	2.49E+03	2.57E+03	6.49E+02
ICP.a.Sb*	<2.09E+02	<2.08E+02	NA	3.74E+01	5.36E+01	2.99E+00
ICP.a.Se*	1.04E+02	<8.63E+01	1.20E+01	<1.41E+01	<1.40E+01	NA
ICP.a.Si	6.37E+01	1.56E+02	6.88E+01	1.82E+03	1.46E+03	4.82E+02
ICP.a.Sm	4.80E+02	4.48E+02	4.94E+01	1.15E+02	9.63E+01	1.02E+01
ICP.a.Sr	1.25E+03	1.23E+03	4.13E+03	7.04E+02	6.65E+02	2.28E+03
ICP.a.Ti	<2.99E+00	<2.98E+00	NA	4.11E+00	1.46E+02	1.07E+02
ICP.a.Tl*	<1.64E+02	<1.63E+02	NA	7.20E+01	3.54E+01	2.15E+00
ICP.a.Zr	1.17E+02	1.21E+02	1.70E+02	2.25E+01	2.57E+01	2.01E+01

*: Analytes with a portion of the data below ten times the DL.

Table A-1. Core Composite Data. (sheet 2 of 5)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)						
Core result	51 1	51 2	Mean/DL	52 1	52 2	Mean/DL
ICP.w.Ag	<5.26E-01	<5.26E-01	NA	<5.06E+00	<5.07E+00	NA
ICP.w.Al	3.44E+02	6.27E+02	1.31E+02	8.49E+02	7.84E+02	2.21E+02
ICP.w.As	<3.16E+00	<3.16E+00	NA	<3.04E+01	<3.04E+01	NA
ICP.w.B	6.07E+02	6.66E+02	6.36E+02	1.61E+01	1.48E+01	1.55E+01
ICP.w.Be	<3.16E-01	<3.16E-01	NA	<3.04E+00	<3.04E+00	NA
ICP.w.Bi	1.08E+02	8.15E+01	1.50E+01	3.75E+02	4.09E+02	6.22E+01
ICP.w.Ca	1.51E+02	8.00E+02	5.29E+02	7.11E+01	5.99E+01	7.28E+01
ICP.w.Cd	<6.32E-01	<6.32E-01	NA	<6.07E+00	<6.08E+00	NA
ICP.w.Ce	<7.16E+00	<7.16E+00	NA	<6.88E+01	<6.89E+01	NA
ICP.w.Cr	2.30E+02	2.16E+02	2.48E+02	2.13E+02	1.84E+02	2.20E+02
ICP.w.Fe	3.15E+02	2.29E+02	1.81E+02	4.29E+02	4.49E+02	2.93E+02
ICP.w.K	6.41E+02	2.60E+02	3.88E+01	2.26E+02	1.35E+02	1.55E+01
ICP.w.La	<1.79E+00	<1.79E+00	NA	<1.72E+01	<1.72E+01	NA
ICP.w.Li*	9.04E-01	7.93E-01	2.12E+00	<4.05E+00	<4.05E+00	NA
ICP.w.Mg	7.30E+00	1.22E+01	3.25E+01	1.00E+01	9.83E+00	3.31E+01
ICP.w.Mn*	1.78E+00	2.37E+00	6.90E+00	<3.04E+00	<3.04E+00	NA
ICP.w.Mo*	8.72E+00	8.67E+00	1.45E+01	6.96E+00	7.17E+00	1.18E+01
ICP.w.Na	1.28E+05	1.40E+05	2.16E+04	8.71E+04	7.65E+04	1.32E+04
ICP.w.Nd	<8.63E+00	<8.63E+00	NA	<8.30E+01	<8.31E+01	NA
ICP.w.Ni*	5.18E+00	3.79E+00	3.45E+00	<1.32E+01	<1.32E+01	NA
ICP.w.P	2.73E+04*	3.33E+04*	6.59E+03	1.84E+04	1.59E+04	3.72E+03
ICP.w.Pb*	2.03E+01	2.01E+01	3.26E+00	<6.28E+01	<6.28E+01	NA
ICP.w.S	4.10E+03	3.84E+03	1.20E+03	3.36E+03	2.86E+03	9.42E+02
ICP.w.Sb	<2.21E+01	<2.21E+01	NA	<2.13E+02	<2.13E+02	NA
ICP.w.Se*	5.86E+01	5.21E+01	6.37E+00	<8.81E+01	8.94E+01	1.03E+01
ICP.w.Si	3.71E+03	4.18E+03	2.47E+03	<1.62E+01	<1.62E+01	NA
ICP.w.Sm	<9.89E+00	<9.89E+00	NA	<9.51E+01	<9.52E+01	NA
ICP.w.Sr*	6.44E+00	4.54E+00	1.83E+01	5.06E+00	6.08E+00	1.86E+01
ICP.w.Ti*	1.25E+00	2.98E+00	7.07E+00	<3.04E+00	<3.04E+00	NA
ICP.w.Tl	<1.73E+01	<1.73E+01	NA	<1.66E+02	<1.66E+02	NA
ICP.w.Zr*	2.10E+00	3.90E+00	4.29E+00	1.22E+01	<7.09E+00	1.75E+01

*: Analytes with a portion of the data below ten times the DL.

Table A-1. Core Composite Data. (sheet 3 of 5)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)						
Core result	51 1	51 2	Mean/DL	52 1	52 2	Mean/DL
ICP.f.Ag	<4.48E+00	<4.46E+00	NA	<4.46E+00	<4.49E+00	NA
ICP.f.Al	7.26E+03	4.20E+03	2.25E+02	2.64E+04	2.75E+04	1.05E+03
ICP.f.As	<1.94E+01	<1.93E+01	NA	<1.93E+01	<1.95E+01	NA
ICP.f.B	<4.98E+00	<4.95E+00	NA	<4.96E+00	<4.99E+00	NA
ICP.f.Be	<1.49E+00	<1.49E+00	NA	<1.49E+00	<1.50E+00	NA
ICP.f.Bi	8.20E+03	8.49E+03	1.82E+02	1.40E+04	1.73E+04	3.39E+02
ICP.f.Ca	7.65E+02	7.94E+02	3.12E+02	7.02E+02	7.81E+02	2.97E+02
ICP.f.Cd*	6.35E+00	5.95E+00	1.76E+00	5.66E+00	9.81E+00	2.21E+00
ICP.f.Ce*	8.76E+01	1.04E+02	1.50E+00	1.32E+02	1.37E+02	2.09E+00
ICP.f.Cr	3.51E+02	3.59E+02	4.73E+01	3.41E+02	3.89E+02	4.87E+01
ICP.f.Fe	2.63E+04	2.66E+04	3.31E+03	2.10E+04	4.28E+04	3.99E+03
ICP.f.K	NA	NA	NA	NA	NA	NA
ICP.f.La	<9.96E+00	<9.90E+00	NA	<9.92E+00	<9.98E+00	NA
ICP.f.Li*	4.87E+00	5.07E+00	1.66E+00	3.14E+00	4.98E+00	1.35E+00
ICP.f.Mg	2.23E+02	2.40E+02	1.55E+02	1.90E+02	2.52E+02	1.47E+02
ICP.f.Mn	1.96E+02	1.83E+02	1.26E+02	1.61E+02	3.13E+02	1.58E+02
ICP.f.Mo*	1.05E+01	1.06E+01	2.36E+00	7.96E+00	6.63E+00	1.62E+00
ICP.f.Na	1.19E+05	1.27E+05	6.15E+03	1.15E+05	1.08E+05	5.60E+03
ICP.f.Nd*	8.11E+01	8.33E+01	2.11E+00	5.53E+01	<3.89E+01	1.42E+00
ICP.f.Ni	2.85E+03	1.37E+03	2.81E+02	3.80E+03	2.53E+03	4.21E+02
ICP.f.P	3.15E+04	3.43E+04	9.40E+02	3.36E+04	2.89E+04	8.94E+02
ICP.f.Pb	7.63E+02	6.90E+02	1.86E+01	3.46E+02	7.96E+02	1.46E+01
ICP.f.S	3.49E+03	3.64E+03	1.83E+02	2.91E+03	3.06E+03	1.53E+02
ICP.f.Sb*	1.39E+02	1.04E+02	1.61E+00	<7.54E+01	<7.58E+01	NA
ICP.f.Se	<7.02E+01	<6.98E+01	NA	<6.99E+01	<7.04E+01	NA
ICP.f.Si	4.98E+03	4.75E+03	2.86E+02	7.11E+03	7.39E+03	4.26E+02
ICP.f.Sm*	1.48E+02	2.08E+02	3.42E+00	7.95E+01	6.34E+01	1.37E+00
ICP.f.Sr	9.34E+02	9.74E+02	6.36E+02	7.51E+02	8.54E+02	5.35E+02
ICP.f.Ti*	<3.49E+00	1.63E+01	4.65E+00	5.22E+00	7.28E+00	1.79E+00
ICP.f.Tl*	<1.25E+02	1.44E+02	1.15E+00	<1.24E+02	<1.25E+02	NA
ICP.f.Zr	8.56E+01	6.63E+01	1.27E+01	1.27E+02	9.38E+01	1.83E+01

*: Analytes with a portion of the data below ten times the DL.

Table A-1. Core Composite Data. (sheet 4 of 5)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)						
Core result	51 1	51 2	Mean/DL	52 1	52 2	Mean/DL
Total Dissolved Solid (wt%)	3.78E-01	3.96E-01	NA	4.12E-01	3.92E-01	NA
RS (wt%)	2.77E+01	2.42E+01	NA	3.08E+01	3.22E+01	NA
Cr(VI)	<1.85E+01	<1.84E+01	NA	<1.92E+01	<1.95E+01	NA
NH ₄	<8.20E+02	<8.16E+02	NA	<4.20E+03	<4.26E+03	NA
CN	9.29E+01	9.06E+01	4.59E+01	4.49E+01	4.69E+01	2.30E+01
IC.F	8.53E+03	9.92E+03	9.23E+02	1.40E+04	1.32E+04	3.32E+03
IC.Cl	7.32E+02	6.32E+02	3.41E+01	3.89E+02	4.09E+02	9.50E+01
IC.NO ₂	1.57E+04	1.49E+04	1.53E+02	7.98E+03	8.29E+03	3.87E+02
IC.NO ₃	9.64E+04	8.92E+04	9.28E+02	5.48E+04	5.77E+04	2.68E+03
IC.PO ₄	8.70E+04	1.02E+05	9.45E+02	1.40E+05	1.25E+05	3.23E+03
IC.SO ₄	1.30E+04	1.23E+04	1.27E+02	6.98E+03	7.26E+03	3.39E+02
Spec.w.NO ₂	1.50E+04	1.35E+04	3.75E+01	7.71E+03	8.24E+03	2.10E+01
TIC	5.64E+03	5.71E+03	1.14E+01	2.99E+03	2.56E+03	5.55E+00
TOC	1.52E+03	1.35E+03	2.61E+00	2.00E+03	1.92E+03	3.56E+00

*: Analytes with a portion of the data below ten times the DL.

TIC: Total inorganic carbon.

TIC: Total organic carbon.

Table A-1. Core Composite Data. (sheet 5 of 5)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)						
Core result	51 1	51 2	Mean/DL	52 1	52 2	Mean/DL
AT	5.44E-04	4.96E-04	2.60E+00	5.50E-03	4.26E-03	1.74E+01
TB	1.61E+01	1.69E+01	4.23E+03	1.10E+01	9.68E+00	1.40E+03
C-14	2.55E-04	<2.22E-04	5.80E-01	1.15E-04	1.73E-04	6.26E+00
H-3	1.56E-03	1.17E-03	5.06E+00	1.04E-03	1.18E-03	4.11E+00
GEA.Cs-137	1.24E+01	1.16E+01	4.43E+03	6.39E+00	6.59E+00	4.06E+03
GEA.Cs-134	<1.27E-03	<1.29E-03	NA	<2.04E-03	<1.64E-03	NA
GEA.Am-241	<2.81E-02	<2.67E-02	NA	<2.22E-02	<2.28E-02	NA
GEA.Co-60	<1.20E-03	<1.45E-03	NA	<1.99E-03	<2.08E-03	NA
GEA.Eu-154	<3.91E-03	<3.40E-03	NA	<4.36E-03	<5.82E-03	NA
GEA.Eu-155	<1.25E-02	<1.23E-02	NA	<1.49E-02	<1.51E-02	NA
GEA.K-40	<3.24E-02	<3.27E-02	NA	<6.49E-02	<6.53E-02	NA
GEA.CePr-144	<4.09E-02	<3.95E-02	NA	<5.79E-02	<5.79E-02	NA
GEA.Ru-103	<6.19E-03	<5.93E-03	NA	<7.11E-03	<7.21E-03	NA
GEA.RuRh-106	<7.91E-02	<7.57E-02	NA	<7.52E-02	<7.49E-02	NA
GEA.Th-228/Pb	<8.73E-03	<8.44E-03	NA	<1.03E-02	<1.07E-02	NA
RS.GEA.Cs-137	1.71E+01	1.77E+01	NA	5.67E+00	7.43E+00	NA
RS.GEA.Cs-134	<1.21E-02	<1.39E-02	NA	<7.66E-03	<7.50E-03	NA
RS.GEA.Am-241	<3.49E-01	<3.85E-01	NA	<1.92E-01	<1.92E-01	NA
RS.GEA.Co-60	2.84E-02	2.96E-02	1.21E+01	7.00E-03	9.00E-03	4.21E+00
RS.GEA.Eu-154	1.20E-01	1.49E-01	3.06E+01	1.25E-01	1.38E-01	2.80E+01
RS.GEA.Eu-155	<1.59E-01	<2.06E-01	NA	1.07E-01	1.39E-01	1.23E+01
RS.GEA.K-40	3.71E-02	<3.38E-02	5.98E-01	3.83E-02	3.75E-02	NA
RS.GEA.CePr-144	<2.71E-01	<3.05E-01	NA	<1.50E-01	<1.58E-01	NA
RS.GEA.Ru-103	<2.56E-02	<2.78E-02	NA	<1.42E-02	<1.55E-02	NA
RS.GEA.RuRh106	<1.61E-01	<1.81E-01	NA	<9.57E-02	<9.86E-02	NA
RS.GEA.Th228/Pb	<5.18E-02	<5.79E-02	NA	<2.95E-02	<3.10E-02	NA
% Solids	48.61	47.61	NA	5.22E+01	5.23E+01	NA
Bulk.Density	1.46E+00	NR	NA	1.19E+00	NR	NA
pH	1.16E+01	1.16E+01	NA	1.14E+01	1.14E+01	NA
Hg	<1.25E-01	<1.25E-01	NA	1.53E-01	1.34E-01	NA
CN.dir	9.49E+01	9.67E+01	NA	5.14E+01	6.13E+01	NA

*: Analytes with a portion of the data below ten times the DL.
 RS: Residual solids from water digestion.

Table A-2. Core 50 Segment Data. (sheet 1 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)						
Core segment	50 1R	Mean/DL	50 2	Mean/DL	50 3	Mean/DL
ICP.f.Ag	<4.46E+00 <4.45E+00	NA	<4.50E+00 <4.47E+00	NA	<4.46E+00 <4.46E+00	NA
ICP.f.Al	9.90E+03 9.72E+03	3.85E+02	9.09E+04 9.49E+04	3.64E+03	1.85E+04 2.30E+04	8.12E+02
ICP.f.As	<1.93E+01 <1.93E+01	NA	2.23E+01 <1.94E+01	1.14E+00	<1.93E+01 <1.93E+01	NA
ICP.f.B	6.98E+00 6.92E+00	1.39E+00	<5.00E+00 <4.97E+00	NA	<4.95E+00 <4.95E+00	NA
ICP.f.Be	<1.49E+00 <1.48E+00	NA	<1.50E+00 <1.49E+00	NA	<1.49E+00 <1.49E+00	NA
ICP.f.Bi	2.05E+04 1.83E+04	4.22E+02	2.71E+03 2.52E+03	5.67E+01	1.06E+04 1.14E+04	2.39E+02
ICP.f.Ca	1.06E+03 1.04E+03	4.20E+02	8.95E+02 7.49E+02	3.29E+02	1.10E+03 9.10E+02	4.04E+02
ICP.f.Cd	4.68E+00 6.83E+00	1.65E+00	6.58E+00 6.41E+00	1.86E+00	6.65E+00 6.49E+00	1.88E+00
ICP.f.Ce	1.33E+02 1.13E+02	1.92E+00	<6.40E+01 <6.36E+01	NA	<6.34E+01 7.87E+01	1.23E+00
ICP.f.Cr	3.39E+02 3.27E+02	4.44E+01	2.64E+02 2.52E+02	3.44E+01	2.05E+02 2.33E+02	2.92E+01
ICP.f.Fe	1.94E+04 1.86E+04	2.38E+03	2.03E+04 2.04E+04	2.55E+03	2.25E+04 2.51E+04	2.98E+03
ICP.f.K	NA NA	NA	NA NA	NA	NA NA	NA
ICP.f.La	<9.90E+00 <9.88E+00	NA	<1.00E+01 <9.94E+00	NA	<9.90E+00 <9.90E+00	NA
ICP.f.Li	<2.97E+00 <2.96E+00	NA	4.40E+00 4.34E+00	1.46E+00	3.31E+00 4.69E+00	1.33E+00

NA: Not available.

Table A-2. Core 50 Segment Data. (sheet 2 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)						
Core segment	50 1R	Mean/DL	50 2	Mean/DL	50 3	Mean/DL
ICP.f.Mg	1.80E+02 1.74E+02	1.18E+02	2.52E+02 2.50E+02	1.67E+02	2.11E+02 2.34E+02	1.49E+02
ICP.f.Mn	9.55E+01 9.52E+01	6.36E+01	2.42E+02 2.29E+02	1.57E+02	1.39E+02 1.59E+02	9.93E+01
ICP.f.Mo	4.80E+00 <4.45E+00	1.07E+00	1.29E+01 1.28E+01	2.87E+00	<4.46E+00 4.49E+00	9.97E-01
ICP.f.Na	1.25E+05 1.30E+05	6.35E+03	5.83E+04 5.21E+04	2.76E+03	1.24E+05 1.21E+05	6.15E+03
ICP.f.Nd	<3.86E+01 <3.85E+01	NA	4.02E+01 7.35E+01	1.46E+00	7.69E+01 8.43E+01	2.07E+00
ICP.f.Ni	9.78E+03 8.07E+03	1.19E+03	4.47E+03 3.47E+03	5.29E+02	4.48E+03 4.67E+03	6.09E+02
ICP.f.P	2.87E+04 3.24 E+04*	8.72E+02	4.34E+03 3.34E+03	1.10E+02	4.45E+04 4.08E+04	1.22E+03
ICP.f.Pb	2.39E+02 2.44E+02	6.21E+00	5.35E+02 5.25E+02	1.36E+01	4.48E+02 5.44E+02	1.27E+01
ICP.f.S	2.96E+03 2.88E+03	1.50E+02	2.95E+03 2.71E+03	1.45E+02	1.29E+03 1.47E+03	7.08E+01
ICP.f.Sb	<7.52E+01 <7.51E+01	NA	7.83E+01 1.90E+02	1.76E+00	1.28E+02 1.18E+02	1.62E+00
ICP.f.Se	<6.98E+01 <6.97E+01	NA	<7.05E+01 <7.01E+01	NA	<6.98E+01 <6.98E+01	NA
ICP.f.Si	9.97E+03 9.72E+03*	5.79E+02	2.23E+03 1.88E+03	1.21E+02	4.67E+03 5.25E+03	2.92E+02
ICP.f.Sm	6.95E+01 6.99E+01	1.34E+00	1.95E+02 1.94E+02	3.73E+00	2.02E+02 1.36E+02	3.25E+00
ICP.f.Sr	4.29E+02 4.14E+02	2.81E+02	8.53E+02 8.41E+02	5.65E+02	1.02E+03 1.14E+03	7.20E+02

NA: Not available.

Table A-2. Core 50 Segment Data. (sheet 3 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)						
Core segment	50 1R	Mean/DL	50 2	Mean/DL	50 3	Mean/DL
ICP.f.Ti	<3.47E+00 <3.46E+00	NA	3.98E+01 3.37E+01	1.05E+01	<3.47E+00 3.14E+01	8.97E+00
ICP.f.Tl	<1.24E+02 <1.24E+02	NA	<1.25E+02 <1.24E+02	NA	2.03E+02 <1.24E+02	1.62E+00
ICP.f.Zr	1.24E+01 3.02E+01	3.55E+00	<6.00E+00 <5.96E+00	NA	<5.94E+00 <5.94E+00	NA
Sr-90	3.37E+01 2.96E+01	7.03E+03	1.55E+02 1.50E+02	2.54E+04	1.26E+02 1.25E+02	2.09E+04
GEA.Cs-137	7.08E+00 6.97E+00	9.76E+02	1.21E+01 1.15E+01	8.25E+02	5.65E+00 6.43E+00	NA
GEA.Cs-134	<6.10E-03 <5.63E-03	NA	<1.33E-02 <1.43E-02	NA	<6.88E-03 <6.73E-03	NA
GEA.Am-241	<6.69E-02 <6.57E-02	NA	<1.51E-01 <1.54E-01	NA	<8.42E-02 <8.81E-02	NA
GEA.Co-60	<6.24E-03 <6.87E-03	NA	<1.14E-02 <1.27E-02	NA	<5.15E-03 <5.94E-03	NA
GEA.Eu-154	1.08E-01 8.90E-02	4.93E+00	<2.96E-02 <3.14E-02	NA	<1.69E-02 <1.78E-02	NA
GEA.Eu-155	8.92E-02 8.26E-02	6.82E+00	<6.89E-02 <7.01E-02	NA	<3.89E-02 <4.11E-02	NA
GEA.K-40	<1.54E-01 <1.54E-01	NA	<3.14E-01 <3.12E-01	NA	<1.55E-01 <1.55E-01	NA
GEA.CePr-144	<8.82E-02 <8.75E-02	NA	<2.02E-01 <1.98E-01	NA	<1.10E-01 <1.18E-01	NA
GEA.Ru-103	<1.12E-02 <1.13E-02	NA	<2.16E-02 <2.06E-02	NA	<1.04E-02 <1.12E-02	NA
GEA.RuRh-106	<1.63E-01 <1.53E-01	NA	<3.26E-01 <3.11E-01	NA	<1.60E-01 <1.66E-01	NA

NA: Not available.

Table A-2. Core 50 Segment Data. (sheet 4 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)						
Core segment	50 1R	Mean/DL	50 2	Mean/DL	50 3	Mean/DL
GEA.Th-228/Pb	<1.67E-02 <1.67E-02	NA	<3.49E-02 <3.33E-02	NA	<1.79E-02 <1.93E-02	NA
DSC	NO EXOTH NO EXOTH	NA	NO EXOTH NO EXOTH	NA	NO EXOTH NO EXOTH	NA
TGA (%H ₂ O)	2.70E+01 2.54E+01	NA	4.58E+01 4.03E+01	NA	4.44E+01 4.21E+01	NA
% Solids	8.25E+01 8.15E+01	NA	5.83E+01 5.86E+01	NA	IS IS	NA
Bulk.Density	NA IS	NA	1.71E+00 NR	NA	NA NA	NA
CN ($\mu\text{g/g}$)	4.43E+01 5.26E+01	1.21E+01	6.56E+01 6.25E+01	1.60E+01	3.92E+01 4.62E+01	1.07E+01
pH	10.3 NA	NA NA	11.2 NA	NA NA	11.4 NA	NA NA

IS: Insufficient sample.

NR: Not required.

NA: Not available.

Table A-3. Core 51 Segment Data. (sheet 1 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)										
Core seg	51 2	Mean/DL	51 3U2	Mean/DL	51 3L	Mean/DL	51 4U	Mean/DL	51 4L	Mean/DL
ICP.f.Ag	4.57E+00 <4.48E+00	1.01E+00	<4.23E+00 <4.16E+00	NA	<4.39E+00 <4.50E+00	NA	6.21E+00 <4.38E+00	1.38E+00	<4.34E+00 <4.32E+00	NA
ICP.f.Al	1.13E+04 1.27E+04	4.71E+02	1.34E+03 1.15E+03	4.86E+01	5.86E+02 7.90E+02	2.70E+01	2.22E+03 2.32E+03	8.90E+01	9.27E+03 9.16E+03	3.61E+02
ICP.f.As	<1.94E+01 <1.94E+01	NA	<1.83E+01 <1.80E+01	NA	<1.90E+01 <1.95E+01	NA	<1.88E+01 <1.90E+01	NA	<1.88E+01 <1.87E+01	NA
ICP.f.B	<4.98E+00 <4.98E+00	NA	<4.70E+00 <4.62E+00	NA	<4.87E+00 <5.00E+00	NA	<4.81E+00 <4.86E+00	NA	8.64E+00 <4.80E+00	1.73E+00
ICP.f.Be	<1.49E+00 <1.49E+00	NA	<1.41E+00 <1.39E+00	NA	<1.46E+00 <1.50E+00	NA	<1.44E+00 <1.46E+00	NA	<1.45E+00 <1.44E+00	NA
ICP.f.Bi	9.86E+02 9.87E+02	2.15E+01	1.00E+03 8.66E+02	2.03E+01	1.09E+03 1.04E+03	2.33E+01	3.51E+03 3.73E+03	7.87E+01	1.96E+04 1.75E+04	4.02E+02
ICP.f.Ca	2.16E+03 2.03E+03	8.36E+02	9.63E+02 9.59E+02	3.84E+02	9.56E+02 1.02E+03	3.96E+02	1.40E+03 1.46E+03	5.72E+02	2.06E+03 2.81E+03	9.76E+02
ICP.f.Cd	4.06E+01 1.67E+01	8.17E+00	7.84E+00 7.60E+00	2.21E+00	7.52E+00 6.53E+00	2.01E+00	8.27E+00 1.04E+01	2.67E+00	5.57E+00 7.51E+00	1.87E+00
ICP.f.Ce	<6.37E+01 <6.37E+01	NA	<6.02E+01 <5.91E+01	NA	<6.24E+01 <6.40E+01	NA	6.79E+01 <6.23E+01	1.06E+00	2.12E+02 2.26E+02	3.42E+00
ICP.f.Cr	3.70E+02 3.41E+02	4.73E+01	3.21E+02 2.80E+02	4.01E+01	3.92E+02 3.95E+02	5.24E+01	4.80E+02 5.04E+02	6.56E+01	3.55E+02 3.42E+02	4.65E+01
ICP.f.Fe	3.46E+04 3.87E+04	4.59E+03	3.12E+04 2.58E+04	3.56E+03	3.42E+04 3.43E+04	4.29E+03	3.40E+04 3.61E+04	4.39E+03	2.00E+04 1.93E+04	2.46E+03
ICP.f.K	NA NA	NA	NA NA	NA	NA NA	NA	NA NA	NA	NA NA	NA
ICP.f.La	<9.96E+00 <9.96E+00	NA	<9.40E+00 <9.24E+00	NA	<9.75E+00 <1.00E+01	NA	<9.62E+00 <9.73E+00	NA	<9.65E+00 <9.60E+00	NA
ICP.f.Li	8.79E+00 8.75E+00	2.92E+00	7.74E+00 6.86E+00	2.43E+00	8.64E+00 7.03E+00	2.61E+00	8.95E+00 8.50E+00	2.91E+00	<2.90E+00 2.89E+00	9.63E-01

NA: Not available.

Table A-3. Core 51 Segment Data. (sheet 2 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)										
Core seg	51 2	Mean/DL	51 3U	Mean/DL	51 3L	Mean/DL	51 4U	Mean/DL	51 4L	Mean/DL
ICP.f.Mg	5.47E+02 5.33E+02	3.60E+02	2.86E+02 2.42E+02	1.76E+02	2.58E+02 2.51E+02	1.69E+02	3.37E+02 3.52E+02	2.29E+02	2.14E+02 2.27E+02	1.47E+02
ICP.f.Mn	8.24E+02 9.33E+02	5.86E+02	2.92E+02 2.67E+02	1.87E+02	2.78E+02 2.85E+02	1.88E+02	2.50E+02 2.68E+02	1.73E+02	9.89E+01 9.96E+01	6.61E+01
ICP.f.Mo	2.06E+01 1.82E+01	4.31E+00	1.22E+01 1.25E+01	2.76E+00	9.53E+00 1.17E+01	2.36E+00	7.13E+00 6.93E+00	1.56E+00	5.27E+00 7.30E+00	1.40E+00
ICP.f.Na	7.20E+04 7.02E+04	3.56E+03	1.02E+05 1.14E+05	5.40E+03	7.89E+04 7.69E+04	3.90E+03	8.80E+04 7.69E+04	4.12E+03	1.20E+05 1.24E+05	6.10E+03
ICP.f.Nd	1.07E+02 7.91E+01	2.38E+00	1.17E+02 1.20E+02	3.03E+00	1.98E+02 1.40E+02	4.33E+00	1.47E+02 1.36E+02	3.64E+00	<3.76E+01 7.12E+01	1.83E+00
ICP.f.Ni	1.19E+04 1.23E+04	1.61E+03	1.70E+03 9.68E+02	1.77E+02	1.07E+03 6.37E+02	1.14E+02	9.83E+02 7.38E+02	1.15E+02	1.02E+04 8.49E+03	1.25E+03
ICP.f.P	5.35E+03 5.31E+03	1.52E+02	2.13E+04 2.89E+04*	7.17E+02	7.88E+03 7.35E+03	2.17E+02	1.27E+04 6.73E+03	2.77E+02	3.10E+04* 3.39E+04*	9.26E+02
ICP.f.Pb	1.34E+03 1.32E+03	3.41E+01	1.55E+03 1.45E+03	3.85E+01	8.95E+02 1.08E+03	2.53E+01	9.65E+02 1.04E+03	2.56E+01	2.78E+02 2.49E+02	6.77E+00
ICP.f.S	4.35E+03 4.23E+03	2.20E+02	3.64E+03 3.25E+03	1.76E+02	4.26E+03 4.27E+03	2.19E+02	4.26E+03 4.47E+03	2.24E+02	3.11E+03 3.06E+03	1.58E+02
ICP.f.Sb	1.08E+02 7.74E+01	1.22E+00	1.15E+02 1.10E+02	1.47E+00	2.30E+02 1.60E+02	2.57E+00	1.81E+02 1.83E+02	2.39E+00	<7.34E+01 9.42E+01	1.24E+00
ICP.f.Se	<7.02E+01 <7.02E+01	NA	<6.63E+01 <6.52E+01	NA	<6.87E+01 <7.05E+01	NA	<6.78E+01 <6.86E+01	NA	<6.81E+01 <6.77E+01	NA
ICP.f.Si	5.74E+03 4.44E+03	2.99E+02	1.10E+03 8.63E+02	5.77E+01	9.25E+02 1.14E+03	6.06E+01	2.68E+03 2.78E+03	1.61E+02	1.01E+04* 9.87E+03*	5.87E+02
ICP.f.Sm	1.35E+02 9.74E+01	2.23E+00	2.39E+02 1.03E+02	3.29E+00	3.05E+02 <5.20E+01	5.87E+00	1.94E+02 2.35E+02	4.12E+00	<5.02E+01 6.24E+01	1.20E+00
ICP.f.Sr	1.06E+03 1.02E+03	6.93E+02	1.17E+03 1.03E+03	7.33E+02	1.35E+03 1.35E+03	9.00E+02	1.56E+03 1.65E+03	1.07E+03	4.21E+02 4.09E+02	2.77E+02

* : Outside instrument calibration range.

NA: Not available.

Table A-3. Core 51 Segment Data. (sheet 3 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)										
Core seg	51 2	Mean/DL	51 3U	Mean/DL	51 3L	Mean/DL	51 4U	Mean/DL	51 4L	Mean/DL
ICP.f.Ti	9.75E+01 7.61E+01	2.48E+01	2.30E+01 2.20E+01	6.43E+00	<3.41E+00 <3.50E+00	NA	<3.37E+00 <3.40E+00	NA	<3.38E+00 4.51E+00	1.29E+00
ICP.f.Tl	<1.25E+02 <1.25E+02	NA	1.67E+02 <1.16E+02	1.34E+00	<1.22E+02 <1.25E+02	NA	<1.20E+02 <1.22E+02	NA	<1.21E+02 <1.20E+02	NA
ICP.f.Zr	<5.98E+00 4.82E+01	8.04E+00	1.94E+01 1.19E+01	2.62E+00	1.10E+01 <6.00E+00	1.83E+00	4.58E+01 4.56E+01	7.62E+00	1.79E+01 3.59E+01	4.48E+00
Sr-90	1.88E+02 1.92E+02	6.79E+04	2.12E+02 1.90E+02	1.06E+04	2.44E+02 2.40E+02	1.27E+04	2.21E+02 2.32E+02	1.19E+04	2.69E+01 2.80E+01	1.31E+03
GEA.Cs-137	9.77E+01 1.02E+02	1.26E+04	1.62E+01 1.44E+01	1.94E+03	1.71E+01 1.70E+01	2.16E+02	1.67E+01 1.90E+01	2.26E+03	1.37E+01 1.35E+01	1.72E+03
GEA.Cs-134	<1.39E-02 <1.51E-02	NA	<8.79E-03 <9.19E-03	NA	<1.14E-02 <1.02E-02	NA	<1.05E-02 <1.00E-02	NA	<8.49E-03 <9.06E-03	NA
GEA.Am-241	<2.13E-01 <2.16E-01	NA	<1.36E-01 <1.26E-01	NA	<1.48E-01 <1.51E-01	NA	<1.39E-01 <1.48E-01	NA	<8.58E-02 <8.34E-02	NA
GEA.Co-60	<7.10E-03 <1.05E-02	NA	<8.93E-03 <8.78E-03	NA	3.76E-02 <8.00E-03	2.65E+00	<8.89E-03 2.64E-02	1.86E+00	<8.92E-03 <7.72E-03	NA
GEA.Eu-154	3.10E-01 3.17E-01	1.31E+01	<2.07E-02 <2.11E-02	NA	4.37E-02 <2.59E-02	8.92E-01	<1.85E-02 <2.52E-02	NA	<2.12E-02 <2.11E-02	NA
GEA.Eu-155	<1.40E-01 <1.41E-01	NA	<8.60E-02 <8.09E-02	NA	<9.35E-02 <9.49E-02	NA	<8.79E-02 <9.49E-02	NA	<5.35E-02 <5.32E-02	NA
GEA.K-40	<2.86E-01 <2.93E-01	NA	<2.76E-01 <2.72E-01	NA	<2.82E-01 <2.93E-01	NA	<2.82E-01 <2.83E-01	NA	<2.87E-01 <2.78E-01	NA
GEA.CePr-144	<5.10E-01 <5.13E-01	NA	<2.92E-01 <2.71E-01	NA	<3.17E-01 <3.10E-01	NA	<2.97E-01 <3.16E-01	NA	<1.98E-01 <1.97E-01	NA
GEA.Ru-103	<6.13E-02 <6.28E-02	NA	<2.49E-02 <2.36E-02	NA	<2.64E-02 <2.71E-02	NA	<2.71E-02 <2.74E-02	NA	<2.33E-02 <2.26E-02	NA
GEA.RuRh-106	<6.18E-01 <6.53E-01	NA	<2.88E-01 <2.68E-01	NA	<2.97E-01 <2.88E-01	NA	<2.85E-01 <3.03E-01	NA	<2.57E-01 <2.53E-01	NA

NA: Not available.

Table A-3. Core 51 Segment Data. (sheet 4 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)										
Core seg	51 2	Mean/DL	51 3U	Mean/DL	51 3L	Mean/DL	51 4U	Mean/DL	51 4L	Mean/DL
GEA.Th-228/Pb	<8.80E-02 <8.92E-02	NA	<4.21E-02 <3.85E-02	NA	<4.30E-02 <4.50E-02	NA	<4.23E-02 <4.42E-02	NA	<3.46E-02 <3.32E-02	NA
DSC	NO EXOTH NO EXOTH	NA	NO EXOTH NO EXOTH	NA	NO EXOTH NO EXOTH	NA	NO EXOTH NO EXOTH	NA	NO EXOTH NO EXOTH	NA
TGA (%H ₂ O)	6.01E+01 5.85E+01	NA	5.94E+01 5.99E+01	NA	5.43E+01 5.42E+01	NA	5.48E+01 5.46E+01	NA	5.28E+01 5.34E+01	NA
% Solids	4.03E+01 3.92E+01	NA	4.40E+01 4.57E+01	NA	4.67E+01 4.75E+01	NA	4.45E+01 4.56E+01	NA	5.01E+01 5.08E+01	NA
Bulk.Density	IS NR	NA	1.49E+00 NR	NA	1.70E+00 NR	NA	1.48E+00 NR	NA	1.53E+00 NR	NA
CN ($\mu\text{g/g}$)	9.57E+01 9.48E+01	2.38E+01	1.10E+02 1.09E+02	2.74E+01	1.03E+02 1.02E+02	2.56E+01	9.42E+01 8.88E+01	2.29E+01	5.74E+01 5.72E+01	NA
pH	10.6 NA	NA NA	11.4 NA	NA NA	11.4 NA	NA NA	11.2 NA	NA NA	11.6 NA	NA NA

IS: Insufficient sample.

NA: Not available.

NR: Not required.

Table A-4. Core 52 Segment Data. (sheet 1 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)								
Core segment	52 1	Mean/DL	52 2	Mean/DL	52 3U	Mean/DL	52 3L	Mean/DL
ICP.f.Ag	<2.46E+01 <2.46E+01	NA	<4.48E+00 <4.48E+00	NA	4.72E+00 5.45E+00	1.13E+00	5.31E+00 5.09E+00	1.16E+00
ICP.f.Al	2.12E+05 2.15E+05	1.16E+04	4.63E+04 3.98E+04	1.69E+03	7.81E+03 8.53E+03	3.20E+02	1.52E+04 1.56E+04	6.04E+02
ICP.f.As	<1.48E+02 <1.47E+02	NA	2.35E+01 <1.94E+01	1.20E+00	<1.93E+01 <1.92E+01	NA	<1.94E+01 <1.92E+01	NA
ICP.f.B	<4.92E+01 <4.91E+01	NA	<4.98E+00 <4.98E+00	NA	<4.96E+00 <4.92E+00	NA	8.02E+00 1.18E+01	1.98E+00
ICP.f.Be	<1.48E+01 <1.47E+01	NA	<1.49E+00 <1.49E+00	NA	<1.49E+00 <1.48E+00	NA	<1.49E+00 <1.48E+00	NA
ICP.f.Bi	<3.10E+02 3.76E+02	1.19E+01	1.15E+04 1.07E+04	2.41E+02	9.58E+03 1.09E+04	2.24E+02	2.21E+04 2.26E+04	4.85E+02
ICP.f.Ca	1.35E+04 8.30E+03	2.42E+03	6.71E+02 8.71E+02	3.08E+02	5.83E+02 1.02E+03	3.20E+02	4.37E+02 4.07E+02	1.69E+02
ICP.f.Cd	<2.95E+01 <2.95E+01	NA	4.59E+00 5.19E+00	1.40E+00	6.22E+00 4.78E+00	1.57E+00	5.92E+00 6.08E+00	1.71E+00
ICP.f.Ce	<3.35E+02 <3.34E+02	NA	2.02E+02 1.58E+02	2.81E+00	2.07E+02 2.35E+02	3.45E+00	3.76E+02 3.08E+02	5.34E+00
ICP.f.Cr	1.23E+02 1.61E+02	3.16E+01	2.56E+02 2.42E+02	3.32E+01	2.75E+02 2.96E+02	3.81E+01	5.45E+02 5.16E+02	7.08E+01
ICP.f.Fe	4.77E+04 3.34E+04	5.40E+03	2.06E+04 2.15E+04	2.62E+03	2.45E+04 2.23E+04	2.92E+03	1.90E+04 1.90E+04	2.38E+03
ICP.f.K	NA NA	NA	NA NA	NA	NA NA	NA	NA NA	NA
ICP.f.La	<8.37E+01 <8.35E+01	NA	<9.96E+00 <9.96E+00	NA	<9.92E+00 <9.84E+00	NA	<9.94E+00 <9.86E+00	NA
ICP.f.Li	<1.97E+01 <1.96E+01	NA	6.21E+00 5.80E+00	2.00E+00	7.88E+00 8.64E+00	2.75E+00	5.55E+00 4.57E+00	1.69E+00

NA: Not available.

Table A-4. Core 52 Segment Data. (sheet 2 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)								
Core segment	52 1	Mean/DL	52 2	Mean/DL	52 3U	Mean/DL	52 3L	Mean/DL
ICP.f.Mg	4.07E+02 4.43E+02	2.83E+02	1.93E+02 1.66E+02	1.20E+02	2.02E+02 1.92E+02	1.31E+02	1.56E+02 1.61E+02	1.06E+02
ICP.f.Mn	1.85E+03 3.28E+03	1.71E+03	2.26E+02 2.06E+02	1.44E+02	1.75E+02 1.58E+02	1.11E+02	9.94E+01 8.57E+01	6.17E+01
ICP.f.Mo	<2.95E+01 <2.95E+01	NA	1.37E+01 1.31E+01	2.98E+00	9.82E+00 5.74E+00	1.73E+00	9.77E+00 8.21E+00	2.00E+00
ICP.f.Na	2.65E+04 2.80E+04	8.81E+02	9.85E+04 1.12E+05	5.25E+03	1.35E+05 1.27E+05	6.55E+03	1.08E+05 1.06E+05	5.35E+03
ICP.f.Nd	<4.04E+02 <4.03E+02	NA	7.68E+01 <3.88E+01	1.97E+00	5.97E+01 9.63E+01	2.00E+00	7.07E+01 4.94E+01	1.54E+00
ICP.f.Ni	NA NA	NA	2.61E+03 3.22E+03	3.89E+02	3.44E+03 1.06E+03	3.00E+02	8.13E+03 1.07E+04	1.26E+03
ICP.f.P	<2.26E+02 <2.26E+02	NA	2.22E+04* 2.91E+04*	7.31E+02	3.87E+04 3.50E+04*	1.05E+03	2.55E+04 2.64E+04*	7.43E+02
ICP.f.Pb	1.18E+03 2.50E+03	5.94E+01	4.44E+02 3.95E+02	1.08E+01	4.91E+02 4.12E+02	1.16E+01	1.44E+02 1.19E+02	3.38E+00
ICP.f.S	1.08E+03 1.15E+03	6.79E+01	2.64E+03 2.51E+03	1.32E+02	2.47E+03 2.63E+03	1.31E+02	3.61E+03 3.53E+03	1.83E+02
ICP.f.Sb	<1.03E+03 <1.03E+03	NA	8.28E+01 <7.57E+01	1.09E+00	1.13E+02 1.27E+02	1.58E+00	1.42E+02 <7.50E+01	1.86E+00
ICP.f.Se	<4.28E+02 <4.27E+02	NA	<7.02E+01 <7.02E+01	NA	<6.99E+01 <6.94E+01	NA	<7.01E+01 <6.95E+01	NA
ICP.f.Si	4.60E+03 4.72E+03	5.82E+02	5.89E+03 5.19E+03	3.26E+02	4.68E+03 5.09E+03	2.87E+02	1.14E+04 1.11E+04*	6.65E+02
ICP.f.Sm	<4.63E+02 <4.62E+02	NA	1.10E+02 9.71E+01	2.00E+00	1.06E+02 1.02E+02	2.00E+00	<5.17E+01 <5.13E+01	NA
ICP.f.Sr	4.67E+01 5.06E+01	3.24E+01	6.81E+02 6.16E+02	4.32E+02	9.60E+02 9.30E+02	6.30E+02	3.72E+02 2.91E+02	2.21E+02

NA: Not available.

*: Outside instrument calibration range.

Table A-4. Core 52 Segment Data. (sheet 3 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)								
Core segment	52 1	Mean/DL	52 2	Mean/DL	52 3U	Mean/DL	52 3L	Mean/DL
ICP.f.Ti	1.48E+02 2.75E+02	1.41E+02	2.24E+01 7.89E+00	4.31E+00	4.89E+00 4.30E+00	1.31E+00	8.96E+00 1.39E+01	3.26E+00
ICP.f.Tl	<8.07E+02 <8.06E+02	NA	<1.25E+02 <1.25E+02	NA	<1.24E+02 <1.23E+02	NA	<1.24E+02 <1.23E+02	NA
ICP.f.Zr	9.72E+01 1.78E+02	3.91E+01	9.29E+00 1.36E+01	1.92E+00	1.68E+02 9.00E+01	2.15E+01	1.11E+02 2.52E+02	3.02E+01
Sr-90	1.79E+02 1.51E+02	1.65E+02	9.22E+01 8.37E+01	3.26E+02	9.25E+01 9.92E+01	3.55E+02	1.96E+01 1.51E+01	6.43E+01
GEA.Cs-137	1.08E+01 1.09E+01	1.57E+03	1.09E+01 9.66E+00	3.45E+02	7.39E+00 8.26E+00	2.63E+02	1.06E+01 1.07E+01	3.57E+02
GEA.Cs-134	<9.00E-03 <8.14E-03	NA	<2.46E-02 <2.25E-02	NA	<2.09E-02 <2.40E-02	NA	<2.19E-02 <2.54E-02	NA
GEA.Am-241	2.53E-01 <9.49E-02	4.52E+00	<5.28E-02 <4.98E-02	NA	<5.21E-02 <5.06E-02	NA	<3.61E-02 <3.58E-02	NA
GEA.Co-60	<6.39E-03 <6.39E-03	NA	<2.51E-02 <2.07E-02	NA	<2.13E-02 <1.90E-02	NA	<2.20E-02 <2.54E-02	NA
GEA.Eu-154	1.21E+00 9.44E-01	5.98E+01	<6.48E-02 <7.37E-02	NA	<7.74E-02 <7.67E-02	NA	<6.76E-02 <6.42E-02	NA
GEA.Eu155	1.07E+00 7.69E-01	7.07E+01	<8.27E-02 <8.07E-02	NA	<7.89E-02 <8.11E-02	NA	<6.86E-02 <6.66E-02	NA
GEA.K-40	1.70E-01 <1.55E-01	5.31E-01	<7.17E-01 <7.32E-01	NA	<7.24E-01 <7.08E-01	NA	<7.20E-01 <7.20E-01	NA
GEA.CePr144	<1.47E-01 <1.33E-01	NA	<3.19E-01 <3.13E-01	NA	<3.05E-01 <3.14E-01	NA	<2.84E-01 <2.82E-01	NA
GEA.Ru103	<1.46E-02 <1.42E-02	NA	<3.83E-02 <3.40E-02	NA	<3.37E-02 <3.41E-02	NA	<3.63E-02 <3.56E-02	NA
GEA.RuRh106	<2.19E-01 <2.10E-01	NA	<5.03E-01 <5.03E-01	NA	<4.39E-01 <4.28E-01	NA	<4.74E-01 <4.79E-01	NA

NA: Not available.

Table A-4. Core 52 Segment Data. (sheet 4 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)								
Core segment	52 1	Mean/DL	52 2	Mean/DL	52 3U	Mean/DL	52 3L	Mean/DL
DSC	NO EXOTH NO EXOTH	NA	NO EXOTH NR	NA	NO EXOTH NR	NA	NO EXOTH NO EXOTH	NA
TGA (%H ₂ O)	1.52E+01 1.53E+01	NA	5.56E+01 5.54E+01	NA	5.46E+01 5.46E+01	NA	5.48E+01 4.97E+01	NA
% Solids	8.34E+01 8.33E+01	NA	5.11E+01 5.19E+01	NA	4.85E+01 4.87E+01	NA	4.66E+01 4.65E+01	NA
Bulk. Density	IS NR	NA	1.55E+00 NR	NA	1.50E+00 NR	NA	1.52E+00 NR	NA
CN ($\mu\text{g/g}$)	3.15E+01 3.05E+01	7.75E+00	6.34E+01 6.00E+01	1.54E+01	5.05E+01 5.37E+01	1.30E+01	4.14E+01 4.57E+01	NA
pH	10.5 NA	NA NA	11.4 NA	NA NA	11.8 NA	NA NA	10.9 NA	NA NA

IS: Insufficient sample.

NR: Not required.

NA: Not available.

Table A-5. Drainable Liquid Core Composite Data, Acidified Samples. (sheet 1 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)									
Core result	50 1	50 2	Mean/DL	51 1	51 2	Mean/DL	52 1	52 2	Mean/DL
ICP Ag	<9 00E 02	<9 00E 02	NA	2 54E 01	2 62E 01	2 87E+00	<2 25E 01	<2 25E-01	NA
ICP Al*	4 45E+00	4 06E+00	8 33E+00	1 11E+01	1 18E+01	2 25E+01	4 72E+01	4 84E+01	3 75E+01
ICP As	<3 90E 01	<3 90E 01	NA	<3 90E 01	<3 90E 01	NA	<9 75E 01	<9 75E 01	NA
ICP B	9 33E+00	9 03E+00	9 18E+01	2 42E+01	2 50E+01	2 46E+02	2 83E+01	3 20E+01	1 21E+02
ICP Be	<3 00E 02	<3 00E 02	NA	<3 00E 02	<3 00E 02	NA	<7 50E 02	<7 50E 02	NA
ICP Bi	<9 20E 01	<9 20E 01	NA	<9 20E 01	<9 20E 01	NA	1 69E+01	1 70E+01	7 40E+00
ICP Ca	4 87E+00	3 70E+00	8 56E+01	7 00E+00	2 95E+00	9 94E+01	3 48E+00	4 40E+00	3 15E+01
ICP Cd	<7 00E 02	<7 00E 02	NA	<7 00E 02	<7 00E 02	NA	<1 75E 01	<1 75E 01	NA
ICP Ce	<1 28E+00	<1 28E+00	NA	<1 28E+00	<1 28E+00	NA	<3 20E+00	<3 20E+00	NA
ICP Cr	4 56E+01	4 50E+01	3 02E+02	2 71E+02	2 75E+02	1 82E+03	1 86E+02	1 90E+02	5 00E+02
ICP Fe	5 82E+00	5 67E+00	3 59E+01	4 75E+01	4 85E+01	3 00E+02	1 89E+01	1 92E+01	4 76E+01
ICP K	4 68E+01	4 66E+01	3 16E+01	3 60E+02	3 74E+02	2 48E+02	1 37E+02	1 39E+02	3 73E+01
ICP La	<2 00E 01	<2 00E 01	NA	<2 00E 01	<2 00E-01	NA	<5 00E 01	<5 00E 01	NA
ICP Li	<6 00E 02	<6 00E 02	NA	<6 00E 02	<6 00E 02	NA	<1 50E 01	<1 50E 01	NA
ICP Mg	1 32E+00	1 16E+00	4 13E+01	5 11E 01	3 10E 01	1 37E+00	3 90E 01	3 96E 01	5 24E+00
ICP Mn	<3 00E 02	3 45E 02	1 15E+00	7 56E 02	8 11E 02	2 61E+00	<7 50E 02	<7 50E 02	NA
ICP Mo	2 23E+00	2 14E+00	2 43E+01	2 22E+01	2 26E+01	2 49E+02	2 09E+00	2 16E+00	9 48E+00
ICP Na	1 46E+04	1 46E+04	3 65E+04	9 63E+04	9 47E+04	2 39E+05	5 23E+04	5 15E+04	5 20E+04
ICP Nd*	9 49E 01	1 12E+00	1 32E+00	7 95E 01	1 04E+00	1 18E+00	<1 95E+00	<1 95E+00	NA
ICP Ni	1 79E+00	1 75E+00	1 18E+01	1 59E+01	1 62E+01	1 07E+02	2 75E+00	2 82E+00	7 44E+00
ICP P	7 85E+02	7 95E+02	1 13E+03	2 02E+03	2 03E+03	2 89E+03	2 63E+03	2 55E+03	1 48E+03

*: Analytes with a portion of the data below ten times the DL.

NA: Not available.

Table A-5. Drainable Liquid Core Composite Data, Acidified Samples. (sheet 2 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)									
Core result	50 1	50 2	Mean/DL	51 1	51 2	Mean/DL	52 1	52 2	Mean/DL
ICP Pb	<7 80E 01	<7 80E 01	NA	<7 80E 01	<7 80E 01	NA	<1 95E+00	<1 95E+00	NA
ICP S	8 31E+02	8 18E+02	2 11E+03	6 03E+03	5 99E+03	1 54E+04	3 35E+03	3 32E+03	3 42E+03
ICP Sb*	1 57E+00	2 27E+00	1 26E+00	2 52E+00	2 52E+00	1 66E+00	<3 80E+00	<3 80E+00	NA
ICP Se	<1 41E+00	<1 41E+00	NA	<1 41E+00	<1 41E+00	NA	<3 52E+00	<3 52E+00	NA
ICP Si	6 08E+01	5 62E+01	1 72E+02	6 58E+01	6 68E+01	1 95E+02	7 82E+01	9 61E+01	1 02E+02
ICP Sm*	2 07E+00	<1 04E+00	1 99E+00	3 40E+00	3 92E+00	3 52E+00	<2 60E+00	<2 60E+00	NA
ICP Sr*	1 40E 01	1 39E 01	4 67E+00	1 75E 01	1 69E 01	5 73E+00	1 80E+00	1 82E+00	2 41E+01
ICP Ti	<7 00E 02	<7 00E 02	NA	<7 00E 02	<7 00E 02	NA	<1 75E 01	<1 75E 01	NA
ICP Tl	<2 50E+00	<2 50E+00	NA	<2 50E+00	3 21E+00	1 28E+00	<6 25E+00	<6 25E+00	NA
ICP Zr*	1 34E 01	1 34E 01	1 12E+00	6 56E 01	6 41E 01	5 41E+00	1 76E+00	1 63E+00	5 68E+00
DSC	NO EXOTH	NO EXOTH	NA	NO EXOTH	NO EXOTH	NA	NO EXOTH	NO EXOTH	NA
TGA (%H ₂ O)	96 5	93 7	NA	73 4	74	NA	83 2	82 6	NA
SPG	1 02	1 02	NA	1 21	1 19	NA	1 10	1 11	NA
Total Dissolved Solid	4 1	4 67	NA	24	25 4	NA	13 2	13 7	NA
pH	9 63	9 62	NA	10 7	10 7	NA	10 3	10 3	NA
NH ₄	4 16E+01	4 30E+01	1 06E+00	8 31E+01	8 03E+01	5 19E 0 1	2 17E+02	2 25E+02	2 76E+00
CN	1 35E+01	1 34E+01	3 36E+01	1 52E+02	1 52E+02	3 80E+02	4 00E+01	3 96E+01	9 95E+01
IC F	1 70E+02	1 77E+02	1 74E+03	8 24E+02	8 26E+02	8 25E+03	6 68E+02	6 78E+02	6 73E+03
IC Cl	1 99E+02	1 93E+02	9 80E+02	1 34E+03	1 34E+03	6 70E+03	8 51E+02	8 69E+02	4 30E+03
IC NO ₂	2 59E+03	2 57E+03	2 58E+03	2 75E+04	2 78E+04	2 77E+04	7 99E+03	8 12E+03	8 06E+03

*: Analytes with a portion of the data below ten times the DL.

NA: Not available.

Table A-5. Drainable Liquid Core Composite Data, Acidified Samples. (sheet 3 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)									
Core result	50 1	50 2	Mean/DL	51 1	51 2	Mean/DL	52 1	52 2	Mean/DL
IC PO4	2 30E+03	2 50E+03	2 40E+03	6 29E+03	6 19E+03	6 24E+03	7 65E+03	7 61E+03	7 63E+03
IC SO4	4 64E+03	4 65E+03	4 65E+03	1 68E+04	1 68E+04	1 68E+04	9 58E+03	9 58E+03	9 58E+03
IC NO3	2 12E+04	2 12E+04	2 12E+04	1 34E+05	1 35E+05	1 35E+05	1 00E+05	1 00E+05	1 00E+05
Spec w NO2	2 83E+03	2 63E+03	1 37E+01	1 31E+04	1 20E+04	1 53E+01	7 57E+03	7 27E+03	1 81E+01
TIC	5 16E+02	5 08E+02	1 02E+02	4 58E+03	4 51E+03	9 09E+02	3 46E+02	3 32E+02	6 78E+01
TOC	1 10E+03	1 20E+03	2 09E+02	1 05E+03	1 08E+03	1 94E+02	3 40E+02	3 69E+02	6 45E+01
AT	9 74E 04	8 54E 04	2 23E+00	1 71E 02	1 61E 02	2 55E+01	5 42E 04	4 80E 04	1 70E+01
U	9 44E+01	9 61E+01	1 02E+01	6 10E+02	5 66E+02	6 13E+00	3 97E+01	4 15E+01	9 23E+00
U 238	3 17E 05	3 23E 05	1 03E+01	2 05E 04	1 90E 04	6 17E+00	1 33E 05	1 39E 05	9 07E+00
Pu239/240	<6 57E 05	<6 60E 05	NA	1 11E 02	1 17E 02	8 51E+01	<6 70E 05	<6 28E 05	NA
Pu238	<9 01E 05	<9 01E 05	NA	2 44E 03	2 56E 03	1 10E+01	<1 71E 04	<1 14E 04	NA
Am 241	<4 03E 05	<2 67E 05	NA	2 04E 04	NA	1 40E+01	6 79E 05	7 22E 05	1 40E+00
TB	2 54E+00	2 45E+00	3 04E+02	2 57E+01	2 47E+01	2 65E+03	7 50E+00	7 61E+00	5 04E+02
Sr 90	1 05E 02	1 11E 02	1 37E+02	1 18E 01	NA	2 00E 01	4 55E 02	4 43E 02	1 40E+03
Tc 99	7 93E 03	8 16E 03	5 03E+02	8 58E 02	IS	2 38E+03	1 71E 02	1 62E 02	9 25E+02
C 14	1 99E 05	1 60E 05	8 16E+00	3 80E 04	6 56E 04	8 64E+01	6 22E 05	8 55E 05	3 36E+01
H 3	2 48E 04	3 43E 04	1 14E+01	9 93E 03	3 96E 03	3 02E+01	4 89E 04	4 52E 04	1 81E+01
GEA Cs 137	1 70E+00	1 73E+00	2 95E+03	1 80E+01	1 87E+01	1 31E+04	5 06E+00	5 40E+00	3 51E+04
GEA Cs 134	<4 66E 04	<5 14E 04	NA	<1 40E 03	<1 35E 03	NA	<2 66E 04	<2 72E 04	NA

NA: Not available.

IS: Insufficient sample.

TIC: Total inorganic carbon.

TOC: Total organic carbon.

Table A-5. Drainable Liquid Core Composite Data, Acidified Samples. (sheet 4 of 4)

(Units $\mu\text{g/g}$ Except Radionuclides $\mu\text{Ci/g}$)									
Core result	50 1	50 2	Mean/DL	51 1	51 2	Mean/DL	52 1	52 2	Mean/DL
GEA.Am-241	<7.33E-03	<7.33E-03	NA	<3.23E-02	<3.30E-02	NA	<5.68E-03	<5.90E-03	NA
GEA.Co-60	<4.06E-04	<5.28E-04	NA	<1.35E-03	<1.10E-03	NA	<1.24E-04	<1.24E-04	NA
GEA.Eu-154	<1.31E-03	<1.44E-03	NA	<4.23E-03	<3.99E-03	NA	<5.50E-04	<5.29E-04	NA
GEA.Eu-155	<3.07E-03	<3.14E-03	NA	<1.47E-02	<1.50E-02	NA	<2.57E-03	<2.65E-03	NA
GEA.K-40	<1.30E-02	<1.29E-02	NA	<3.04E-02	<3.04E-02	NA	3.73E-03	<3.35E-03	NA
GEA.CePr-144	<9.99E-03	<1.01E-02	NA	<4.78E-02	<4.88E-02	NA	<8.34E-03	<8.61E-03	NA
GEA.Ru-103	<1.50E-03	<1.52E-03	NA	<7.17E-03	<7.34E-03	NA	<1.27E-03	<1.30E-03	NA
GEA.RuRh-106	<2.08E-02	<2.07E-02	NA	<9.32E-02	<9.51E-02	NA	<1.63E-02	<1.68E-02	NA
GEA.Th-228/Pb	<2.08E-03	<2.10E-03	NA	<1.02E-02	<1.03E-02	NA	<1.78E-03	<1.84E-03	NA
I-129	<7.48E-05	<8.26E-05	NA	<3.85E-05	<3.72E-05	NA	<3.79E-05	<3.84E-05	NA

NA: Not available.

Table A-6. Homogenization Test Data. (sheet 1 of 3)

(Units $\mu\text{g/g}$)				
Analyte	Core 50 Seg. 2 Loc. 1 Aliquot 2	Mean/DL	Core 50 Seg. 2 Loc. 2 Aliquot 2	Mean/DL
ICP.a.Al	1.32E+05 7.90E+04	2.86E+04	9.58E+04 1.22E+05	2.95E+04
ICP.a.Bi	4.03E+03 2.80E+03	5.43E+02	3.87E+03 3.61E+03	5.94E+02
ICP.a.Ca	1.52E+03 1.47E+03	1.67E+03	4.69E+03 9.42E+02	3.13E+03
ICP.a.Cd*	7.52E+00 5.21E+00	1.06E+01	6.94E+00 6.84E+00	1.15E+01
ICP.a.Cr	3.29E+02 2.33E+02	3.12E+02	3.14E+02 2.89E+02	3.34E+02
ICP.a.Fe	3.18E+04 2.10E+04	1.76E+04	3.15E+04 2.93E+04	2.03E+04
ICP.a.K	2.81E+02 1.77E+02	1.97E+01	2.51E+02 2.27E+02	2.06E+01
ICP.a.Li*	7.47E+00 5.09E+00	1.57E+01	7.09E+00 6.46E+00	1.69E+01
ICP.a.Mg	2.82E+02 1.94E+02	7.93E+02	3.27E+02 2.46E+02	9.57E+02
ICP.a.Mn	3.16E+02 2.25E+02	9.03E+02	3.25E+02 3.19E+02	1.07E+03
ICP.a.Mo	1.51E+01 1.07E+01	2.15E+01	1.35E+01 1.30E+01	2.20E+01
ICP.a.Na	8.93E+04 6.32E+04	1.23E+04	8.26E+04 7.68E+04	1.29E+04
ICP.a.Ni	1.77E+02 1.26E+02	1.16E+02	1.77E+02 1.72E+02	1.34E+02
ICP.a.P	8.17E+03 4.05E+03	1.33E+03	4.12E+03 5.79E+03	1.08E+03
ICP.a.Pb	7.63E+02 5.34E+02	1.05E+02	7.33E+02 6.65E+02	1.13E+02
ICP.a.S	4.32E+03 3.42E+03	1.17E+03	4.49E+03 4.86E+03	1.42E+03
ICP.a.Sm	3.76E+02 2.03E+02	3.07E+01	3.37E+01 3.34E+02	1.96E+01
ICP.a.Sr	1.21E+03 8.32E+02	3.40E+03	1.20E+03 1.14E+03	3.90E+03

*: Analytes with a portion of the data below ten times the DL.

Table A-6. Homogenization Test Data. (sheet 2 of 3)

(Units $\mu\text{g/g}$)				
Analyte	Core 51 Seg. 3L Loc. 1 Aliquot 2	Mean/DL	Core 51 Seg. 3L Loc. 2 Aliquot 2	Mean/DL
ICP.a.Al	9.15E+02 IS	2.47E+02	4.38E+02 3.85E+02	1.11E+02
ICP.a.Bi	1.92E+03 IS	3.05E+02	1.53E+03 1.39E+03	2.32E+02
ICP.a.Ca	1.09E+03 IS	1.21E+03	9.06E+02 8.43E+02	9.72E+02
ICP.a.Cd*	1.23E+01 IS	2.05E+01	7.47E+00 6.62E+00	1.18E+01
ICP.a.Cr	4.94E+02 IS	5.49E+02	4.15E+02 3.87E+02	4.46E+02
ICP.a.Fe	6.91E+04 IS	4.61E+04	4.25E+04 4.00E+04	2.75E+04
ICP.a.K	4.35E+02 IS	3.75E+01	3.53E+02 3.37E+02	2.97E+01
ICP.a.Li	1.30E+01 IS	3.25E+01	9.79E+00 9.10E+00	2.36E+01
ICP.a.Mg	3.23E+02 IS	1.08E+03	2.73E+02 2.55E+02	8.80E+02
ICP.a.Mn	4.34E+02 IS	1.45E+03	3.23E+02 3.00E+02	1.04E+03
ICP.a.Mo*	1.29E+01 IS	2.15E+01	9.93E+00 1.01E+01	1.67E+01
ICP.a.Na	1.13E+05 IS	1.82E+04	9.57E+04 9.89E+04	1.57E+04
ICP.a.Ni	2.99E+02 IS	2.30E+02	2.44E+02 2.26E+02	1.81E+02
ICP.a.P	6.33E+03 IS	1.38E+03	7.46E+03 9.84E+03	1.88E+03
ICP.a.Pb	1.66E+03 IS	2.68E+02	1.34E+03 1.23E+03	2.08E+02
ICP.a.S	5.92E+03 IS	1.79E+03	4.92E+03 4.51E+03	1.43E+03
ICP.a.Sm	1.12E+03 IS	1.19E+02	9.23E+02 8.86E+02	9.63E+01
ICP.a.Sr	2.03E+03 IS	6.77E+03	1.71E+03 1.60E+03	5.50E+03

IS: Insufficient sample.

*: Analytes with a portion of the data below ten times the DL.

Table A-6. Homogenization Test Data. (sheet 3 of 3)

(Units $\mu\text{g/g}$)				
Analyte	Core 52 Seg. 3L Loc. 1 Aliquot 2	Mean/DL	Core 52 Seg. 3L Loc. 2 Aliquot 2	Mean/DL
ICP.a.Al	1.60E+04 1.64E+04	4.38E+03	1.85E+04 1.87E+04	5.03E+03
ICP.a.Bi	2.37E+04 2.49E+04	3.86E+03	2.78E+04 2.80E+04	4.43E+03
ICP.a.Ca	3.75E+02 4.05E+02	4.33E+02	4.20E+02 4.09E+02	4.60E+02
ICP.a.Cd	3.99E+00 3.10E+00	5.90E+00	3.94E+00 4.07E+00	6.67E+00
ICP.a.Cr	5.32E+02 5.63E+02	6.09E+02	6.23E+02 6.08E+02	6.84E+02
ICP.a.Fe	1.88E+04 1.96E+04	1.28E+04	2.23E+04 2.23E+04	1.49E+04
ICP.a.K	2.18E+02 2.39E+02	1.97E+01	2.10E+02 2.17E+02	1.84E+01
ICP.a.Li*	1.39E+00 1.48E+00	3.60E+00	1.58E+00 1.57E+00	3.92E+00
ICP.a.Mg	1.49E+02 1.50E+02	4.97E+02	1.63E+02 1.59E+02	5.37E+02
ICP.a.Mn	5.64E+01 6.01E+01	1.94E+02	6.83E+01 6.55E+01	2.23E+02
ICP.a.Mo*	3.61E+00 3.81E+00	6.18E+00	4.05E+00 3.87E+00	6.60E+00
ICP.a.Na	1.16E+05 1.08E+05	1.81E+04	1.25E+05 1.25E+05	2.02E+04
ICP.a.Ni	3.36E+01 3.39E+01	2.60E+01	3.83E+01 3.76E+01	2.92E+01
ICP.a.P	2.80E+04* 2.42E+04*	5.67E+03	2.76E+04* 2.74E+04*	5.98E+03
ICP.a.Pb	1.44E+02 1.46E+02	2.34E+01	1.66E+02 1.62E+02	2.65E+01
ICP.a.S	3.43E+03 3.51E+03	1.05E+03	3.84E+03 3.84E+03	1.16E+03
ICP.a.Sm*	2.85E+01 2.75E+01	2.98E+00	3.64E+01 3.79E+01	3.95E+00
ICP.a.Sr	3.90E+02 3.29E+02	1.20E+03	3.35E+02 3.19E+02	1.09E+03

*: Sample absorbance outside linear range of instrument.

*: Analytes with a portion of the data below ten times the DL.

APPENDIX B

DATA PLOTS

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Figure B-1. Core Composite Data. (sheet 1 of 13)

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Units are ug/g except for radionuclides which are uCi/g

Figure B-1. Core Composite Data. (sheet 2 of 13)

Units are ug/g except for radionuclides which are uCi/g

Figure B-1. Core Composite Data. (sheet 3 of 13)

Units are ug/g except for radionuclides which are uCi/g

Figure B-1. Core Composite Data. (sheet 4 of 13)

Units are ug/g except for radionuclides which are uCi/g

Figure B-1. Core Composite Data. (sheet 5 of 13)

Units are ug/g except for radionuclides which are uCi/g

Figure B-1. Core Composite Data. (sheet 6 of 13)

Units are ug/g except for radionuclides which are uCi/g

Figure B-1. Core Composite Data. (sheet 7 of 13)

Units are ug/g except for radionuclides which are uCi/g

Figure B-1. Core Composite Data. (sheet 8 of 13)

Units are ug/g except for radionuclides which are uCi/g

Figure B-1. Core Composite Data. (sheet 9 of 13)

Units are ug/g except for radionuclides which are uCi/g

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Figure B-1. Core Composite Data. (sheet 10 of 13)

Units are ug/g, except for radionuclides which are uCi/g

Figure B-1. Core Composite Data. (sheet 11 of 13)

Units are ug/g except for radionuclides which are uCi/g

Figure B-1. Core Composite Data. (sheet 12 of 13)

Units are ug/g except for radionuclides which are uCi/g

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Figure B-1. Core Composite Data. (sheet 13 of 13)

Units are ug/g except for radionuclides which are uCi/g

Figure B-2. Core Segment Data. (sheet 1 of 7)

Units are $\mu\text{g/g}$ except for radionuclides which are $\mu\text{Ci/g}$

▽ Segment 1R	◇ Segment 2	⊠ Segment 3U	⊗ Segment 4U
△ Segment 1	□ Segment 3	⊞ Segment 3L	⊕ Segment 4L

Figure B-2. Core Segment Data. (sheet 2 of 7)

Units are $\mu\text{g/g}$ except for radionuclides which are $\mu\text{Ci/g}$

▽ Segment 1R	◇ Segment 2	⊠ Segment 3U	⊗ Segment 4U
△ Segment 1	□ Segment 3	⊞ Segment 3L	⊕ Segment 4L

Figure B-2. Core Segment Data. (sheet 3 of 7)

Units are $\mu\text{g/g}$ except for radionuclides which are $\mu\text{Ci/g}$

▽ Segment 1R	◇ Segment 2	⊠ Segment 3U	⊗ Segment 4U
△ Segment 1	□ Segment 3	⊞ Segment 3L	⊕ Segment 4L

Figure B-2. Core Segment Data. (sheet 4 of 7)

Units are $\mu\text{g/g}$ except for radionuclides which are $\mu\text{Ci/g}$

▽ Segment 1R	◇ Segment 2	⊠ Segment 3U	⊗ Segment 4U
△ Segment 1	□ Segment 3	⊞ Segment 3L	⊕ Segment 4L

Figure B-2. Core Segment Data. (sheet 5 of 7)

Units are $\mu\text{g/g}$ except for radionuclides which are $\mu\text{Ci/g}$

▽ Segment 1R
△ Segment 1

◇ Segment 2
□ Segment 3

⊠ Segment 3U
⊞ Segment 3L

⊗ Segment 4U
⊕ Segment 4L

Figure B-2. Core Segment Data. (sheet 6 of 7)

Units are $\mu\text{g/g}$ except for radionuclides which are $\mu\text{Ci/g}$

▽ Segment 1R	◇ Segment 2	⊠ Segment 3U	⊗ Segment 4U
△ Segment 1	□ Segment 3	⊞ Segment 3L	⊕ Segment 4L

Figure B-2. Core Segment Data. (sheet 7 of 7)

Units are $\mu\text{g/g}$ except for radionuclides which are $\mu\text{Ci/g}$

▽ Segment 1R
Δ Segment 1

◇ Segment 2
□ Segment 3

⊗ Segment 3U
⊕ Segment 3L

⊗ Segment 4U
⊕ Segment 4L

Figure B-3. Drainable Liquid Data. (sheet 1 of 7)

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Units are ug/g except for radionuclides which are UCI/g

Figure B-3. Drainable Liquid Data. (sheet 2 of 7)

Units are ug/g except for radionuclides which are UCI/g

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Figure B-3. Drainable Liquid Data. (sheet 3 of 7)

Units are ug/g except for radionuclides which are UCi/g

Figure B-3. Drainable Liquid Data. (sheet 4 of 7)

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Units are ug/g except for radionuclides which are UCi/g

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Figure B-3. Drainable Liquid Data. (sheet 5 of 7)

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Units are ug/g except for radionuclides which are UCi/g

Figure B-3. Drainable Liquid Data. (sheet 6 of 7)

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Units are ug/g except for radionuclides which are UCI/g

Figure B-3. Drainable Liquid Data. (sheet 7 of 7)

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Units are ug/g except for radionuclides which are UC/g

Figure B-4. Homogenization Test Data. (sheet 1 of 3)

Location 1 = O , Location 2 = X
Units are ug/g except radionuclides which are uCi/g

Figure B-4. Homogenization Test Data. (sheet 2 of 3)

Location 1 = O, Location 2 = X
Units are ug/g except radionuclides which are uCi/g

Figure B-4. Homogenization Test Data. (sheet 3 of 3)

Location 1 = O , Location 2 = X
Units are ug/g except radionuclides which are uCi/g

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APPENDIX C
MEAN CONCENTRATION CALCULATION METHODS

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This appendix contains a description of the statistical models that describe the structure of the data from core samples taken from tank T-107. Equations are also presented for estimates of the mean concentration, the variance for the mean concentration, and the confidence interval (CI) on the mean concentration.

The statistical model that describes the structure of the core composite data or the drainable liquid data is

$$y_{ij} = \mu + C_i + A_{ij}, \quad i=1, \dots, a, \quad j=1, \dots, n_i, \quad (1)$$

where

y_{ij} = laboratory results from the j^{th} duplicate of the i^{th} core composite sample or drainable liquid sample from the tank

μ = the grand mean

C_i = the effect of the i^{th} core (spatial effect)

A_{ij} = the analytical error associated with the j^{th} duplicate from the i^{th} core

a = the number of cores

n_i = the number of analytical results from the i^{th} core.

This is an unbalanced one-way random effects analysis of variance model. The C_i variable is assumed to be a random effect. It is assumed that C_i and A_{ij} are each distributed normally with mean zero and variances of $\sigma^2(C)$ and $\sigma^2(A)$, respectively. Estimates of $\sigma^2(C)$ and $\sigma^2(A)$ were obtained using Restricted Maximum Likelihood Estimation (REML). This method applied to variance component estimation is described by Harville (1977).

An estimate of the true unknown mean concentration μ is the mean of the core means; i.e., each core is weighted equally

$$\hat{\mu} = \bar{y} = \frac{1}{a} \sum_{i=1}^a \bar{y}_{i+}, \quad \text{where} \quad \bar{y}_{i+} = \sum_{j=1}^{n_i} \frac{y_{ij}}{n_i}. \quad (2)$$

The variance of $\bar{y}$ (Snedecor and Cochran 1980, Chapter 13) is

$$\sigma^2(\bar{y}) = \frac{\sigma^2(C)}{a} + \frac{\sigma^2(A)}{a^2} \sum_{i=1}^a \frac{1}{n_i}. \quad (3)$$

The estimated variance of $\bar{y}$ is obtained by substituting the REML estimators of the two variance components into Equation 3. The degrees of freedom associated with the estimate of variance is approximately the number of cores with data minus one.

The 95% confidence interval on the mean concentration μ is (LL, UL) where

$$95\% \text{ LL} = \bar{y} - t_{0.975} \sqrt{\hat{\sigma}^2(\bar{y})}, \text{ and } 95\% \text{ UL} = \bar{y} + t_{0.975} \sqrt{\hat{\sigma}^2(\bar{y})}, \quad (4)$$

and $t_{0.975}$ is the 0.975 percentile point from a Student's t distribution with approximated degrees of freedom $a-1$.

The statistical model that describes the structure of the core segment data is

$$y_{ijk} = \mu + C_i + S_{ij} + A_{ijk}, \quad i=1, \dots, a, \quad j=1, \dots, b_i, \quad k=1, \dots, n_{ij}, \quad (5)$$

where

y_{ijk} = laboratory results from the k^{th} duplicate of the j^{th} segment of the i^{th} core from the tank

μ = the grand mean

C_i = the effect of the i^{th} core (spatial effect)

S_{ij} = the effect of the j^{th} segment sample from the i^{th} core (spatial effect)

A_{ijk} = the analytical error associated with the k^{th} duplicate in the j^{th} composite from the i^{th} core

a = the number of cores

b_i = the number of segments (half segments) in the i^{th} core

n_{ij} = the number of analytical results from the j^{th} segments (half segments) in the i^{th} core.

The number of segments (half segments) in cores 50, 51, and 52 were 3, 5, and 4 (i.e., $b_1 = 3$, $b_2 = 5$ and $b_3 = 4$).

The variables C_i and S_{ij} are treated as random effects. It is assumed that C_i , S_{ij} , and A_{ijk} are each distributed normally with mean zero and variances of $\sigma^2(C)$, $\sigma^2(S)$, and $\sigma^2(A)$, respectively. Estimates of $\sigma^2(C)$, $\sigma^2(S)$, and $\sigma^2(A)$ were obtained using REML. This method applied to variance component estimation is described by Harville (1977).

The mean concentration of each analyte of interest in the tank was calculated using the following equation:

$$\bar{y} = \frac{1}{a} \sum_{i=1}^a \bar{y}_{i++} = \frac{1}{a} \sum_{i=1}^a \frac{\sum_{j=1}^{b_i} \sum_{k=1}^{n_{ij}} y_{ijk}}{n_{i+}} = \frac{1}{a} \sum_{i=1}^a \frac{\sum_{j=1}^{b_i} \sum_{k=1}^{n_{ij}} (\mu + C_i + S_{ij} + A_{ijk})}{n_{i+}}, \quad (6)$$

where

$$\bar{y}_{i++} = \frac{\sum_{j=1}^{b_i} \sum_{k=1}^{n_{ij}} y_{ijk}}{n_{i+}} \quad \text{and} \quad n_{i+} = \sum_{j=1}^{b_i} n_{ij}. \quad (7)$$

This mean equally weights the results from each core regardless of the unbalance that may exist for a particular analyte.

The variance of $\bar{y}$ is

$$V(\bar{y}) = C_1 \sigma^2(C) + C_2 \sigma^2(S) + C_3 \sigma^2(A) \quad (8)$$

where

$$C_1 = \frac{1}{a}, \quad C_2 = \frac{1}{a^2} \sum_{i=1}^a \left(\frac{1}{n_{i+}} \right)^2 \left[\sum_{j=1}^{b_i} n_{ij}^2 \right], \quad C_3 = \frac{1}{a^2} \sum_{i=1}^a \left(\frac{1}{n_{i+}} \right). \quad (9)$$

Using $\hat{\sigma}^2(C)$, $\hat{\sigma}^2(S)$, and $\hat{\sigma}^2(A)$ (REML variance component estimates), an estimated variance of $\bar{y}$ is

$$\hat{\sigma}^2(\bar{y}) = C_1 \hat{\sigma}^2(C) + C_2 \hat{\sigma}^2(S) + C_3 \hat{\sigma}^2(A). \quad (10)$$

The approximate degrees of freedom used for $\hat{\sigma}^2(\bar{y})$ is the number of cores with data minus one.

The lower and upper 95% limits (95% LL and 95% UL, respectively) on the mean concentration are

$$95\% \text{ LL} = \bar{y} - t_{0.975} \sqrt{\hat{\sigma}^2(\bar{y})} \quad \text{and} \quad 95\% \text{ UL} = \bar{y} + t_{0.975} \sqrt{\hat{\sigma}^2(\bar{y})} \quad (11)$$

where $t_{0.975}$ is the 0.975 percentile from a Student's t-distribution with approximate degrees of freedom equal to the number of cores with data minus one.

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