REV 0

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ACRONYMS & ABBREVIATIONS

Ac-228	actinium-228
Am-241	americium-241
AOC	area of concern
cm	centimeter
DCGL	derived concentration guideline level
EPA	U. S. Environmental Protection Agency
EU	exposure unit
ft	foot or feet
LBG	Leggette, Brashears, and Graham, Inc.
MDC	minimum detectable concentration
Np-237	neptunium-237
pCi/g	picocuries per gram
Pa-233	protactinium-233
Pu-239	plutonium-239
Pu-240	plutonium-240
Ra-228	radium-228
SAIC	Science Applications International Corporation
site	The Westinghouse Electric Co. Hematite Site
SOF	sum of the fractions
Tc-99	technetium-99
Th-228	thorium-228
Th-232	thorium-232
U	uranium
UCL-95	upper 95% confidence limit of the mean
U-234	uranium-234
U-235	uranium-235
U-238	uranium-238

EXECUTIVE SUMMARY

The Westinghouse Electric Company Hematite Site (site or Hematite Site) has been impacted by licensed activities that occurred during facility operation from 1956 to 2001. The site, when in operation, was primarily used for the manufacture of uranium metal and uranium compounds for nuclear fuel, using natural and enriched uranium. Also, a limited amount of work was performed with thorium compounds as part of early research into the use of thorium in the fuel cycle. Because of these past activities, uranium (U-234, U-235, U-238), thorium (Th-232), and technetium (Tc-99) may have been released to the soils. Other radionuclides that may be present in trace quantities at the site include transuranic radionuclides: americium-241 (Am-241), plutonium-239/240 (Pu-239/240), and neptunium-237 (Np-237). Np-237, Pu-239/240, Tc-99, and U-234 are the primary focus of this report.

The purposes of this report are to (1) identify radionuclide surrogates; and (2) develop scaling factors for inferred radionuclides (hard-to-detect) with respect to surrogates present in surface and subsurface soil. Surrogates are chosen based on their ease of detection (typically gamma emitting radionuclides) and established relationships with inferred radionuclides. The use of surrogates to quantify the activity of inferred radionuclides via scaling factors minimizes the cost typically associated with analysis of samples for hard to detect radionuclides, while maintaining a reasonable level of confidence that the activity of the inferred radionuclides is not underestimated, resulting in an underestimate of the remediation effort necessary to achieve required goals.

For the purpose of this evaluation, the Hematite Site was initially divided into four exposure units (EUs). The EUs are defined as follows:

EU-1 – Main facility operation areas
EU-2 – Outlying areas of the site
EU-3 – Surface Water Features, and
EU-4 - Groundwater

The EU-1 is further divided into two units – the Evaporation Ponds (EU-1B) and Rest of Main Facility Operation Areas (EU-1A) based on the nature of contamination present at the Site. This report addresses surrogate radionuclides and scaling factors for four of the five EUs. The fifth EU is associated with potential groundwater contamination and is not included in this evaluation.

Site characterization data within each EU were divided into two groups based on surface soil and volumetric soil sources. All characterization data were reduced and evaluated prior to performance of statistical analysis. Whenever both gamma and alpha spectroscopy sampling results were available for the same sample, the evaluation utilized the alpha sampling results for the statistical analyses. In addition, alpha spectroscopy results for uranium isotopes were used to establish a surrogate and determine a scaling factor to quantify the activity of U-234.

Numerous site literature was reviewed, surface and volumetric soil sample analysis data compiled and statistical analyses conducted to establish a relationship among radionuclides present at the site. Pearson correlation statistical analysis was used to determine the correlation among all radionuclides in each EU as follows:

- If the frequency of detection for any radionuclides was less than 5%, and/or the sample size for any radionuclide was less than 5, no correlation was established for that radionuclide.
- The results of the statistical analysis showed that U-238 can be used as surrogate for Np-237, Pu-239 and Tc-99 for the three EUs evaluated.
- Although it was determined that U-238 or U-235 could be used as a surrogate for U-234, U-235 was determined to be the preferred surrogate.

The majority of uranium processed at the site was for commercial nuclear fuel, typically about 3% enriched in U-235. However, the site processed a variety of uranium, with a U-235 content representative of natural uranium to > 90% enrichment. As the enrichment increases, the activity of U-234 greatly increases. Therefore, there is a very broad range of calculated U-234 to U-238 ratios for the range of enrichments. However, the calculated U-234 to U-235 ratio remains fairly constant over an enrichment range of 1% to 75%, with values between 18 and 20. Although the evaluation of sample results indicates both U-234 to U-238 and U-234 to U-235 ratios are very close to that expected for 3% enriched uranium, U-235 was chosen as the preferred surrogate. Although the U-234 to U-235 scaling factor based on sample results (22) is slightly higher than the calculated ratio, the higher value will provide a conservative result.

The evaluation then determined the scaling factors for each radionuclide based on the relationship established by statistical analyses. The scaling factors were determined by using the sampling results for those samples with a sum of fractions (SOF) less than 1 to ensure that the scaling factor is representative of the site residual condition after remediation. The scaling factor was determined as follows based on evaluation of the remaining data set.

- If frequency of detection for any radionuclide was zero, no scaling factor was derived.
- If the frequency of detection was less than or equal to 5, the maximum ratio of the detected concentration results were used as the scaling factor for those analytes.
- If the frequency of detection exceeded 5 samples, then ratios from all sample data with SOF less than 1 was used to calculate a 95% upper confidence limit of the mean (UCL_{95}). Statistical analysis was conducted to determine the distribution of scaling factor results for all detected samples with sum of the fractions (SOF) less than 1 within an EU and to calculate the UCL_{95}. The smaller of UCL_{95} value and the maximum detected concentration ratio of individual samples from the dataset was then selected as the scaling factor for that radionuclide.

The results of scaling factors for each EU are presented in Table 16.

1.0 INTRODUCTION

1.1 PURPOSE

The purposes of this report are to (1) identify radionuclide surrogates, and (2) develop scaling factors for inferred radionuclides (hard-to-detect) with respect to surrogates present in surface and subsurface soil at the site. The site-specific derived concentration guideline levels (DCGLs) were developed and published in the report "Derivation of site-specific DCGLs for Westinghouse Electric Company Hematite Facility" (Ref 5). The information regarding scaling factors and the DCGLs can then be used to determine the relative importance of each radionuclide to the final dose calculation, and to optimize the sample analysis protocol for the site.

1.2 SCOPE

"Derivation of Site-Specific DCGLs for Westinghouse Electric Company Hematite Facility" (Ref 5) identifies the following radionuclides of concern for the site: U-234, U-235, U-238, Tc-99, Th-232 and progeny, Am-241, Np-237, and Pu-239. However, based on a review of the site operational history and current data, Am-241, Np-237, Pu-239, and Th-232 are expected to be present in trace quantities; therefore, this evaluation focuses on these radionuclides. In addition, this evaluation addresses both Tc-99 and U-234. This evaluation does not address groundwater contamination (i.e., groundwater data), although the DCGL document does consider the migration of radionuclides to groundwater as a potential exposure pathway.

2.0 SITE RADIOLOGICAL CHARACTERISTICS

Forty-five (45) years of processing nuclear material and formerly authorized on-site disposal of process waste has resulted in radioactive contamination of soils at the Hematite site. The primary operations that were conducted at the facility included the manufacture of uranium metal and uranium compounds from natural and enriched uranium for use as nuclear fuel. Certain areas within the facility were dedicated to particular production processes as well as certain types of work (i.e., low enriched processes versus highly enriched processes). Other areas of the facility were used for storage, and again were separated primarily by degree of enriched material or product stored.

Spent nuclear fuel was recycled and the recycled material then used as feed in the uranium enrichment (gaseous diffusion) facilities. This resulted in the potential presence of transuranic radionuclides (elements with an atomic number greater than the atomic number of uranium) and Tc-99 in some of the uranium stock used at the site. Transuranic radionuclides that have been or may be found in trace quantities in surface and subsurface soil include Am-241, Np-237 and Pu-239.

Am-241, Np-237, Pu-239, and Th-232 are all alpha and gamma radiation emitters and are heavy metals. These radionuclides are expected to be at concentrations that are insignificant as compared to the uranium concentrations found at the site.

3.0 METHODOLOGY

The methodology described in "An Approach Toward Minimization of Sample Analysis Costs for Mixed Radionuclides using MARSSIM for a Final Status Survey" (Ref 3) was used as the basis to identify radionuclide surrogates and to establish scaling factors for inferred radionuclide concentrations present at the site. The methodology consists of the following steps:

(1) Define the DCGL for each radionuclide of concern;

(2) Identify the EUs for the site;

(3) Organize and reduce site characterization data with respect to each EU;

(4) Review of site-related and process-related literature, site history, and conduct correlation statistical analysis by using site characterization data to establish a relationship between surrogates and radionuclides of concern present at each EU;

(5) Determine scaling factors for inferred radionuclides as well as Tc-99 and U-234 at each EU.

These steps are discussed below in more detail.

3.1 DEFINE THE DCGL FOR EACH RADIONUCLIDE OF CONCERN

The site-specific DCGLs were developed and published (Ref 5). As presented in this report, DCGLs were derived for surface (top 15 centimeter (cm)) and volumetric (0-2 meters) sources. Table 1 summarizes the DCGLs for radionuclides of concern at the Westinghouse Hematite site.

Table 1. Soil DCGLs[1]

Radionuclide	Surface Soil (pCi/g)	Volumetric Soils (pCi/g)
Am-241	117	40
Np-237+D	1.4	0.11
Pu-239	129	43
Tc-99	140	23
Th-232+C	3.7	1.5
U-234	518	188
U-235+D	63	35
U-238+D	224	127

[1] Based on a resident farmer scenario. Changes to the DCGL for the Hematite Site may affect the results of this report.

3.2 SITE EXPOSURE UNITS

The Hematite Site has been divided into fifteen Areas of Concern (AOC) based on the Hematite Site Remedial Investigation Feasibility Study Work Plan (Ref 1). The fifteen AOCs are listed in Table 2 below.

Table 2. Site AOCs

AOC Number	Name of AOC
1	Site Groundwater
2	Site Pond, Site Creek, and Northeast Site Creek
3	Burial Pits
4	Evaporation Ponds
5	Former Leach Field / Sanitary Sewer
6	Soil Beneath Buildings
7	Limestone Storage and Fill
8	Outdoor and Shallow Surface Area
9	Former Gas Station
10	Gas Pipeline
11	Red Room Roof Burial Area
12	Domestic Well # 3
13	Deul's Mountain
14	Cistern Burn Pit
15	Joachim Creek Bridge

During this evaluation, site locations were grouped into four EUs based on the activities conducted during site operations. These EUs are listed below.

EU-1 – Main facility boundary footprint,

EU-2 – Outlying areas of the site,

EU-3 – Surface water features, and

EU-4 – Groundwater.

The main facility boundary footprint (EU-1) includes AOC numbers 3, 4, 6, 7, 8, 11, 13, and 14. The concentration of Tc-99 is much higher in the Evaporation Ponds (AOC #4) within EU 1 as compared to other AOCs. Therefore, EU 1 was further divided into two EUs – the Evaporation Ponds (EU-1B) and the rest of main facility boundary footprint (EU-1A). The outlying area (EU-2) consists of property outside of the main facility footprint and includes AOC numbers 9 and 10 (portions within EU-1). The surface water features (EU-3) includes AOC numbers 2 and 15. EU-4 includes site groundwater AOC

1. However, site groundwater is not within the scope of this evaluation. Since soil sampling activities were not conducted at remainder of the AOC areas, they are not included in the EUs.

3.3 ORGANIZATION AND REDUCTION OF SITE CHARACTERIZATION DATA

All data were organized with respect to EUs. The data was then reduced and evaluated prior to performing the statistical analysis. Results for quality control samples were excluded from this evaluation. The sampling results for Am-241 and Np-237 include both gamma and alpha spectroscopy results. The evaluation included only alpha spectroscopy sampling results when both gamma and alpha results were available for the same sample. U-238 is assumed to be in secular equilibrium with its daughter product, Th-234. Therefore, Th-234 sampling results were used as the concentration results for U-238 except when samples were analyzed for isotopic uranium via alpha spectroscopy. For such cases, the U-238 activity from alpha spectroscopy was used.

Site characterization sampling results within each EU were divided into two different datasets based on surface soil and volumetric soil sources. The samples that were collected from the top 15 centimeter (cm) were assumed to be representative of surface soil for the purpose of this evaluation. The dataset containing samples collected below 15 cm were considered representative of volumetric soil. Each dataset was then further organized with respect to the four EUs.

The SOF for each sample within each EU was calculated by adding the ratios of the concentrations of all radionuclides of concern to their corresponding DCGLs. Prior to calculation of SOF, the background concentration for Th-232 was subtracted from the sampling results for each Th-232 sample result. All other radionuclides were evaluated without background corrections. Since the scaling factor for each radionuclide is meant to be representative of the residual site condition after remediation, only sampling results with SOF<1 were used during the evaluation to calculate scaling factors.

3.4 REVIEW OF LITERATURE AND ANALYSES OF SITE CHARACTERIZATION DATA

Site-related literature was reviewed and statistical analyses performed to identify potential surrogates for difficult to measure radionuclides. The following sections summarize results of both literature reviews and statistical analyses.

3.4.1 Radionuclides of Concern and Detection Capabilities

The Hematite Site was primarily used for the manufacturing of uranium metal and uranium compounds for nuclear fuel, using natural and enriched uranium. Also, a limited amount of work was performed with thorium compounds as part of early research into the use of thorium in the fuel cycle. Any thorium present in surface and subsurface soils is assumed to be derived from naturally occurring Th-232 in secular equilibrium with its progeny, (i.e. radium-228 (Ra-228), actinium-228 (Ac-228) and thorium-228 (Th-228)). As indicated in previous sections, some of the feed material may have

contained trace quantities of transuranic radionuclides and Tc-99. The radionuclides of potential concern in surface and subsurface soil at the site are provided in Table 3.

Table 3. Radionuclides of Potential Concern

Radionuclide	Half-life (yrs)	Primary Decay Mode
Am-241	432.2	Alpha
Np-237+D	2.14E6	Alpha
Pu-239	2.41E4	Alpha
Tc-99	2.13E5	Beta
Th-232+C	1.41E10	Alpha
U-234	2.44E5	Alpha
U-235+D	7.04E8	Alpha
U-238+D	4.47E9	Alpha

The first step to establish surrogates for estimating the activity of inferred radionuclides is to determine which radionuclides can be readily measured using standard laboratory equipment and minimal sample preparation requirements (i.e., gamma spectroscopy). Although x-rays and/or gammas accompany the decay of each of the radionuclides identified in Table 3, the energies and/or abundance may be sufficiently low that direct measurement and quantification via gamma spectroscopy is difficult, if not impossible with reasonable counting times. Additionally, the minimum detectable concentration (MDC) must be sufficiently low to evaluate each radionuclide against the established DCGL and, when multiple radionuclides are present, verify that the SOF does not exceed unity.

Of the radionuclides listed in Table 3, the following emit gammas of sufficient energy and abundance to be measured directly via gamma spectroscopy, with a target MDC of 10% of the applicable DCGL:

- Am-241
- U-235

If radioactive decay of the radionuclides results in a radioactive daughter that emits gammas of sufficient energy and abundance and the relationship between the parent and daughter is known, (i.e., secular equilibrium), the activity of the parent can be determined by measuring the activity of the daughter. Of the radionuclides of concern in Table 3, the following can be quantified using the daughter measured activity:

- Th-232 (using Ac-228)
- U-238 (using Th-234)

In these instances, the radioactive daughters are assumed to be in secular equilibrium. Therefore, the activity of the daughter is equal to the activity of the parent and the ratio is 1:1.

Although Np-237 emits several gammas, these gamma energies are very low. The daughter radionuclide, protactinium-233 (Pa-233), which is in secular equilibrium, also emits gammas which are measurable via gamma spectroscopy. However, because the Np-237 DCGL is so low, achieving the target MDC can not be achieved without very long count times. Therefore, this radionuclide was excluded from those that could be measured directly or by use of a daughter radionuclide.

As indicated in Table 3, Tc-99 decays by emission of beta particles. Although beta decay of Tc-99 is accompanied by gamma emission, the gammas are not of sufficient energy or abundance to be measured directly. It is possible to quantify Tc-99 activity using liquid scintillation counting techniques. However, this requires significant sample preparation for analysis (compared to gamma spectroscopy). Therefore, to accomplish the stated purpose of this report, it is necessary to establish a surrogate for quantifying Tc-99 activity.

The following sections provide an evaluation of potential surrogates and, if possible, establish a surrogate to inferred radionuclide scaling factor for the following remaining radionuclides from Table 3:

- Np-237
- Pu-239
- Tc-99
- U-234

3.4.2 Radionuclide Transport in Soil

The next step to establish surrogates for estimating the activity of inferred radionuclides is to determine if there are similarities in radionuclide transport in the media of interest (i.e., soil). One of the primary mechanisms for contaminant transport is vertical contaminant migration downward to the groundwater. Contaminants generally move as a dissolved phase in water, and their rates of migration are controlled both by water migration rates and by adsorption and desorption reactions involving the surrounding soils. Some contaminants are strongly sorbed on soils, and their downward movement through the stratigraphic column is greatly retarded. The equilibrium distribution coefficient, K_d, is the amount of radionuclide sorbed on sediment divided by the amount of radionuclide left in solution. It is a measure of the transport of radionuclides through porous geology. Radionuclides with low values of K_d are more easily transported.

Table 4 lists the site-specific K_d for radioisotopes of concern as reported in the "Determination of Distribution Coefficients for Radionuclides of Concern at the Westinghouse Hematite Facility" (Ref 4). As seen from the table, there are both contaminants that tend not to leach, such as plutonium, thorium, americium as well as contaminants that may be transported to groundwater, such as neptunium, technetium, and uranium. This information was used in Section 5 during the selection of surrogates for inferred radionuclides.

Table 4. Radionuclide Distribution Coefficient (K_d) and Solubility

Radionuclide	K_d	Solubility
Tc-99	106	Soluble
Th-228, 230 and 232	60,000	Insoluble
U-234, 235 and 238	175	Soluble
Pu-238, 239 and 240	2,000	Insoluble
Am-241	1,000	Insoluble
Np-237	2	Soluble

3.4.3 Statistical Analyses of Site Characterization Data

Statistical analysis was conducted on both surface and volumetric soil sampling results to establish relationships between radionuclides present at the Hematite Site. Pearson correlation statistical analysis was used to determine the correlation among all radionuclides in each EU as follows:

- If the frequency of detection for any radionuclide was less than 5% and/or the sample size for any radionuclide was less than 5, no correlation was established.
- Otherwise, a correlation was established for that radionuclide.

Minitab 13 for Windows, a comprehensive statistical and graphical analysis software package created by Minitab, Inc. (Ref 2), was used for the statistical evaluation.

Pearson correlation coefficients were determined for all possible pairs of the radionuclides of concern at the Hematite Site. Correlation statistics range from –1 (perfect negative correlation) to 1 (perfect positive correlation). Table 5 shows the nature of correlation among radionuclides based on the range of correlation coefficient values.

Table 5. Correlation Coefficient and Nature of Correlation

Correlation Coefficient	Nature of Correlation
-1 to –0.7	Strong Negative
-0.7 to –0.3	Weak Negative
-0.3 to +0.3	Little or No
0.3 to 0.7	Weak Positive
0.7 to 1.0	Strong Positive

In addition to the correlation, an associated p-value is calculated that measures the probability (ranging from 0 to 1) for which the true correlation is zero. A high p-value (close to 1) means the hypothesis of zero correlation between the variables cannot be rejected. A low p-value (< 0.10) means the hypothesis of zero correlation between the variables is rejected at the 0.10 significance level and that a significant positive or negative correlation exists between the variables.

Pearson correlation analysis requires equal sample size for all radionuclides when performing any evaluation. Therefore, several evaluations of the overall data set were necessary because the available Pu-239/240 data set (via alpha spectroscopy) and U-234, U-235, and U-238 data set (via alpha spectroscopy) were small as compared to the data set available from gamma spectroscopy analysis.

The first evaluation used alpha and gamma spectroscopy analysis results (i.e., Np-237, U-235 and U-238) and liquid scintillation counting results (i.e., Tc-99) to determine a correlation between these radionuclides. This evaluation primarily used gamma spectroscopy data for Np-237, U-235 and U-238; however, if alpha spectroscopy data was available, it was used in lieu of gamma spectroscopy data.

The second evaluation (if necessary) was performed to determine the correlation between Pu-239/240 and other radionuclides. For the second evaluation (with Pu-239/240), only samples which were analyzed for isotopic plutonium were included in the evaluation for correlation.

A third evaluation (if necessary) was conducted to determine a correlation between U-234 and other uranium isotopes (U-235 and U-238) by using the alpha spectroscopy sampling results at each EU.

3.5 DETERMINATION OF SCALING FACTORS FOR INFERRED RADIONUCLIDES

The scaling factors for inferred radionuclides were determined for each EU based on the relationship established during literature review and analysis of site characterization data. All available site characterization data was used for this step of the evaluation with the exception of samples with SOF > 1. Samples with SOF > 1 were removed from the data set for this part of the evaluation because it was assumed that these data were not representative of the site residual condition after remediation. The scaling factor for each inferred radionuclide was determined in the following manner:

- If the frequency of detection for any radionuclide was zero, no scaling factor was derived.
- If the frequency of detection was less than or equal to 5, the maximum ratio of detected concentration results was used as the scaling factor. In this case, only sampling results reported as detected were used for the determination of scaling factors in order to avoid uncertainties associated with non-detect samples.

- For each sample with SOF<1, the scaling factor for each inferred radionuclide was determined by dividing its concentration by the corresponding surrogate concentration.
- If the frequency of detection exceeded 5 samples, the 95% upper confidence limit of the mean (UCL_{95}) was determined using the Environmental Protection Agency's (EPA) software ProUCL Version 3.0 based on the distribution of the scaling factors for individual samples (including samples reported as non-detects).
- The smaller of the UCL_{95} value and the maximum detected concentration ratio of individual samples from the dataset was then selected as the scaling factor for that radionuclide.

Reasonably conservative values of scaling factors were developed in order to ensure that the number of samples required was not underestimated when a sample analysis protocol is established later in the project.

4.0 RESULTS OF STATISTICAL ANALYSES

Pearson correlation statistical analysis was performed for both surface soil and volumetric soil data for each EU. The results of the analyses are presented below.

4.1 SURFACE SOIL SOURCES

Appendix A presents the surface soil characterization sampling results for each EU. Table 6 presents summary statistics of surface soil characterization sampling results for each EU.

Table 6. Summary Statistics for Surface Soil Sampling Results

EUs	Radionuclides	Type of Sample	Number of Sample	Frequency of Detection	Concentration (pCi/g)	
					Maximum	Minimum
EU-1A	Americium-241	Detect	2	3%	2.94	2.3
		Non-Detect	67		3.8	-1.77
	Neptunium-237	Detect	6	9%	0.12	0.02
		Non-Detect	63		0.13	-17.8
	Plutonium 239/240	Detect	4	24%	0.014	0.007
		Non-Detect	13		0.008	0.0001
	Technetium-99	Detect	46	67%	691	0.90
		Non-Detect	23		0.93	0.03
	Uranium-238	Detect	38	55%	705	1
		Non-Detect	31		3.4	-0.47
	Uranium-234	Detect	3	100%	472	1.93
	Uranium-235	Detect	27	39%	308	0.13
		Non-Detect	42		1.26	-0.22
EU-1B	Americium-241	Detect	2	17%	3.12	1.04
		Non-Detect	10		1.8	-0.06
	Neptunium-237	Detect	4	33%	0.58	0.04
		Non-Detect	8		0.15	-39.6
	Plutonium 239/240	Detect	1	17%	0.03	0.03
		Non-Detect	5		0.01	0.00004
	Technetium-99	Detect	12	100%	17100	5.24
		Non-Detect	0		0	0
	Uranium-238	Detect	12	100%	550	4.12
		Non-Detect	0		0	0
	Uranium-234	Detect	1	100%	103	103
	Uranium-235	Detect	11	92%	184	4.26
		Non-Detect	1		0.74	0.74

Table 6. Summary Statistics for Surface Soil Sampling Results (con't)

EUs	Radionuclides	Type of Sample	Number of Sample	Frequency of Detection	Concentration (pCi/g)	
					Maximum	Minimum
EU-2	Americium-241	Detect	0	0%	0	0
		Non-Detect	24		0.54	-0.30
	Neptunium-237	Detect	0	0%	0	0
		Non-Detect	24		0.122	-9.52
	Plutonium 239/240	Detect	2	67%	0.033	0.016
		Non-Detect	1		0.007	0.007
EU-2	Technetium-99	Detect	0	0%	0	0
		Non-Detect	24		2.34	-0.293
	Uranium-238	Detect	6	25%	3.21	0.80
		Non-Detect	18		1.75	-0.48
	Uranium-234	Detect	4	100%	1.12	0.759
	Uranium-235	Detect	5	21%	0.68	0.03
		Non-Detect	19		0.43	-0.29
EU-3	Americium-241	Detect	0	0%	0	0
		Non-Detect	25		0.37	-0.63
	Neptunium-237	Detect	2	8%	0.03	0.03
		Non-Detect	23		0.096	-7.1
	Plutonium 239/240	Detect	0	0%	0	0
		Non-Detect	8		0.012	-0.002
	Technetium-99	Detect	15	60%	284	1.2
		Non-Detect	10		0.81	-0.23
	Uranium-238	Detect	20	59%	84.6	0.24
		Non-Detect	14		1.75	-0.43
	Uranium-234	Detect	17	100%	937	0.25
	Uranium-235	Detect	16	64%	41.7	0.02
		Non-Detect	9		0.35	-0.04

Pearson correlation analysis was performed by using surface soil site characterization results for each EU. The results of the analyses for each EU are presented below.

4.1.1 Results of Correlation Analysis for EU-1A

Tables 7a and 7b present the results of Pearson correlation analyses for each radionuclide including outliers for EU-1A. The frequency of detection for Am-241 is less than 5%; therefore, no correlation was established for that radionuclide. The radionuclides with a p-value < 0.10 are shown in bold for each relationship. The results in Tables 7a and 7b indicate that for EU-1A:

- A weak positive correlation exists between U-238 and U-235.

Table 7a. Pearson Correlation Coefficients for EU-1A (w/o Pu-239/240) (Relationship between Np-237, Tc-99, U-238, and U-235)

Nuclide	Statistics	Np-237	Tc-99	U-238
Tc-99	Correlation	**-0.286**	--	--
	p value	**0.017**	--	--
U-238	Correlation	0.109	0.078	--
	p value	0.371	0.524	--
U-235	Correlation	0.111	0.13	**0.5**
	p value	0.363	0.289	**0**

Table 7b. Pearson Correlation Coefficients for EU-1A (with Pu-239/240) (Relationship between Np-237, Pu-239/240, Tc-99, U-238, and U-235)

Nuclide	Statistics	Np-237	Tc-99	U-235	U-238
Pu-239/240	Correlation	-0.093	-0.098	0.056	-0.238
	p value	0.723	0.708	0.83	0.357
U-238	Correlation	**0.88**	-0.075	**0.801**	--
	p value	**0**	0.776	**0**	--

4.1.2 Results of Correlation Analysis for EU-1B

Tables 8a and 8b present the results of Pearson correlation analyses for each radionuclide in EU-1B. The radionuclides with a p-value < 0.10 are shown in bold for each relationship. The results in Tables 8a and 8b indicate that for EU-1B:

- Both U-238 and U-235 have strong positive correlations with Am-241.
- Np-237 has strong positive correlation with Pu-239/240.
- A strong positive correlation exists between U-235 and U-238.

Table 8a. Pearson Correlation Coefficients for EU-1B (w/o Pu-239/240) (Relationship between Am-241, Np-237, Tc-99, U-238, and U-235)

Nuclide	Statistics	Am-241	Np-237	Tc-99	U-238
Np-237	Correlation	0.198	--	--	--
	p value	0.537	--	--	--
Tc-99	Correlation	0.331	-0.104	--	--
	p value	0.293	0.747	--	--
U-238	Correlation	**0.946**	0.149	0.311	--
	p value	**0**	0.644	0.326	--
U-235	Correlation	**0.916**	0.159	0.059	**0.874**
	p value	**0**	0.622	0.857	**0**

Table 8b. Pearson Correlation Coefficients for EU-1B (with Pu-239/240) (Relationship between Am-241, Np-237, Pu-239/240, Tc-99, U-238, and U-235)

Nuclide	Statistics	Am-241	Np-237	Tc-99	U-235	U-238
Pu-239/240	Correlation	-0.012	**0.85**	-0.34	0.127	-0.126
	p value	0.982	**0.032**	0.509	0.811	0.812
U-238	Correlation	**0.965**	0.226	**0.964**	**0.965**	--
	p value	**0.002**	0.667	**0.002**	**0.002**	--

4.1.3 Results of Correlation Analysis for EU-2

Table 6 shows that the frequency of detection for Am-241, Np-237 and Tc-99 is zero and the sample size for Pu-239/240 is only 3, even though its frequency of detection is 67%. No correlation analysis was performed for EU-2.

4.1.4 Results of Correlation Analysis for EU-3

Table 6 shows that the frequency of detection for Am-241 and Pu-239/240 is zero; therefore, no correlation analysis was performed for these radionuclides in EU-3. Tables 9a and 9b present the results of Pearson correlation analyses for other radionuclides in EU-3. The radionuclides with a p-value < 0.10 are shown in bold for each relationship. The results in Tables 9a and 9b indicate that for EU-3:

- Tc-99 has a strong positive correlation with U-238 and U-235.
- A strong positive correlation exists between U-235 and U-238.
- U-235 has a perfect positive correlation with U-234.
- U-238 has a strong positive correlation with U-234.

Table 9a. Pearson Correlation Coefficients for EU-3 (Relationship between Np-237, Tc-99, U-238, and U-235)

Nuclide	Statistics	Np-237	Tc-99	U-238
Tc-99	Correlation	0.13	--	--
	p value	0.536	--	--
U-238	Correlation	0.155	**0.82**	--
	p value	0.459	**0**	--
U-235	Correlation	0.137	**0.828**	**0.988**
	p value	0.514	**0**	**0**

Table 9b. Pearson Correlation Coefficients for Uranium at EU-3 (Relationship between U-234, U-235 and U-238 using alpha spectroscopy data)

Nuclide	Statistics	U-234	U-235
U-235	Correlation	**1**	--
	p value	**0**	--
U-238	Correlation	**0.985**	**0.989**
	p value	**0**	**0**

4.2 VOLUMETRIC SOIL SOURCES

Summary statistics were performed for each EU by using the appropriate site characterization sampling results. Appendix B presents the volumetric soil characterization sampling results for each EU. Table 10 presents the volumetric soil characterization data summary statistics for each EU.

Table 10. Summary Statistics for Volumetric Soil Sampling Results

EUs	Radionuclides	Type of Sample	Number of Sample	Frequency of Detection	Concentration (pCi/g)	
					Maximum	Minimum
EU-1A	Americium-241	Detect	13	5%	2.94	-0.04
		Non-Detect	246		3.8	-1.77
	Neptunium-237	Detect	13	5%	6	0.002
		Non-Detect	246		13	-26.3
	Plutonium 239/240	Detect	10	26%	0.01	0.003
		Non-Detect	29		0.008	-0.002
	Technetium-99	Detect	70	30%	691	0.79
		Non-Detect	167		1.39	-0.83
	Uranium-238	Detect	62	25%	705	0.76
		Non-Detect	189		3.4	-1.9
	Uranium-234	Detect	21	100%	604	0.71
	Uranium-235	Detect	50	20%	308	0.02
		Non-Detect	201		1.26	-0.4
EU-1B	Americium-241	Detect	2	5%	3.12	1.04
		Non-Detect	39		1.8	-0.45
	Neptunium-237	Detect	4	10%	0.58	0.04
		Non-Detect	37		6.17	-39.6
	Plutonium 239/240	Detect	3	33%	0.03	0.005
		Non-Detect	6		0.01	0.00
	Technetium-99	Detect	35	85%	17100	1.17
		Non-Detect	6		1.45	0.06
	Uranium-238	Detect	18	44%	550	1.13
		Non-Detect	23		2.64	-1.87
	Uranium-234	Detect	3	100%	103	2.42
	Uranium-235	Detect	17	41%	184	0.148
		Non-Detect	24		0.74	-0.27
EU-2	Americium-241	Detect	0	0%	0	0
		Non-Detect	163		0.54	-0.57
	Neptunium-237	Detect	1	1%	0.35	0.35
		Non-Detect	162		13.4	-17.3
	Plutonium 239/240	Detect	2	67%	0.03	0.02
		Non-Detect	1		0.01	0.01
	Technetium-99	Detect	2	1%	1.68	0.83
		Non-Detect	161		2.34	-0.44
	Uranium-238	Detect	16	10%	3.21	0.37
		Non-Detect	148		2.74	-1.13
	Uranium-234	Detect	13	100%	1.7	0.49

Table 10. Summary Statistics for Volumetric Soil Sampling Results (con't)

EUs	Radionuclides	Type of Sample	Number of Sample	Frequency of Detection	Concentration (pCi/g)	
					Maximum	Minimum
EU-2	Uranium-235	Detect	14	9%	0.68	0.02
		Non-Detect	149		0.67	-0.54
EU-3	Americium-241	Detect	0	0%	0	0
		Non-Detect	41		0.37	-0.63
	Neptunium-237	Detect	3	7%	0.15	0.03
		Non-Detect	38		0.11	-9.18
	Plutonium 239/240	Detect	0	0%	0	0
		Non-Detect	9		0.01	-0.002
	Technetium-99	Detect	17	41%	284	0.907
		Non-Detect	24		0.81	-0.23
	Uranium-238	Detect	23	44%	84.6	0.24
		Non-Detect	18		2.55	-0.52
	Uranium-234	Detect	19	100%	937	0.25
	Uranium-235	Detect	18	44%	41.7	0.02
		Non-Detect	23		0.53	-0.42

Pearson correlation analyses were performed by using site volumetric soil sources results for each EU. The results of the analyses for each EU are presented below.

4.2.1 Results of Correlation Analysis for EU-1A

Tables 11a, 11b and 11c present the results of Pearson correlation analyses for each radionuclide in EU-1A. The radionuclides with a p-value < 0.10 are shown in bold for each relationship. The results in Tables 11a, 11b, and 11c indicate that for EU-1A:

- U-235 has an almost perfect positive correlation with U-234.
- U-238 has a strong positive correlation with U-234 and U-235.

Table 11a. Pearson Correlation Coefficients for EU-1A (w/o Pu-239/240)
(Relationship between Am-241, Np-237, Tc-99, U-238, and U-235)

Nuclide	Statistics	Am-241	Np-237	Tc-99	U-238
Np-237	Correlation	0.025	--	--	--
	p value	0.744	--	--	--
Tc-99	Correlation	-0.076	0.075	--	--
	p value	0.33	0.337	--	--
U-238	Correlation	-0.498	0.051	0.061	--
	p value	0	0.511	0.436	--
U-235	Correlation	-0.444	0.153	0.014	**0.954**
	p value	0	0.049	0.853	**0**

Table 11b. Pearson Correlation Coefficients for EU-1A (with Pu-239/240) (Relationship between Am-241, Np-237, Pu-239/240, Tc-99, U-238, and U-235)

Nuclide	Statistics	Am-241	Np-237	Tc-99	U-235	U-238
Pu-239/240	Correlation	0.329	0.046	0.035	0.229	-0.086
	p value	0.109	0.828	0.869	0.27	0.682
U-238	Correlation	0.366	**0.886**	0.002	**0.798**	--
	p value	0.072	**0**	0.991	**0**	--

Table 11c. Pearson Correlation Coefficients for Uranium at EU-1A (Relationship between U-234, U-235 and U-238 using alpha spectroscopy data)

Nuclide	Statistics	U-234	U-235
U-235	Correlation	**0.999**	--
	p value	**0**	--
U-238	Correlation	**0.719**	**0.743**
	p value	**0**	**0**

4.2.2 Results of Correlation Analysis for EU-1B

Tables 12a and 12b present the results of Pearson correlation analyses for each radionuclide in EU-1B. The radionuclides with a p-value < 0.10 are shown in bold for each relationship. The results in Tables 12a and 12b indicate that for EU-1B:

- Am-241 has weak positive correlation with Tc-99 and a strong positive correlation with U-238 and U-235.
- Tc-99 has a weak positive correlation with U-238.
- A strong positive correlation exists between Np-237 and Pu-239.
- U-238 has strong positive correlation with U-235.

Table 12a. Pearson Correlation Coefficients for EU-1B (w/o Pu-239/240) (Relationship between Am-241, Np-237, Tc-99, U-238, and U-235)

Nuclide	Statistics	Am-241	Np-237	Tc-99	U-238
Np-237	Correlation	0.123	--	--	--
	p value	0.442	--	--	--
Tc-99	Correlation	**0.399**	-0.103	--	--
	p value	**0.01**	0.523	--	--
U-238	Correlation	**0.896**	0.08	**0.407**	--
	p value	**0**	0.621	**0.008**	--
U-235	Correlation	**0.876**	0.086	0.203	**0.906**
	p value	**0**	0.594	0.202	**0**

Table 12b. Pearson Correlation Coefficients for EU-1B (with Pu-239/240) (Relationship between Am-241, Np-237, Pu-239/240, Tc-99, U-238, and U-235)

Nuclide	Statistics	Am-241	Np-237	Tc-99	U-235	U-238
Pu-239/240	Correlation	0.078	**0.822**	-0.239	0.223	-0.01
	p value	0.842	**0.007**	0.535	0.565	0.98
U-238	Correlation	**0.966**	**0.315**	**0.959**	0.966	--
	p value	**0**	**0.409**	**0**	**0**	--

4.2.3 Results of Correlation Analysis for EU-2

Table 10 shows that the frequency of detection for Am-241, Np-237 and Tc-99 are less than 5%, and the sample size for Pu-239/240 is only 3, even though its frequency of detection is 67%. No correlation analysis was performed for those inferred radionuclides in EU-2. Table 13 presents the results of Pearson correlation analysis for uranium isotopes in EU-2. The results show that both U-235 and U-238 have perfect and almost perfect positive correlations with U-234, respectively. There is an almost perfect positive correlation between U-235 and U-238.

Table 13. Pearson Correlation Coefficients for Uranium at EU-2 (Relationship between U-234, U-235 and U-238 using alpha spectroscopy data)

Nuclide	Statistics	U-234	U-235
U-235	Correlation	**1**	--
	p value	**0**	--
U-238	Correlation	**0.997**	**0.998**
	p value	**0**	**0**

4.2.4 Results of Correlation Analysis for EU-3

Table 10 shows that the frequency of detection for Am-241 and Pu-239/240 are zero; therefore, no correlation analysis was performed for those inferred radionuclides in EU 3. Tables 14a and 14b present the results of Pearson correlation analyses for other radionuclides in EU-3. The radionuclides with a p-value < 0.10 are shown in bold for each relationship. The results in Table 14a and 14b indicate that for EU-3:

- Both U-235 and U-238 have an almost perfect positive correlation with U-234.
- Tc-99 has strong positive correlations with U-238 and U-235.
- A strong positive correlation exists between U-235 and U-238.

Table 14a. Pearson Correlation Coefficients for EU-3 (Relationship between Np-237, Tc-99, U-238, and U-235)

Nuclide	Statistics	Np-237	Tc-99	U-238
Tc-99	Correlation	0.135	--	--
	p value	0.4	--	--
U-238	Correlation	0.172	**0.815**	--
	p value	0.281	**0**	--
U-235	Correlation	0.173	**0.806**	**0.984**
	p value	0.279	**0**	**0**

Table 14b. Pearson Correlation Coefficients for Uranium at EU-3 (Relationship between U-234, U-235 and U-238 using alpha spectroscopy data)

Nuclide	Statistics	U-234	U-235
U-235	Correlation	**0.999**	--
	p value	**0**	--
U-238	Correlation	**0.985**	**0.986**
	p value	**0**	**0**

5.0 RECOMMENDED SURROGATES FOR INFERRED RADIONUCLIDES

Site specific literature was reviewed and sampling results for U-238, U-235, U-234, Tc-99, Am-241, Np-237, and Pu-239/240 were evaluated against each other to determine if a relationship exists between radionuclides to provide justification for use as a surrogate radionuclide. The analyses were performed for both surface soil and volumetric soil sources. The results of the statistical analysis are summarized in Table 15.

Tc-99

The results indicate that U-238 has positive correlation with Tc-99 in EU-1B (volumetric soil) and EU-3 (both surface and volumetric soil) when all U-238 (gamma and alpha spectroscopy) and Tc-99 data in the EU are evaluated. Also, when only U-238 alpha spectroscopy data is evaluated, Tc-99 has a strong positive correlation with U-238 in EU-1B surface and volumetric soils.

Therefore U-238 was recommended as the surrogate for this radionuclide.

Np-237 and Pu-239/240

Even though sampling results for Np-237 and Pu-239/240 showed positive correlation between each other for surface and volumetric soil of EU-1B, their mobility rates are quite the opposite. Also, two hard-to-detect radionuclides cannot be used as surrogates for each other. When reviewing the K_d values among all radionuclides present at the site, the mobility rate for Np-237 is the highest (K_d = 2), whereas the mobility rate for Pu-239/240 is the second lowest (K_d = 2,000). The U-238 K_d value of 175 is comparable to that for Pu-239; however, it is much higher than that for Np-237.

Therefore, based on similarity of K_d values and the fact that U-238 is the origin of the Pu-239/240, U-238 was chosen as the surrogate for Pu-239/240.

Although a positive correlation between Np-237 and U-238 was not identified when all data (gamma and alpha spectroscopy) was evaluated, when only the alpha spectroscopy data was evaluated a strong positive correlation was identified in EU-1A (the footprint of the main facility operation area). Therefore, based on this strong positive correlation in EU-1A and the fact that U-238 is the origin of the raw material for Np-237, it is recommended that U-238 be chosen as a surrogate for Np-237.

U-234

The majority of uranium processed at the site was for commercial nuclear fuel, typically about 3% enriched in U-235. However, the site processed a variety of uranium, with a U-235 content representative of natural uranium to > 90% enrichment. As the enrichment increases, the activity of U-234 greatly increases. Therefore, there is a very broad range of calculated U-234 to U-238 ratios for the range of enrichments. However, the calculated U-234 to U-235 ratio remains fairly constant over an enrichment range of 1% to 75%, with ratio values approximating 20. Although the evaluation of sample results indicates both U-234 to U-238 and U-234 to U-235 ratios are very close to that expected

for 3% enriched uranium, U-235 was chosen as the preferred surrogate. Although the U-234 to U-235 scaling factor based on sample results (22) is slightly higher than the calculated ratio, the higher value will provide a conservative result. Therefore, it is recommended that U-235 be chosen as the surrogate for U-234.

Table 15. Selection of Surrogates for Inferred Radionuclides

Nuclide	Surrogate based on Correlation Analysis Results								Recommended Surrogate Radionuclide
	EU-1A		EU-1B		EU-2		EU-3		
	Surf.	Vol.	Surf.	Vol.	Surf.	Vol.	Surf.	Vol.	
Np-237	None **U-238**	None **U-238**	Pu-239	Pu-239	None	None	None	None	U-238
Tc-99	None	None	None **U-238**	U-238 **U-238**	None	None	U-235 U-238	U-235 U-238	U-238
Pu-239	None	None	Np-237	Np-237	None	None	ND	ND	U-238
U-234 (Alpha Spec)	ND	U-235 U-238	ND	ND	ND	U-235 U-238	U-235 U-238	U-235 U-238	U-235

Surf = Surface Soil Sources; Vol = Volumetric Soil Sources
Bolded = correlation based on alpha spectroscopy results for U, Pu, Np, Am. Tc-99 was also evaluated for correlation.
ND = Not Determined due to data set having less than 5 samples or a frequency of detection less than 5%.

6.0 DETERMINATION OF SCALING FACTORS

Appendices D, E, and F present the calculation of scaling factors for surface soil, volumetric soils, and uranium isotopes, respectively. Table 16 summarizes the results of scaling factor calculations for each EU. The table also includes the distribution determined for each dataset.

Table 16. Scaling Factors

Radionuclide		EU-1A				EU-1B				EU-3			
Inferred	Surrogate	Surface		Volume		Surface		Volume		Surface		Volume	
		Dist[1]	K[2]	Dist[1]	K[2]	Dist[1]	K[2]	Dist[1]	K[2]	Dist[1]	K[2]	Dist[1]	K[2]
Np-237	U-238	ND	0	O	0.0007	O	0.0014	O	0.0014	ND	0	ND	0
Pu-239		O	0.0081	O	0.0081	ND	0	O	0.0042	ND	0	ND	0
Tc-99		G	11.61	G	8.22	O	5.7	G	3.23	G	4.48	L	4.85
U-234[3]	U-235	22											

[1] Dist. = Distribution (L = Lognormal; G = Gamma: O = Less than 5 detected samples, so maximum detected ratio was selected; ND = No detected sample)
[2] K = Scaling Factor;
[3] Scaling factor for U-234 was determined by using alpha spec sampling results for all EUs.

7.0 CONCLUSIONS

The purposes of this report were to:

- Identify radionuclide surrogates, and
- Develop scaling factors for inferred radionuclides (hard-to-detect) with respect to surrogates present in surface and subsurface soil, at the site.

Pearson correlation analysis was used to determine if statistical relationships exist between radionuclides of concern at the Hematite Site. The results of the Pearson correlation analyses showed that:

- U-238 has significant positive correlation with Tc-99 and Np-237; therefore, U-238 is recommended as a surrogate for both of those radionuclides.
- Np-237 has a positive correlation with Pu-239/240; however, the mobility for these radionuclides are significantly different. On the other hand, the mobility rates for U-238 and Pu-239/240 are comparable. Since U-238 is the origin of the raw material for Pu-239/240, U-238 is recommended as a surrogate for Pu-239/240.
- U-235 has perfect positive correlation with U-234, hence, it is recommended as the surrogate for U-234.

Once the appropriate relationship was determined, scaling factors could be calculated based on these relationships. Scaling factors are presented in Table 16 for each EU for discussion purposes. The final evaluation of scaling factors will result in a single scaling factor for each radionuclide of concern at the site.

When individual scaling factors for radionuclides of concern at the site are finalized, the final scaling factors and the DCGLs may then be used to determine the relative importance of each radionuclide to the final dose calculation, and to optimize the sample analysis protocol for the site.

8.0 REFERENCES

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APPENDIX A

SAMPLING RESULTS AND SUMMARY STATISTICS OF SURFACE SOILS FOR EUs 1-3

Summary Statistics for EU-1A Surface Soil

	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
# of Samples	2	67	6	63	4	13	46	23	38	31	3	27	42
Frequency of Detection	3%		9%		24%		67%		55%		100%	39%	
Max Concentration	2.94	3.8	0.119	0.126	0.0144	0.00844	691	0.929	705	3.4	472	308	1.26
Min Concentration	2.3	-1.77	0.0184	-17.8	0.00706	0.00008	0.902	0.0335	1	-0.473	1.93	0.127	-0.217

Sampling Results for EU-1A Surface Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
BD-09-00-SL		0.03		0.01		0.00	86.90		4.26			3.63	
BD-10-00-SL		3.80		0.05			176.00		389.00			104	
BD-11-00-SL		1.66		-0.04			19.00		432.00			102	
BD-12-00-SL		1.94	0.06		0.01		574.00		36.20			20.2	
BP-01-00-SL		0.04		-0.04				0.59	2.27				0.24
BP-02-00-SL		-0.08		-0.05			1.13			1.03			0.40
BP-03-00-SL		0.26	0.04		0.01		8.83		27.00			35.3	
BP-04-00-SL		0.01		0.00		0.00	68.30		4.43			1.2	
BP-05-00-SL		-0.04		0.05			2.81			1.97			0.19
BP-06-00-SL		0.08		-0.04			6.36		2.33				0.46
BP-07-00-SL		0.57	0.07			0.01	26.30		53.90			53.5	
BP-08-00-SL		-0.09		-0.13				0.0335	31.40				0.87
BP-09-00-SL		0.14		-0.10				0.495	2.03				0.22
BP-10-00-SL		0.17		0.03				0.546		2.09			-0.22
BP-11-00-SL		-0.19		-3.25				0.295		1.77			0.18
BP-12-00-SL		-0.14		-0.11				0.175	1		2.35	0.138	
CB-01-00-SL		-0.142		0.01		0.00	5.15		18.40			2.87	
DM-01-00-SL	2.3			0.02			35.8		102.00			308	
DM-02-00-SL	2.94			0.05			154		451.00			237	
LF-01-00-SL		-0.11		-0.04			5.49			2.20			0.59
LF-02-00-SL		0.01		-0.01			0.902			0.64			0.17
LF-03-00-SL		0.04		-6.69			1.56			0.52			0.28
LF-04-00-SL		0.30		0.13			2.38			1.23			0.12
LF-05-00-SL		0.03		-0.03			12.3		2.38				0.56
NB-20-00-SL		0.01		-10.60				0.24		1.57			-0.12
NB-21-00-SL		0.09		0.01				0.0628		1.06			0.42
OA-01-00-SL		-0.02		0.02	0.0144		10.3		16.50			4.57	
OA-02-00-SL		0.14		0.01		0.00503	7.39		9.10			3.61	
OA-03-00-SL		-0.29		-4.40				0.396		0.69			0.17

Sampling Results for EU-1A Surface Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
OA-04-00-SL		-1.77		0.04				0.588	705.00			12.2	
OA-05-00-SL		0.06		0.03				0.451	3.64				0.78
OA-06-00-SL		-0.02		-0.06				0.41	2.02				0.11
OA-07-00-SL		0.10		0.00		0.00113	1.59		5.76			1.51	
OA-08-00-SL		0.98	0.02			0.00629	58.1		74.3		472	19.5	
OA-09-00-SL		-0.24		-2.76				0.695		1.03			0.00
OA-10-00-SL		-0.42		0.00			20.8			0.67			0.35
OA-11-00-SL		-0.10		0.01		0.00844	53		9.04			2.71	
OA-12-00-SL		-0.55		0.05			1.64			1.34			0.49
OA-13-00-SL		0.08		-12.00			5.85		10.80			3.6	
OA-14-00-SL		0.37		-0.14			12.4		5.22			1.14	
OA-15-00-SL		-0.24		0.12			8.22			-0.47			0.63
OA-16-00-SL		-0.19		0.01		0.00203	21.3			3.40		1.03	
OA-20-00-SL		0.28		-0.01			52.6		2.93				0.58
OA-21-00-SL		0.33		-17.80			640		17.60			2.88	
OA-22-00-SL		0.08		0.00		0.00322	691		8.43			1.86	
OA-23-00-SL		-0.05		-0.10			189		34.40			120	
OA-24-00-SL		-0.46		-0.04			13.1			1.47			0.17
OA-25-00-SL		-0.13		-0.19			87.6		4.73				1.26
OA-26-00-SL		-0.11	0.12			0.00338	109		165.00			39	
OA-27-00-SL		0.14		0.02				0.223		1.51			0.18
OA-28-00-SL		0.03		0.08			0.928			2.14			0.19
OA-29-00-SL		-0.14		-2.53			0.907			1.57			0.02
OA-30-00-SL		-0.07		-5.14				0.145		1.74			0.00
OA-31-00-SL		0.10		-3.79				0.154		0.47			0.18
OA-32-00-SL		-0.04		-0.25				0.333	2.94				0.25
OA-33-00-SL		0.05		0.00				0.437		1.76			0.64
OA-34-00-SL		-0.26		0.01				0.9		1.77			0.34
OA-35-00-SL		-0.43		-0.01			1.57			0.94			0.06
OA-36-00-SL		-0.06		-0.09			1.39			1.71			0.07
OA-37-00-SL		-0.07		0.00	0.00872			0.278	1.08		1.93	0.127	
OA-38-00-SL		0.00		-0.08				0.929		1.27			0.07
OA-39-00-SL		0.01		-1.87			1.45			0.47			0.33
OA-40-00-SL		0.03		0.07				0.703		0.86			0.35
PL-01-00-SL		0.07		0.00		0.00826	37.9		8.15			2.43	
PL-02-00-SL		-0.08		-0.04			1.58			1.35			0.39
PL-03-00-SL		0.06		-4.08			2.96		2.04				0.04
RR-01-00-SL		0.86	0.11			0.00008	14.9		248.00			57.9	
RR-02-00-SL		0.25		-0.01			1.76		4.87				0.58
RR-03-00-SL		0.18		0.11				0.179		1.03			0.83

Summary Statistics for EU-1B Surface Soil

	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
# of Samples	2	10	4	8	1	5	12	0	12	0	1	11	1
Frequency of Detection	17%		33%		17%		100%		100%		100%	92%	
Max Concentration	3.12	1.8	0.584	0.152	0.0297	0.0105	17100	0	550	0	103	184	0.736
Min Concentration	1.04	-0.0615	0.0403	-39.6	0.0297	0.00004	5.24	0	4.12	0	103	4.26	0.736

Sampling Results for EU-1B Surface Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
EP-01-00-SL		0.86	0.44				183		92.30			31.2	
EP-02-00-SL		0.91	0.58		0.03		219		86.70			30.3	
EP-03-00-SL		0.23	0.04			0.00	17.2		28.30			6.97	
EP-04-00-SL	3.12			-0.12			189		550.00			184	
EP-05-00-SL		0.06		-0.04			5.24		88.50			18.5	
EP-06-00-SL	1.04			-0.04			51		52.10			96.5	
EP-07-00-SL		0.09		0.15			23.5		4.12				0.74
EP-08-00-SL		0.12		-39.60			3420		27.10			8.87	
EP-09-00-SL		0.03		-0.01		0.01	111		13.80			4.95	
EP-10-00-SL		1.80	0.10			0.00	17100		272.00			51.4	
EP-11-00-SL		-0.06		0.01		0.01	112		11.2		103	4.26	
EP-12-00-SL		0.39		0.01		0.00	59.9		20.30			4.81	

Summary Statistics for EU-2 Surface Soil

	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
# of Samples	0	24	0	24	2	1	0	24	6	18	4	5	19
Frequency of Detection	0%		0%		67%		0%		25%		100%	21%	
Max Concentration	0	0.535	0	0.122	0.0334	0.00697	0	2.34	3.21	1.75	1.12	0.682	0.427
Min Concentration	0	-0.304	0	-9.52	0.0155	0.00697	0	-0.293	0.801	-0.484	0.759	0.026	-0.285

Sampling Results for EU-2 Surface Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
GS-01-00-SL		-0.01		-9.52				0.431		0.31			0.10
GS-02-00-SL		-0.08		-7.58				0.385		0.79			-0.07
GS-03-00-SL		0.01		-1.30				-0.0783		-0.48			-0.18
GS-04-00-SL		0.11		-3.01				0.0157		1.61			-0.04
GS-05-00-SL		-0.10		-3.73				0.326		1.13			-0.12
NB-01-00-SL		0.54		-0.07				0.807		-0.45			-0.03
NB-02-00-SL		0.09		-0.06				0.158		0.77	0.759	0.026	
NB-03-00-SL		0.00		0.00	0.0334			0.891		0.57		0.682	
NB-04-00-SL		0.00		0.04				0.952		1.48			-0.03
NB-05-00-SL		-0.09		-5.92				0.154		1.72			-0.24
NB-06-00-SL		0.05		0.01	0.0155			-0.0905	0.851		0.888	0.0565	
NB-07-00-SL		0.13		0.12				0.377		1.75			0.43
NB-08-00-SL		-0.30		0.05				-0.293	3.21				0.16
NB-09-00-SL		-0.03		-3.19				0.452		0.72			0.23
NB-16-00-SL		0.07		-0.22				-0.135		1.58			-0.29
NB-17-00-SL		-0.04		0.02				-0.166	0.801		1.09	0.0328	
NB-18-00-SL		0.00		0.04				0.401	1.91				0.02
NB-19-00-SL		-0.02		0.03				0.774		1.50			0.32
NB-22-00-SL		-0.05		-3.17				2.34	2.32				-0.02
NB-23-00-SL		-0.13		0.00		0.00697		0.289	0.913		1.12	0.0843	
NB-24-00-SL		0.05		-2.56				0.401		0.71			0.17
NB-25-00-SL		-0.07		-1.02				0.818		1.22			0.22
NB-26-00-SL		-0.11		0.05				0.509		0.16			0.16
NB-27-00-SL		0.38		-0.17				-0.147		0.76			0.07

Summary Statistics for EU-3 Surface Soil

	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
# of Samples	0	25	2	23	0	8	15	10	20	14	17	16	9
Frequency of Detection	0%		8%		0%		60%		59%		100%	64%	
Max Concentration	0	0.368	0.0331	0.0957	0	0.012	284	0.808	84.6	1.75	937	41.7	0.345
Min Concentration	0	-0.627	0.0263	-7.1	0	-0.00173	1.2	-0.23	0.244	-0.432	0.25	0.024	-0.0421

Sampling Results for EU-3 Surface Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
SW-01-00-SL		-0.28		0.02		0.00916	22.3		9.81			2.86	
SW-01-SS		0.13	0.03			0.00625	255		29.5		236	10.6	
SW-02-00-SL		0.01		-0.03			18.4		32.00			11.8	
SW-02-SS		-0.12		0.00		0.00181	1.36		1.03		3.99	0.175	
SW-03-00-SL		-0.29		0.07				0.808		1.30			0.35
SW-03-SS		-0.02		-0.95			2.8		1.39		7.92	0.402	
SW-04-00-SL		-0.07		0.10				0.366		1.72			0.25
SW-04-SS		-0.11		0.06			1.91		0.952	0.71	2.8	0.093	
SW-05-SS		-0.49		0.09			16.8		3.33		19.1	0.785	
SW-06-SS		0.22		0.00			284		84.6		937	41.7	
SW-07-SS		-0.18	0.03			0.00003	36.3		41.4		291	14.1	
SW-08-SS		0.05		0.02				0.0218	0.299	0.27	0.331		0.01
SW-10-SS		0.07		0.05				0.463	0.517	0.48	0.468		0.02
SW-11-SS		0.03		-1.19				0.188	0.599	1.27	1.12		0.02
SW-12-SS		-0.09		-0.10			4.36		0.566	0.63	1.47	0.076	
SW-13-SS		0.14		0.00		0.0061	1.54		0.593	-0.43	0.989	0.0488	
SW-14-SS		0.00		-0.54				-0.23	0.244	0.55	0.25	0.024	
SW-15-SS		-0.22		0.01				0.166	0.619	0.99	0.548	0.0272	
SW-16-SS		0.00		-7.10				0.352	0.262	0.29	0.28		0.02
NB-10-00-SL		-0.10		-5.51				0.148		1.70			0.31
NB-11-00-SL		0.06		0.00		0.012	12.7		9.88			3	
NB-12-00-SL		0.01		0.00		0.00712		0.407	0.903		1.45	0.08	
NB-13-00-SL		0.07		-0.07			1.2			1.65			-0.04
NB-14-00-SL		-0.63		0.00		-0.00173	7.43		3.53		52.3	1.98	
NB-15-00-SL		0.37		0.05			1.81			1.75			0.14

APPENDIX B

SAMPLING RESULTS AND SUMMARY STATISTICS OF VOLUMETRIC SOILS FOR EUs 1-3

Summary Statistics for EU-1A Volumetric Soil

	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
# of samples	13	246	13	246	10	29	70	167	62	189	21	50	201
Frequency of Detection	5%		5%		26%		30%		25%		100%	20%	
Max Concentration	2.94	3.8	6	13	0.0144	0.00844	691	1.39	705	3.4	604	308	1.26
Min Concentration	-0.04	-1.77	0.00197	-26.3	0.00266	-0.00226	0.785	-0.828	0.76	-1.9	0.712	0.0233	-0.4

Sampling Results for EU-1A Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
BD-09-00-SL		0.03		0.01		0.00	86.90		4.26			3.63	
BD-10-00-SL		3.80		0.05			176.00		389.00			104.00	
BD-11-00-SL		1.66		-0.04			19.00		432.00			102.00	
BD-12-00-SL		1.94	0.06		0.01		574.00		36.20			20.20	
BD-13-09-SL		-0.17		-3.29				0.68	0.89		1.08	0.09	
BD-13-15-SL		-0.14		-9.11				0.74		0.33			-0.37
BD-13-23-SL		0.19		-0.08				0.81		1.31			-0.16
BD-13-30-SL		0.02		-0.03				1.01		1.17			0.20
BD-14-05-SL		0.05		-0.20				1.39	0.92		1.24	0.08	
BD-14-13-SL		0.22		0.09				0.62		0.33			0.05
BD-14-25-SL		-0.08		-1.87				0.20		1.17			-0.17
BD-14-31-SL		-0.01		-0.03				-0.01		0.68			0.25
BD-15-05-SL		-0.18		-0.01				0.13		-0.25			-0.13
BD-15-17-SL	0.27			-0.20				0.21		1.45			0.32
BD-15-25-SL		-0.03		-0.08				0.92		1.26			0.25
BD-15-31-SL		-0.03	0.32					0.32		0.93			0.13
BD-16-05-SL		0.02		0.01		0.00	1.61		0.87		1.73	0.07	
BD-16-15-SL		-0.15		0.00				0.01		0.39		0.55	
BD-16-19-SL		-0.12		-3.04				0.08		2.15			0.27
BD-16-25-SL		0.09		0.03				0.24		0.55			0.31
BD-16-34-SL		-0.04		-0.03				0.16		0.95			0.16
BLD240-01-01	0.01			0.00		0.00				1.10			0.12
BLD240-01-09		-0.23		-2.00						0.90			0.23
BLD240-01-31		0.00		0.00	0.01								
BLD240-03-04		0.00	0.01			0.00				1.32			0.44
BLD240-03-14		0.00		0.00	0.00								
BLD240-03-19		-0.08		8.00						0.70			0.36
BLD240-04-02	0.01			0.00		0.00				1.70			0.02
BLD240-04-04		-0.29		5.30						0.90			0.30
BLD240-04-33		0.00		0.00		0.00							
BLD240-05-01		-0.08		2.00						1.37			-0.08
BLD240-05-02		0.00		-13.00						1.60			-0.40

Sampling Results for EU-1A Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
BLD253-02-01		-0.06		3.00					3.70				0.90
BLD253-02-04	0.00		0.01			0.00	7.50		11.10		172.00	7.74	
BLD253-02-21	0.00			0.00		0.00							
BLD255-05-01	0.01		0.01		0.01								
BLD255-05-23		0.00		0.00		0.00							
BLD255-07-02		0.00		0.00		0.00			1.70			0.06	
BLD255-07-15	-0.04		6.00						1.10			0.37	
BLD255-07-33		0.00	0.00		0.00								
BLD255-08-01	0.00		0.02			0.01	30.20		13.80		604.00	23.10	
BLD255-08-08	0.01			0.00	0.01					0.85			0.34
BLD260-06-01	0.00			0.00	0.00				5.04		17.80	0.79	
BLD260-06-03		0.01		13.00						0.60			0.12
BLD260-06-31	0.01			0.00		0.00							
BP-01-00-SL		0.04		-0.04				0.59	2.27				0.24
BP-02-00-SL		-0.08		-0.05			1.13			1.03			0.40
BP-03-00-SL		0.26	0.04		0.01		8.83		27.00			35.30	
BP-04-00-SL		0.01		0.00		0.00	68.30		4.43			1.20	
BP-05-00-SL		-0.04		0.05			2.81			1.97			0.19
BP-06-00-SL		0.08		-0.04			6.36		2.33				0.46
BP-07-00-SL		0.57	0.07			0.01	26.30		53.90			53.50	
BP-08-00-SL		-0.09		-0.13				0.03	31.40				0.87
BP-09-00-SL		0.14		-0.10				0.50	2.03				0.22
BP-10-00-SL		0.17		0.03				0.55		2.09			-0.22
BP-11-00-SL		-0.19		-3.25				0.30		1.77			0.18
BP-12-00-SL		-0.14		-0.11				0.18	1.00		2.35	0.14	
BP-13-05-SL		0.01		-0.06				0.59	0.85		0.94	0.05	
BP-13-11-SL		0.00		-0.72				0.42		1.41			0.08
BP-13-15-SL		0.05		-0.04				0.32		0.98			-0.14
BP-13-25-SL		-0.41		0.04				0.36		1.20			0.39
BP-13-35-SL		0.14		-4.33				0.59		-0.47			0.12
BP-17-05-SL		-0.03		-0.83			4.26			1.47			0.35
BP-17-15-SL		-0.20		0.02			2.46			0.49			0.29
BP-17-23-SL		-0.35		-9.08			1.66			1.01			-0.26
BP-17-31-SL		-0.05		-7.89				0.31		1.27			-0.15
BP-18-05-SL		-0.30		0.01				0.04		0.27			0.18
BP-18-15-SL		0.00		-0.04				-0.05		1.11			0.72
BP-18-25-SL		0.45		-2.38				0.34		1.11			0.09
BP-18-31-SL		-0.17		-4.27				0.39		0.20			-0.12
BP-19-05-SL		-0.36		0.05				-0.23		0.95			0.15
BP-19-13-SL		0.58		-4.40				-0.20		-1.29			0.10
BP-19-25-SL		-0.12		-0.03				0.22		-0.21			0.16
BP-19-29-SL		-0.05		-0.04				0.00		0.31			0.57
BP-20-03-SL		-0.10		-4.90				-0.72		1.10			-0.11

Sampling Results for EU-1A Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
BP-20-19-SL		-0.19		-0.08				-0.08		0.78			0.11
BP-20-27-SL		-0.10		-0.07				-0.43		-0.38			-0.02
BP-21-07-SL		-0.09		-7.71				-0.29		1.24			0.12
BP-21-13-SL		0.07		-3.31				-0.52		0.75			0.08
BP-21-24-SL		0.06		0.04				-0.83		1.66			0.18
BP-21-34-SL		0.11		-0.05				-0.41		0.27			0.47
BP-22-05-SL		0.24		-7.77				-0.22		1.67			0.01
BP-22-13-SL		-0.41		-3.38				0.06		0.73			0.05
BP-22-23-SL		-0.37		-0.15				-0.16		1.45			0.17
BP-22-33-SL		0.01		-3.15				0.37		0.35			-0.15
CB-01-00-SL		-0.14		0.01		0.00	5.15		18.40			2.87	
CB-02-05-SL		0.17		0.03			0.79		1.14		2.48	0.14	
CB-02-15-SL		-0.16		-0.04				0.13		-0.86			0.28
CB-02-25-SL		-0.10		-0.01				0.04		0.89			0.43
DM-01-00-SL	2.3			0.02			35.80		102.00			308.00	
DM-02-00-SL	2.94			0.05			154.00		451.00			237.00	
DM-02-05-SL		0.13		0.02		0.00	13.90		36.30			9.24	
DM-02-17-SL		-0.68		-0.13				0.90		0.38			0.07
DM-02-22-SL		0.10		-26.30			10.90		27.20		157.00	6.38	
DM-02-33-SL		0.53		0.01		0.00		-0.16	12.00			2.91	
DM-03-05-SL		0.16		-0.02			2.54		0.86		0.71	0.06	
DM-03-13-SL		0.00		0.03			5.84			0.59			0.12
DM-03-25-SL		-0.02		-0.08			7.04			1.22			0.28
DM-03-34-SL		0.23		0.08				0.90		0.70			0.20
LF-01-00-SL		-0.11		-0.04			5.49			2.20			0.59
LF-02-00-SL		0.01		-0.01			0.90			0.64			0.17
LF-03-00-SL		0.04		-6.69			1.56			0.52			0.28
LF-04-00-SL		0.30		0.13			2.38			1.23			0.12
LF-05-00-SL		0.03		-0.03			12.30		2.38				0.56
LF-06-05-SL		-0.09		0.00		0.00	4.26		1.42		5.62	0.24	
LF-06-13-SL		0.06		-4.38				0.91	2.34				0.03
LF-06-27-SL		-0.21		-2.68				0.33		0.41			0.01
LF-06-32-SL		-0.18		-4.64				0.51		0.25			-0.28
LF-07-15-SL		0.23		0.14				0.17		0.77			-0.15
LF-07-25-SL		-0.20		-0.41				0.94		-0.09			0.39
LF-07-34-SL		0.00		0.21				1.09		1.41			0.12
LF-08-05-SL		-0.09		0.02			4.37			0.82			0.19
LF-08-15-SL		0.12		-0.08				0.23		0.75			0.30
LF-08-21-SL		-0.59		-1.24				0.20		0.23			0.03
LF-08-37-SL		0.06		-12.90			4.21			-0.37			-0.20
LF-09-03-SL		-0.71		0.17			1.60			1.37			0.21
LF-09-17-SL		-0.16		-4.25				0.52		-0.44			-0.18
LF-09-25-SL		-0.15		0.08				0.69		0.49			0.17

Sampling Results for EU-1A Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
LF-09-31-SL		0.03		-0.10				0.14		0.69			0.29
NB-20-00-SL		0.01		-10.60				0.24		1.57			-0.12
NB-21-00-SL		0.09		0.01				0.06		1.06			0.42
NB-39-05-SL		0.36		-0.51			2.11			1.09			0.23
NB-39-15-SL		0.13		-4.11			2.43			1.86			0.28
NB-39-25-SL		-0.11		-0.15				0.42		1.40			0.14
NB-39-30-SL		0.22		-12.70				0.48		1.92			-0.19
NB-47-05-SL		-0.08		0.08				0.25		0.13			0.12
NB-47-15-SL		0.16		-8.32				0.04		0.89			0.00
NB-47-25-SL		0.06		0.10				0.33		1.35			0.00
NB-47-31-SL		-0.30		-0.05				0.24		1.16			0.34
NB-48-05-SL		0.66		0.04				0.30		1.41			0.26
NB-48-11-SL		-0.11		-2.91				0.54		0.56			-0.10
NB-48-15-SL		-0.10		-0.21				0.37		0.92			0.55
NB-48-25-SL		-0.45		-3.34				0.46		0.96			0.28
NB-48-35-SL		0.03		0.00				0.75		1.03			0.37
NB-49-05-SL		0.00		0.09				0.35		-1.90			0.60
NB-49-15-SL		-0.60		-0.74				-0.01		1.44			0.03
NB-49-25-SL		-0.15		-6.31				0.16		-0.55			-0.10
NB-49-37-SL		0.15		-1.51				0.60		0.05			-0.09
NB-50-05-SL		-0.22		0.01				0.16		1.13			0.19
NB-50-15-SL		0.12		-0.06				0.33		1.06			0.03
NB-50-25-SL		-0.05		0.04				0.22		-0.53			0.36
NB-50-37-SL		0.22		0.08				0.13		0.61			-0.15
NB-51-05-SL		-0.26		-3.81				0.02	0.81		0.83	0.05	
NB-51-13-SL		-0.72		-0.11				0.33		0.53			0.77
NB-51-25-SL		0.47		0.01				0.37		-0.86			0.07
NB-51-37-SL		-0.09		-0.08				0.21		0.77			0.31
NB-52-05-SL		-0.03		0.13				0.24		0.50			0.06
NB-52-13-SL		0.13		0.08				0.10		0.63			0.17
NB-52-25-SL		-0.05		0.00				0.30		-0.98			-0.20
NB-52-35-SL		0.02		-0.09				-0.18		0.52			0.43
NB-53-05-SL		-0.10		0.09				0.08		1.30			0.15
NB-53-13-SL		-0.43		-0.05				0.49		-0.26			0.11
NB-53-23-SL		0.02		0.01				0.10		1.57			0.41
NB-53-33-SL		0.09		0.02				0.30		0.83			0.20
NB-54-05-SL		0.16		-7.11				0.29		1.32			0.25
NB-54-13-SL		0.07		-4.65				0.12		1.23			0.42
NB-54-25-SL		-0.03		0.11				0.38		1.23			-0.06
NB-54-31-SL		0.02		-1.60				0.13		0.21			0.08

Sampling Results for EU-1A Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
NB-55-05-SL		-0.01		-3.10				0.21	0.90		0.84	0.06	
NB-55-13-SL		-0.09		-0.13				0.51		1.80			0.17
NB-55-25-SL		0.14		-5.26				0.31		0.19			-0.23
NB-55-33-SL		-0.36		-2.21				0.37		0.34			-0.06
NB-56-05-SL		-0.14		-5.89				0.55		-0.36			-0.10
NB-56-13-SL		-0.03		-6.51				0.20		1.08			0.06
NB-56-25-SL		-0.09		-0.04				0.50		0.43			0.41
NB-56-33-SL		0.05		-0.05				0.11		0.37			0.17
NB-57-05-SL		-0.51		-9.54				0.11		1.60			-0.14
NB-57-15-SL		-0.15		0.00				0.43		-0.75			0.08
NB-57-29-SL		0.08		0.14				-0.01		1.86			-0.23
NB-57-34-SL		0.06		-1.37				-0.05		1.05			0.19
NB-58-05-SL		-0.50		0.01				0.21		-0.12			0.11
NB-58-15-SL		0.73		-3.81				0.43		0.89			0.00
NB-58-29-SL		0.05		-1.47				0.34		1.48			-0.05
NB-58-36-SL		-0.15		-5.41				0.17		1.03			-0.05
NB-59-05-SL		0.12		-0.02				0.12		1.64			0.14
NB-59-13-SL		-0.22		-11.50				0.11		0.65			-0.11
NB-59-25-SL		0.07		-2.50				0.57		1.41			-0.21
NB-59-31-SL		0.05		-1.50				0.14		0.83			-0.14
NB-60-05-SL		-0.10		0.04				-0.03		-0.88			0.25
NB-60-13-SL		0.01		0.06				1.12		1.06			-0.10
NB-60-23-SL		-0.03		-0.01				0.63		0.60			0.29
NB-60-31-SL		0.04		-10.60				0.25		1.44			-0.16
NB-61-05-SL		-0.43		-4.25				0.06		0.15			0.08
NB-61-13-SL		0.00		0.14				-0.09		0.94			0.00
NB-61-23-SL		0.06		-7.50				0.31		0.87			0.03
NB-61-28-SL		-0.04		0.03				0.30		1.18			0.13
NB-74-05-SL		-0.17		0.01			7.49			1.00			0.36
NB-74-17-SL		0.56		0.01			2.81			-0.46			-0.08
NB-74-25-SL		0.07		-6.14			2.45			-0.13			0.03
NB-74-33-SL		-0.06		-0.09				0.49		-0.30			-0.06
OA-01-00-SL		-0.02		0.02	0.01		10.30		16.50			4.57	
OA-02-00-SL		0.14		0.01		0.01	7.39		9.10			3.61	
OA-03-00-SL		-0.29		-4.40				0.40		0.69			0.17
OA-04-00-SL		-1.77		0.04				0.59	705.00			12.20	
OA-05-00-SL		0.06		0.03				0.45	3.64				0.78
OA-06-00-SL		-0.02		-0.06				0.41	2.02				0.11
OA-07-00-SL		0.10		0.00		0.00	1.59		5.76			1.51	
OA-08-00-SL		0.98	0.02			0.01	58.10		74.30		472.00	19.50	

Sampling Results for EU-1A Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
OA-09-00-SL		-0.24		-2.76				0.70		1.03			0.00
OA-10-00-SL		-0.42		0.00			20.80			0.67			0.35
OA-11-00-SL		-0.10		0.01		0.01	53.00		9.04			2.71	
OA-12-00-SL		-0.55		0.05			1.64			1.34			0.49
OA-13-00-SL		0.08		-12.00			5.85		10.80			3.60	
OA-14-00-SL		0.37		-0.14			12.40		5.22			1.14	
OA-15-00-SL		-0.24		0.12			8.22			-0.47			0.63
OA-16-00-SL		-0.19		0.01		0.00	21.30			3.40		1.03	
OA-18-03-SL		-0.07		0.00				0.59	0.79		0.75	0.02	
OA-18-17-SL		-0.15		-0.06				0.94		2.05			0.32
OA-18-25-SL		0.05		-0.03				0.02		0.65			-0.25
OA-18-33-SL		-0.10		-0.72				0.84		1.90			0.05
OA-19-05-SL		0.12		0.12			1.67			0.86			0.31
OA-19-15-SL		0.07		-1.73				-0.44		0.74			0.14
OA-19-25-SL		0.03		-2.64				0.15		1.64			0.09
OA-19-33-SL		-0.05		-1.99				-0.17		0.10			0.20
OA-20-00-SL		0.28		-0.01			52.60		2.93				0.58
OA-21-00-SL		0.33		-17.80			640.00		17.60			2.88	
OA-22-00-SL		0.08		0.00		0.00	691.00		8.43			1.86	
OA-23-00-SL		-0.05		-0.10			189.00		34.40			120.00	
OA-24-00-SL		-0.46		-0.04			13.10			1.47			0.17
OA-25-00-SL		-0.13		-0.19			87.60		4.73				1.26
OA-26-00-SL		-0.11	0.12			0.00	109.00		165.00			39.00	
OA-27-00-SL		0.14		0.02				0.22		1.51			0.18
OA-28-00-SL		0.03		0.08			0.93			2.14			0.19
OA-29-00-SL		-0.14		-2.53			0.91			1.57			0.02
OA-30-00-SL		-0.07		-5.14				0.15		1.74			0.00
OA-31-00-SL		0.10		-3.79				0.15		0.47			0.18
OA-32-00-SL		-0.04		-0.25				0.33	2.94				0.25
OA-33-00-SL		0.05		0.00				0.44		1.76			0.64
OA-34-00-SL		-0.26		0.01				0.90		1.77			0.34
OA-35-00-SL		-0.43		-0.01			1.57			0.94			0.06
OA-36-00-SL		-0.06		-0.09			1.39			1.71			0.07
OA-37-00-SL		-0.07		0.00	0.01			0.28	1.08		1.93	0.13	
OA-38-00-SL		0.00		-0.08				0.93		1.27			0.07
OA-39-00-SL		0.01		-1.87			1.45			0.47			0.33
OA-40-00-SL		0.03		0.07				0.70		0.86			0.35
PL-01-00-SL		0.07		0.00		0.01	37.90		8.15			2.43	
PL-02-00-SL		-0.08		-0.04			1.58			1.35			0.39
PL-03-00-SL		0.06		-4.08			2.96		2.04				0.04

Sampling Results for EU-1A Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
PL-04-05-SL		-0.36		0.01		0.00	4.54		1.21		4.44	0.25	
PL-04-13-SL		0.04		0.04				1.20		1.10			-0.15
PL-04-23-SL		0.29		-0.04				0.37		1.04			0.64
PL-04-31-SL		0.10		0.07				0.90		0.76			0.15
PL-05-05-SL		0.33		-0.04				-0.05	0.90		1.08	0.11	
PL-05-15-SL		0.12		-4.45				0.65		-0.18			0.05
PL-05-28-SL		-0.10		-1.68				0.17		-0.29			0.42
PL-06-07-SL		-0.07		-6.85				0.76		-0.46			-0.03
PL-06-13-SL		-0.33		0.09				0.36		-1.09			0.32
PL-06-17-SL		-0.63		-6.53				0.45		1.05			-0.04
PL-06-29-SL		-0.14		-1.61				0.81		-0.27			0.05
PL-06-33-SL		-0.19		-4.52			1.18			-0.46			-0.05
RR-01-00-SL		0.86	0.11			0.00	14.90		248.00			57.90	
RR-02-00-SL		0.25		-0.01			1.76		4.87				0.58
RR-03-00-SL		0.18		0.11				0.18		1.03			0.83
RR-04-07-SL		0.05		0.01		0.00		0.11	0.76		0.75	0.06	
RR-04-15-SL		0.33		-2.64				0.09		0.26			0.11
RR-04-25-SL		-0.04		0.07				0.22		1.35			0.19
RR-05-05-SL		0.52		-0.08				0.14	1.28		2.80	0.16	
RR-05-15-SL		0.57		0.03				0.08		-0.38			0.17
RR-05-25-SL		0.10		0.06				0.37		0.33			0.15

Summary Statistics for EU-1B Volumetric Soil

	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
# of samples	2	39	4	37	3	6	35	6	18	23	3	17	24
Frequency of Detection	5%		10%		33%		85%		44%		100%	41%	
Max Concentration	3.12	1.8	0.584	6.17	0.0297	0.0105	17100	1.45	550	2.64	103	184	0.736
Min Concentration	1.04	-0.446	0.0403	-39.6	0.00479	0.00	1.17	0.0559	1.13	-1.87	2.42	0.148	-0.274

Sampling Results for EU-1B Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
EP-01-00-SL		0.86	0.44				183.00		92.30			31.20	
EP-02-00-SL		0.91	0.58		0.03		219.00		86.70			30.30	
EP-03-00-SL		0.23	0.04			0.00	17.20		28.30			6.97	
EP-04-00-SL	3.12			-0.12			189.00		550.00			184.00	
EP-05-00-SL		0.06		-0.04			5.24		88.50			18.50	
EP-06-00-SL	1.04			-0.04			51.00		52.10			96.50	
EP-07-00-SL		0.09		0.15			23.50		4.12				0.74
EP-08-00-SL		0.12		-39.60			3420.00		27.10			8.87	
EP-09-00-SL		0.03		-0.01		0.01	111.00		13.80			4.95	
EP-10-00-SL		1.80	0.10			0.00	17100.00		272.00			51.40	
EP-11-00-SL		-0.06		0.01		0.01	112.00		11.20		103.00	4.26	
EP-12-00-SL		0.39		0.01		0.00	59.90		20.30			4.81	
EP-13-03-SL		0.75		-3.56			13.90		6.97			1.34	
EP-13-13-SL		-0.05		0.11			8.58			2.03			0.19
EP-13-25-SL		-0.09		-0.24			6.39			-1.87			0.02
EP-13-30-SL		0.05		0.07			131.00			0.47			0.36
EP-14-05-SL		0.06		-17.80			12.80			1.54			-0.27
EP-14-13-SL		-0.42		0.04			1.53			-0.38			0.14
EP-14-25-SL		-0.24		-0.11			2.06			-0.46			0.47
EP-14-31-SL		0.00		-4.20				0.54		0.90			-0.05
EP-15-05-SL		0.46		6.17			3.42			1.64			0.17
EP-15-13-SL		0.03		0.24			4.31			1.89			-0.14
EP-15-25-SL		-0.02		-3.91			11.00			0.03			0.00
EP-15-29-SL		-0.09		-1.81				0.62		-1.00			0.08
EP-16-05-SL		-0.02		-9.71			2.62		1.13		2.42	0.15	
EP-16-15-SL		0.59		0.05			17.10			2.05			0.31
EP-16-27-SL		0.35		-3.38			5.24			0.34			-0.07
EP-17-05-SL		0.00		0.01	0.00		1.17		1.15		2.67	0.15	
EP-17-15-SL		0.51		0.24			3.74			1.69			0.42
EP-17-25-SL		-0.05		-1.75			5.21			1.20			0.03

Sampling Results for EU-1B Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
EP-17-30-SL		-0.11		-8.81				0.06		0.32			-0.27
EP-18-09-SL		-0.02		0.00	0.01		11.70		10.60			1.61	
EP-18-15-SL		-0.45		0.14				1.45		0.61			-0.02
EP-18-29-SL		0.06		0.09				0.95		1.07			0.03
EP-19-05-SL		-0.14		-7.86			11.40		10.10			1.49	
EP-19-13-SL		0.17		0.00		0.00	10.40		9.61			1.54	
EP-19-25-SL		0.24		-2.42			4.77			-0.59			-0.10
EP-19-31-SL		-0.16		-1.70				0.71		0.38			0.33
EP-20-05-SL		0.02		-0.08			3.04			0.22			0.32
EP-20-15-SL		0.00		-5.95			2.74			1.64			0.03
EP-20-25-SL		-0.02		0.11			3.93			2.64			0.06

Summary Statistics for EU-2 Volumetric Soil

	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
# of samples	0	163	1	162	2	1	2	161	16	148	13	14	149
Frequency of Detection	0%		1%		67%		1%		10%		100%	9%	
Max Concentration	0	0.535	0.353	13.4	0.0334	0.00697	1.68	2.34	3.21	2.74	1.7	0.682	0.674
Min Concentration	0	-0.571	0.353	-17.3	0.0155	0.00697	0.83	-0.443	0.373	-1.13	0.494	0.0228	-0.539

Sampling Results for EU-2 Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
GS-01-00-SL		-0.01		-9.52				0.43		0.31			0.10
GS-02-00-SL		-0.08		-7.58				0.39		0.79			-0.07
GS-03-00-SL		0.01		-1.30				-0.08		-0.48			-0.18
GS-04-00-SL		0.11		-3.01				0.02		1.61			-0.04
GS-05-00-SL		-0.10		-3.73				0.33		1.13			-0.12
NB-01-00-SL		0.54		-0.07				0.81		-0.45			-0.03
NB-02-00-SL		0.09		-0.06				0.16	0.37		0.76	0.03	
NB-03-00-SL		0.00		0.00	0.03			0.89		0.57		0.68	
NB-04-00-SL		0.00		0.04				0.95		1.48			-0.03
NB-05-00-SL		-0.09		-5.92				0.15		1.72			-0.24
NB-06-00-SL		0.05		0.01	0.02			-0.09	0.85		0.89	0.06	
NB-07-00-SL		0.13		0.12				0.38		1.75			0.43
NB-08-00-SL		-0.30		0.05				-0.29	3.21				0.16
NB-09-00-SL		-0.03		-3.19				0.45		0.72			0.23
NB-16-00-SL		0.07		-0.22				-0.14		1.58			-0.29
NB-17-00-SL		-0.04		0.02				-0.17	0.80		1.09	0.03	
NB-18-00-SL		0.00		0.04				0.40	1.91				0.02
NB-19-00-SL		-0.02		0.03				0.77		1.50			0.32
NB-22-00-SL		-0.05		-3.17				2.34	2.32				-0.02
NB-23-00-SL		-0.13		0.00		0.01		0.29	0.91		1.12	0.08	
NB-24-00-SL		0.05		-2.56				0.40		0.71			0.17
NB-25-00-SL		-0.07		-1.02				0.82		1.22			0.22
NB-26-00-SL		-0.11		0.05				0.51		0.16			0.16
NB-27-00-SL		0.38		-0.17				-0.15		0.76			0.07
NB-28-04-SL		0.20		0.01				0.44		0.37			0.13

Sampling Results for EU-2 Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
NB-28-14-SL		-0.08		0.03				0.36		0.61			0.06
NB-28-24-SL		0.03		-2.80				0.06		0.65			-0.07
NB-28-35-SL		-0.09		-0.07				0.24		0.45			0.16
NB-29-05-SL		-0.14		0.07				0.25		0.49			0.00
NB-29-14-SL		0.07		0.01				0.11		-0.59			0.12
NB-29-22-SL		-0.12		-1.52				0.32		0.71			0.02
NB-30-05-SL		-0.03		0.03				0.08	0.88		0.92	0.04	
NB-30-15-SL		-0.13		-0.48				0.14		2.74			0.24
NB-30-25-SL		0.12		0.11				0.14		0.64			0.41
NB-30-33-SL		-0.36		-0.04				0.03		0.50			0.45
NB-31-05-SL		-0.02		-0.16				-0.03		0.81			0.10
NB-31-15-SL		-0.09		0.04				0.73	0.85		0.92	0.04	
NB-31-27-SL		-0.06		-3.38				-0.13		1.06			-0.20
NB-31-32-SL		-0.15		-5.82				-0.14		1.54			-0.12
NB-32-05-SL		0.07		-0.05				0.40		-1.12			-0.06
NB-32-15-SL		0.16		0.01				0.79		1.08			0.24
NB-32-27-SL		0.13		-3.18			1.68			0.88			0.03
NB-32-33-SL		0.17		-0.43				0.32		0.00			0.17
NB-33-05-SL		-0.09		-0.06				0.55		-0.75			0.17
NB-33-15-SL		-0.05		-0.03				0.10		0.81			0.18
NB-33-27-SL		-0.09		0.06				0.59		-0.14			0.31
NB-34-05-SL		-0.11		-0.14				0.00		1.30			0.19
NB-34-15-SL		0.24		-0.14				0.26		1.96			-0.04
NB-34-25-SL		0.01		0.04				0.33		0.29			0.23
NB-35-01-SL		0.11		0.00				0.33		1.16			-0.12
NB-35-15-SL		-0.03	0.35					0.10		0.68			0.06
NB-35-25-SL		-0.08		-0.20				0.19		0.25			0.13
NB-36-05-SL		-0.04		-8.61				0.15	0.83		0.75	0.05	
NB-36-15-SL		0.15		-0.05				0.24	0.79		0.98	0.03	
NB-36-27-SL		0.04		-17.30				0.00		1.06			-0.48
NB-37-05-SL		-0.10		-0.45				0.28		1.27			-0.08
NB-37-15-SL		0.05		-4.21				0.53		1.33			-0.35
NB-37-25-SL		-0.44		0.16				0.05		0.06			0.24
NB-38-09-SL		-0.21		-0.05				0.46		1.62			-0.01
NB-38-15-SL		-0.18		-6.16				0.15		0.37			-0.36

Sampling Results for EU-2 Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
NB-38-25-SL		-0.05		-3.00				0.27		1.76			-0.08
NB-40-05-SL		0.08		6.03				0.09		1.23			-0.03
NB-40-17-SL		-0.09		-1.21				0.49		1.64			-0.08
NB-40-25-SL		0.05		3.34			0.83			0.17			0.13
NB-40-31-SL		-0.29		13.40				0.22		-0.25			0.25
NB-41-05-SL		0.09		-0.44				0.17		0.45			-0.20
NB-41-13-SL		-0.01		-0.03				0.25		1.20			0.20
NB-41-19-SL		-0.05		-8.81				0.27		0.26			0.32
NB-42-05-SL		-0.15		-0.04				0.54		1.26			0.13
NB-42-13-SL		0.05		-0.06				0.40		0.59			0.07
NB-42-23-SL		0.05		-1.24				0.19		0.07			0.21
NB-43-05-SL		0.40		-2.45				0.39		2.39			0.10
NB-43-13-SL		0.38		-3.91				0.34		0.67			-0.04
NB-44-05-SL		0.01		0.09				0.36	0.47		0.49	0.03	
NB-44-11-SL		-0.18		0.00				0.50		0.73			0.13
NB-44-18-SL		0.13		-2.78				0.51		0.70			0.16
NB-45-05-SL		0.01		-0.04				0.13		1.26			0.56
NB-45-13-SL		0.04		-1.63				0.29		1.27			-0.16
NB-45-25-SL		0.06		-2.58				0.51		0.38			-0.07
NB-45-33-SL		-0.03		-3.56				0.73		0.20			0.11
NB-46-09-SL		-0.08		-10.70				0.72		1.42			-0.52
NB-46-17-SL		-0.04		-0.04				0.62		0.20			0.28
NB-46-25-SL		0.06		-2.23				0.68		1.07			0.11
NB-46-29-SL		0.03		-0.02				0.46		1.41			0.24
NB-62-05-SL		-0.12		0.08				0.54		1.35			0.36
NB-62-12-SL		-0.01		0.01				-0.05		1.34			-0.13
NB-62-22-SL		-0.02		-0.04				0.27		0.04			0.51
NB-63-05-SL		-0.12		0.00				0.22	0.74		0.74	0.04	
NB-63-13-SL		0.28		-2.66				-0.04		-0.57			-0.03
NB-63-19-SL		-0.10		-1.31				0.15		0.52			0.07
NB-64-05-SL		0.09		-0.13				-0.08		0.43			0.33
NB-64-13-SL		0.04		-9.34				0.13		0.11			0.03
NB-64-17-SL		0.24		-0.03				-0.17		0.08			0.23
NB-65-05-SL		-0.34		-0.09				0.12		0.89			0.18
NB-65-13-SL		0.07		-0.13				-0.10		0.28			-0.15

Sampling Results for EU-2 Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
NB-65-17-SL		0.04		-0.08				-0.03		0.58			0.15
NB-66-05-SL		-0.09		0.00				0.85		0.40			-0.21
NB-66-15-SL		-0.36		-2.76				0.53		1.05			0.06
NB-66-19-SL		-0.09		0.00				-0.13		1.04			0.01
NB-67-05-SL		-0.02		-1.70				-0.05		1.29			0.23
NB-67-11-SL		-0.11		-7.79				0.34		0.23			-0.29
NB-67-21-SL		-0.10		-4.51				0.19		0.88			-0.18
NB-68-05-SL		-0.05		0.07				0.19		0.47			0.36
NB-68-13-SL		-0.09		0.03				0.65		0.97			0.00
NB-68-17-SL		0.38		0.04				0.27		0.55			0.28
NB-68-25-SL		-0.01		-0.26				0.50		0.71			0.36
NB-68-33-SL		0.04		0.02				0.35		0.00			-0.03
NB-69-05-SL		-0.03		-8.08				0.04		1.38			-0.54
NB-69-15-SL		0.01		-4.86				0.12		-0.20			0.09
NB-69-22-SL		-0.06		-3.08				0.27		0.88			-0.06
NB-69-34-SL		0.03		-8.13				-0.32		0.31			-0.25
NB-70-05-SL		-0.18		-7.77				0.43		0.45			-0.25
NB-70-15-SL		-0.10		-0.04				0.04		1.16			0.14
NB-70-23-SL		-0.15		-1.79				0.11		1.16			-0.12
NB-70-33-SL		-0.18		0.04				0.37		0.35			0.08
NB-71-01-SL		0.27		0.04				0.67	0.84		1.70	0.06	
NB-71-11-SL		0.03		0.02				-0.03		0.76			0.12
NB-71-27-SL		0.09		-0.16				-0.10		0.41			-0.01
NB-72-05-SL		-0.16		-0.01				-0.44		0.52			0.19
NB-72-11-SL		-0.12		0.05				0.43		0.62			-0.04
NB-72-19-SL		0.02		-12.30				0.14		0.35			-0.39
NB-72-22-SL		0.03		0.00				0.35		0.44			0.00
NB-73-05-SL		-0.02		0.13				0.77		0.56			0.43
NB-73-13-SL		0.10		0.00				1.01		0.55			0.36
NB-73-23-SL		0.02		0.00				0.21		0.52			0.11
NB-75-08-SL		-0.35		-7.52				0.35		1.32			-0.23
NB-75-15-SL		0.00		-13.30				-0.12		0.69			-0.34
NB-75-19-SL		0.25		-0.03				0.58		0.75			0.07
NB-76-06-SL		-0.50		-0.13				1.03		-0.55			-0.13
NB-76-10-SL		-0.09		-0.02				0.13		-0.28			0.13

Sampling Results for EU-2 Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
NB-76-24-SL		0.02		-0.06				0.99		-0.13			0.13
NB-77-05-SL		0.06		0.03				0.40		0.02			0.04
NB-77-13-SL		0.12		0.10				0.66		0.52			-0.06
NB-77-24-SL		0.00		0.03				0.02		0.43			0.02
NB-78-07-SL		0.06		0.05				0.55	0.69		0.74	0.04	
NB-78-11-SL		-0.11		-0.03				-0.21		-0.07			0.09
NB-78-18-SL		0.02		0.03				0.14		1.57			0.23
NB-79-05-SL		0.01		0.06				0.11		-0.35			0.24
NB-79-11-SL		0.01		0.01				-0.07		0.69			0.24
NB-79-24-SL		0.41		-0.02				0.04		0.79			0.20
NB-80-05-SL		0.01		0.02				-0.19		0.42			-0.14
NB-80-11-SL		-0.17		0.06				0.05		-0.20			-0.02
NB-80-27-SL		0.31		0.08				0.19		0.01			0.37
NB-81-09-SL		-0.24		0.07				0.08	0.77	0.53	0.71	0.02	
NB-81-11-SL		0.02		-0.01				0.25		-1.13			0.13
NB-81-31-SL		-0.05		-0.12				0.09		0.27			0.01
NB-82-05-SL		0.19		0.15				1.00		1.41			-0.11
NB-82-11-SL		-0.17		-0.06				-0.18		0.34			-0.45
NB-82-20-SL		0.11		-0.08				0.42		-0.24			0.12
NB-83-05-SL		0.01		0.08				0.14		1.30			0.15
NB-83-11-SL		0.08		-0.02				0.24		-0.09			-0.29
NB-83-23-SL		0.05		0.03				-0.02		0.83			0.11
NB-84-05-SL		0.16		-0.05				0.75		1.69			0.29
NB-84-15-SL		0.01		-0.01				0.01		-0.40			-0.47
NB-84-23-SL		-0.36		-0.01				-0.11		-0.06			-0.23
NB-84-33-SL		-0.23		0.01				0.40		0.64			-0.05
NB-85-05-SL		-0.18		-0.01				0.45		0.55			0.34
NB-85-15-SL		0.16		0.01				0.30		1.78			0.34
NB-85-25-SL		0.15		-0.03				0.22		1.07			-0.04
NB-85-35-SL		0.12		0.04				0.33		-0.38			0.18
NB-86-05-SL		-0.01		0.00				0.29		1.22			0.67
NB-86-15-SL		-0.57		-0.04				0.33		0.68			-0.01
NB-86-19-SL		0.21		-0.01				-0.34		1.24			0.07

Summary Statistics for EU-3 Volumetric Soil

	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
# of Samples	0	41	3	38	0	9	17	24	23	18	19	18	23
Frequency of Detection	0%		7%		0%		41%		44%		100%	44%	
Max Concentration	0	0.368	0.154	0.107	0	0.012	284	0.808	84.6	2.55	937	41.7	0.532
Min Concentration	0	-0.627	0.0263	-9.18	0	-0.00173	0.907	-0.23	0.244	-0.518	0.25	0.024	-0.422

Sampling Results for EU-3 Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
SW-01-00-SL		-0.28		0.02		0.01	22.30		9.81			2.86	
SW-01-SS		0.13	0.03			0.01	255.00		29.50		236.00	10.60	
SW-02-00-SL		0.01		-0.03			18.40		32.00			11.80	
SW-02-01-SL		0.31	0.15			0.01	2.97		20.10		240.00	12.80	
SW-02-09-SL		-0.09		-8.18			0.91			2.06			-0.04
SW-02-15-SL		-0.35		-0.01				0.57		2.55			0.49
SW-02-23-SL		0.13		0.11				0.55		-0.39			0.37
SW-02-SS		-0.12		0.00		0.00	1.36		1.03		3.99	0.18	
SW-03-00-SL		-0.29		0.07				0.81		1.30			0.35
SW-03-SS		-0.02		-0.95			2.80		1.39		7.92	0.40	
SW-04-00-SL		-0.07		0.10				0.37		1.72			0.25
SW-04-SS		-0.11		0.06			1.91		0.95		2.80	0.09	
SW-05-08-SL		-0.07		-5.95				0.36		1.59			0.14
SW-05-12-SL		0.05		-0.08				0.01		-0.16			0.34
SW-05-SS		-0.49		0.09			16.80		3.33		19.10	0.79	
SW-06-05-SL		0.24		-0.03				0.11		1.14			0.53
SW-06-13-SL		0.04		0.02				0.15		1.25			0.49
SW-06-23-SL		0.02		0.00				0.45	2.95				-0.02
SW-06-SS		0.22		0.00			284.00		84.60		937.00	41.70	
SW-07-05-SL		-0.47		-9.18				0.58	0.83		0.87	0.04	
SW-07-15-SL		-0.17		0.05				0.40		1.87			0.20
SW-07-23-SL		-0.05		-5.53				0.59		0.49			-0.15
SW-07-SS		-0.18	0.03			0.00	36.30		41.40		291.00	14.10	
SW-08-03-SL		-0.06		-6.72				0.20		0.61			-0.42
SW-08-05-SL		0.09		0.04				0.58		0.94			0.11
SW-08-15-SL		0.07		-1.37				0.28		0.38			-0.03
SW-08-25-SL		-0.25		-0.04				0.06		-0.52			-0.05
SW-08-SS		0.05		0.02				0.02	0.30		0.33		0.01

Sampling Results for EU-3 Volumetric Soil

Sample ID	Am-241		Np-237		Pu-239/240		Tc-99		U-238		U-234	U-235	
	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Non-Detect	Detect	Detect	Non-Detect
SW-10-SS		0.07		0.05				0.46	0.52		0.47		0.02
SW-11-SS		0.03		-1.19				0.19	0.60		1.12		0.02
SW-12-SS		-0.09		-0.10			4.36		0.57		1.47	0.08	
SW-13-SS		0.14		0.00		0.01	1.54		0.59		0.99	0.05	
SW-14-SS		0.00		-0.54				-0.23	0.24		0.25	0.02	
SW-15-SS		-0.22		0.01				0.17	0.62		0.55	0.03	
SW-16-SS		0.00		-7.10				0.35	0.26		0.28		0.02
NB-10-00-SL		-0.10		-5.51				0.15		1.70			0.31
NB-11-00-SL		0.06		0.00		0.01	12.70		9.88			3.00	
NB-12-00-SL		0.01		0.00		0.01		0.41	0.90		1.45	0.08	
NB-13-00-SL		0.07		-0.07			1.20			1.65			-0.04
NB-14-00-SL		-0.63		0.00		0.00	7.43		3.53		52.30	1.98	
NB-15-00-SL		0.37		0.05			1.81			1.75			0.14

APPENDIX C

DETERMINATION OF THE SUM-OF-THE-FRACTIONS (SOF) FOR EACH SAMPLE

Determination of SOF for each Surface Soil Sample

sampleid	start_dept	end_depth	Tc-99	Th-232g	Th-232n	U-234[1]	U-235	U-238	SOF
EP-10-00-SL	0	0.5	17100.0	0.5	0	1182.2	51.4	272.0	**126.46**
DM-01-00-SL	0	0.5	35.8	31.6	30.1	7084.0	308.0	102.0	**27.42**
EP-08-00-SL	0	0.5	3420.0	0.8	0	204.0	8.9	27.1	**25.08**
DM-02-00-SL	0	0.5	154.0	0.0	0	5451.0	237.0	451.0	**17.40**
EP-04-00-SL	0	0.5	189.0	2.8	1.3	4232.0	184.0	550.0	**15.24**
BP-08-00-SL	0	0.5	0.0	36.4	34.9	19.9	0.9	31.4	**9.64**
BD-10-00-SL	0	0.5	176.0	0.3	0	2392.0	104.0	389.0	**9.26**
OA-23-00-SL	0	0.5	189.0	0.5	0	2760.0	120.0	34.4	**8.74**
BD-11-00-SL	0	0.5	19.0	0.8	0	2346.0	102.0	432.0	**8.21**
EP-06-00-SL	0	0.5	51.0	0.4	0	2219.5	96.5	52.1	**6.41**
OA-22-00-SL	0	0.5	691.0	0.2	0	42.8	1.9	8.4	**5.09**
OA-21-00-SL	0	0.5	640.0	0.1	0	66.2	2.9	17.6	**4.82**
BD-12-00-SL	0	0.5	574.0	1.8	0.4	2.35	20.2	36.2	**4.68**
RR-01-00-SL	0	0.5	14.9	1.4	0	1331.7	57.9	248.0	**4.70**
OA-04-00-SL	0	0.5	0.6	1.1	0	280.6	12.2	705.0	**3.89**
OA-26-00-SL	0	0.5	109.0	0.6	0	897.0	39.0	165.0	**3.87**
EP-02-00-SL	0	0.5	219.0	1.7	0.2	696.9	30.3	86.7	**3.84**
EP-01-00-SL	0	0.5	183.0	1.9	0.5	717.6	31.2	92.3	**3.72**
BP-07-00-SL	0	0.5	26.3	1.3	0	1230.5	53.5	53.9	**3.65**
BP-03-00-SL	0	0.5	8.8	0.9	0	811.9	35.3	27.0	**2.31**
OA-08-00-SL	0	0.5	58.1	1.1	0	533.6	23.2	90.5	**2.22**
EP-05-00-SL	0	0.5	5.2	1.1	0	425.5	18.5	88.5	**1.55**
EP-09-00-SL	0	0.5	111.0	1.3	0	113.9	5.0	13.8	**1.15**
EP-11-00-SL	0	0.5	112.0	1.3	0	103.00	2.4	9.5	**1.08**
SW-02-00-SL	0	0.5	18.4	1.6	0.2	271.4	11.8	32.0	**1.03**
BD-09-00-SL	0	0.5	86.9	0.2	0	83.5	3.6	4.3	0.86
EP-12-00-SL	0	0.5	59.9	0.9	0	110.6	4.8	20.3	0.81
OA-25-00-SL	0	0.5	87.6	0.5	0	29.0	1.3	4.7	0.72
EP-03-00-SL	0	0.5	17.2	1.3	0	160.3	7.0	28.3	0.67
OA-11-00-SL	0	0.5	53.0	0.8	0	62.3	2.7	9.0	0.58
BP-04-00-SL	0	0.5	68.3	0.9	0	27.6	1.2	4.4	0.58
PL-01-00-SL	0	0.5	37.9	1.4	0	55.9	2.4	8.2	0.45
OA-20-00-SL	0	0.5	52.6	0.1	0	13.2	0.6	2.9	0.42
OA-01-00-SL	0	0.5	10.3	1.1	0	105.1	4.6	16.5	0.42
SW-01-00-SL	0	0.5	22.3	1.5	0.0	65.8	2.9	9.8	0.38
NB-11-00-SL	0	0.5	12.7	1.0	0	69.0	3.0	9.9	0.32
OA-02-00-SL	0	0.5	7.4	1.1	0	83.0	3.6	9.1	0.31
OA-13-00-SL	0	0.5	5.9	1.4	0	82.8	3.6	10.8	0.31
CB-01-00-SL	0	0.5	5.2	1.3	0	66.0	2.9	18.4	0.29
EP-07-00-SL	0	0.5	23.5	0.6	0	16.9	0.7	4.1	0.23
OA-16-00-SL	0	0.5	21.3	0.6	0	23.7	1.0	3.4	0.23
OA-14-00-SL	0	0.5	12.4	0.9	0	26.2	1.1	5.2	0.18
NB-14-00-SL	0	0.5	7.4	0.6	0	52.30	0.6	3.4	0.18
OA-10-00-SL	0	0.5	20.8	1.0	0	8.1	0.4	0.7	0.17
LF-05-00-SL	0	0.5	12.3	0.8	0	12.9	0.6	2.4	0.13
OA-07-00-SL	0	0.5	1.6	0.7	0	34.7	1.5	5.8	0.13
RR-03-00-SL	0	0.5	0.2	1.7	0.2	19.2	0.8	1.0	0.11
OA-24-00-SL	0	0.5	13.1	0.9	0	4.0	0.2	1.5	0.11
OA-15-00-SL	0	0.5	8.2	0.5	0	14.5	0.6	0.0	0.10
LF-01-00-SL	0	0.5	5.5	1.4	0	13.5	0.6	2.2	0.08
BP-06-00-SL	0	0.5	6.4	0.8	0	10.6	0.5	2.3	0.08

Determination of SOF for each Surface Soil Sample

sampleid	start_dept	end_depth	Tc-99	Th-232g	Th-232n	U-234[1]	U-235	U-238	SOF
RR-02-00-SL	0	0.5	1.8	1.4	0	13.3	0.58	4.9	0.07
OA-05-00-SL	0	0.5	0.5	1.0	0	18.0	0.8	3.6	0.07
NB-03-00-SL	0	0.5	0.9	0.4	0	15.7	0.7	0.6	0.05
OA-33-00-SL	0	0.5	0.4	1.3	0	14.7	0.6	1.8	0.05
OA-12-00-SL	0	0.5	1.6	0.5	0	11.2	0.5	1.3	0.05
PL-02-00-SL	0	0.5	1.6	1.2	0	8.9	0.4	1.4	0.04
BP-05-00-SL	0	0.5	2.8	1.3	0	4.3	0.2	2.0	0.04
BP-02-00-SL	0	0.5	1.1	0.6	0	9.3	0.4	1.0	0.04
NB-07-00-SL	0	0.5	0.4	1.1	0	9.8	0.4	1.8	0.04
OA-34-00-SL	0	0.5	0.9	1.2	0	7.9	0.3	1.8	0.03
BP-12-00-SL	0	0.5	0.2	1.4	0	7.4	0.3	3.2	0.03
PL-03-00-SL	0	0.5	3.0	0.8	0	0.9	0.0	2.0	0.03
SW-03-00-SL	0	0.5	0.8	1.2	0	7.9	0.3	1.3	0.03
OA-39-00-SL	0	0.5	1.5	1.1	0	7.5	0.3	0.5	0.03
NB-19-00-SL	0	0.5	0.8	1.2	0	7.4	0.3	1.5	0.03
NB-21-00-SL	0	0.5	0.1	1.0	0	9.7	0.4	1.1	0.03
LF-03-00-SL	0	0.5	1.6	0.7	0	6.5	0.3	0.5	0.03
OA-32-00-SL	0	0.5	0.3	1.0	0	5.7	0.2	2.9	0.03
OA-40-00-SL	0	0.5	0.7	1.0	0	8.1	0.4	0.9	0.03
LF-04-00-SL	0	0.5	2.4	1.2	0	2.7	0.1	1.2	0.03
NB-15-00-SL	0	0.5	1.8	1.1	0	3.3	0.1	1.8	0.03
BP-01-00-SL	0	0.5	0.6	1.0	0	5.6	0.2	2.3	0.03
NB-10-00-SL	0	0.5	0.1	1.2	0	7.2	0.3	1.7	0.03
OA-28-00-SL	0	0.5	0.9	1.1	0	4.3	0.2	2.1	0.03
NB-04-00-SL	0	0.5	1.0	1.5	0.0	0.0	0.0	1.5	0.02
NB-22-00-SL	0	0.5	2.3	0.9	0	0.0	0.0	2.3	0.03
BP-09-00-SL	0	0.5	0.5	1.2	0	5.0	0.2	2.0	0.03
SW-04-00-SL	0	0.5	0.4	0.7	0	5.8	0.3	1.7	0.03
NB-25-00-SL	0	0.5	0.8	0.6	0	4.9	0.2	1.2	0.02
NB-08-00-SL	0	0.5	0.0	0.8	0	3.7	0.2	3.2	0.02
OA-36-00-SL	0	0.5	1.4	1.0	0	1.6	0.1	1.7	0.02
BP-11-00-SL	0	0.5	0.3	1.5	0	4.2	0.2	1.8	0.02
NB-09-00-SL	0	0.5	0.5	1.4	0	5.2	0.2	0.7	0.02
LF-02-00-SL	0	0.5	0.9	0.3	0	3.9	0.2	0.6	0.02
OA-27-00-SL	0	0.5	0.2	1.1	0	4.2	0.2	1.5	0.02
OA-35-00-SL	0	0.5	1.6	0.4	0	1.4	0.1	0.9	0.02
NB-17-00-SL	0	0.5	0.0	1.5	0	1.09	0.1	3.4	0.02
OA-06-00-SL	0	0.5	0.4	1.0	0	2.5	0.1	2.0	0.02
OA-38-00-SL	0	0.5	0.9	0.9	0	1.7	0.1	1.3	0.02
OA-03-00-SL	0	0.5	0.4	0.9	0	4.0	0.2	0.7	0.02
NB-24-00-SL	0	0.5	0.4	0.8	0	3.9	0.2	0.7	0.02
NB-13-00-SL	0	0.5	1.2	1.1	0	0.0	0.0	1.7	0.02
OA-29-00-SL	0	0.5	0.9	1.2	0	0.4	0.0	1.6	0.01
OA-31-00-SL	0	0.5	0.2	0.7	0	4.2	0.2	0.5	0.01
NB-12-00-SL	0	0.5	0.4	1.4	0	1.45	0.2	1.3	0.01
NB-26-00-SL	0	0.5	0.5	0.1	0	3.6	0.2	0.2	0.01
BP-10-00-SL	0	0.5	0.5	1.2	0	0.0	0.0	2.1	0.01
NB-18-00-SL	0	0.5	0.4	1.1	0	0.5	0.0	1.9	0.01
NB-02-00-SL	0	0.5	0.2	0.1	0	0.76	0.3	0.8	0.01
OA-37-00-SL	0	0.5	0.3	1.0	0	1.93	0.2	0.6	0.01
GS-01-00-SL	0	0.5	0.4	0.7	0	2.4	0.1	0.3	0.01

Determination of SOF for each Surface Soil Sample

sampleid	start_dept	end_depth	Tc-99	Th-232g	Th-232n	U-234[1]	U-235	U-238	SOF
OA-09-00-SL	0	0.5	0.7	1.0	0	0.0	0.0	1.0	0.01
OA-30-00-SL	0	0.5	0.1	1.0	0	0.0	0.0	1.7	0.01
NB-05-00-SL	0	0.5	0.2	0.8	0	0.0	0.0	1.7	0.01
NB-20-00-SL	0	0.5	0.2	1.1	0	0.0	0.0	1.6	0.01
NB-23-00-SL	0	0.5	0.3	1.0	0	1.12	0.0	0.9	0.01
NB-06-00-SL	0	0.5	0.0	1.3	0	0.89	0.3	0.4	0.01
NB-27-00-SL	0	0.5	0.0	0.6	0	1.6	0.1	0.8	0.01
GS-05-00-SL	0	0.5	0.3	0.7	0	0.0	0.0	1.1	0.01
GS-04-00-SL	0	0.5	0.0	1.0	0	0.0	0.0	1.6	0.01
NB-16-00-SL	0	0.5	0.0	1.0	0	0.0	0.0	1.6	0.01
GS-02-00-SL	0	0.5	0.4	1.0	0	0.0	0.0	0.8	0.01
NB-01-00-SL	0	0.5	0.8	0.7	0	0.0	0.0	0.0	0.01
GS-03-00-SL	0	0.5	0.0	0.2	0	0.0	0.0	0.0	0.00

[1] U-234 concentrations estimated by using a scaling factor of 22 except where actual data was available.
Shaded values are actual U-234 analytical results.
Bolded values have SOF > 1.

Determination of SOF for each Subsurface Soil Sample

sampleid	start_dept	end_depth	Tc-99	Th-232g	Th-232n	U-234	U-235	U-238	SOF
EP-13-30-SL	28	31	131.0	1.0	0	8.3	0.4	0.5	5.75
BLD255-08-01			30.2	1.0	0	604.00	13.4	17.3	5.04
SW-02-01-SL	0	2	3.0	2.4	0.9	240.00	8.6	22.5	2.44
DM-02-05-SL	4	6	13.9	0.9	0	212.5	9.2	36.3	2.28
DM-02-22-SL	21	23	10.9	0.8	0	157.00	8.2	28.9	1.77
BLD253-02-04			7.5	1.2	0	172.00	5.9	10.9	1.50
EP-13-03-SL	2	4	13.9	1.2	0	30.8	1.3	7.0	0.86
EP-18-09-SL	8	10	11.7	1.0	0	37.0	1.6	10.6	0.84
EP-16-15-SL	14	16	17.1	1.0	0	7.2	0.3	2.1	0.81
EP-19-05-SL	4	6	11.4	1.0	0	34.3	1.5	10.1	0.80
EP-19-13-SL	12	14	10.4	1.3	0	35.4	1.5	9.6	0.76
EP-14-05-SL	4	6	12.8	1.1	0	0.0	0.0	1.5	0.57
DM-02-33-SL	32	34	0.0	1.2	0	66.9	2.9	12.0	0.53
EP-15-25-SL	24	26	11.0	0.5	0	0.0	0.0	0.0	0.48
EP-13-13-SL	12	14	8.6	1.0	0	4.3	0.2	2.0	0.42
NB-74-05-SL	4	6	7.5	1.0	0	8.3	0.4	1.0	0.39
DM-03-25-SL	24	26	7.0	0.3	0	6.4	0.3	1.2	0.36
EP-17-05-SL	4	6	1.2	1.8	0.4	2.67	0.4	1.4	0.32
EP-13-25-SL	24	26	6.4	1.1	0	0.5	0.0	0.0	0.28
DM-03-13-SL	12	14	5.8	1.1	0	2.7	0.1	0.6	0.28
EP-20-05-SL	4	6	3.0	1.6	0.1	7.2	0.3	0.2	0.27
EP-17-25-SL	24	26	5.2	1.5	0.0	0.8	0.0	1.2	0.25
BP-17-05-SL	4	6	4.3	1.3	0	8.1	0.4	1.5	0.25
PL-04-05-SL	4	6	4.5	0.7	0	4.44	0.3	1.7	0.24
EP-17-15-SL	14	16	3.7	1.3	0	9.6	0.4	1.7	0.24
EP-16-27-SL	26	28	5.2	0.1	0	0.0	0.0	0.3	0.23
LF-06-05-SL	4	6	4.3	1.2	0	5.62	0.4	0.0	0.23
LF-08-05-SL	4	6	4.4	1.4	0	4.3	0.2	0.8	0.22
EP-19-25-SL	24	26	4.8	1.3	0	0.0	0.0	0.0	0.21
EP-15-13-SL	12	14	4.3	1.0	0	0.0	0.0	1.9	0.20
EP-20-25-SL	24	26	3.9	0.8	0	1.3	0.1	2.6	0.20
CB-02-25-SL	24	26	0.0	1.7	0.2	9.8	0.4	0.9	0.20
NB-55-05-SL	4	6	0.2	1.7	0.2	0.84	0.1	1.6	0.19
NB-68-25-SL	24	26	0.5	1.6	0.2	8.3	0.4	0.7	0.19
EP-15-05-SL	4	6	3.4	1.1	0	3.9	0.2	1.6	0.19
LF-08-37-SL	36	38	4.2	0.3	0	0.0	0.0	0.0	0.18
BLD260-06-01				1.0	0	17.80	0.9	6.9	0.17
BLD253-02-01				0.2	0	20.7	0.9	3.7	0.16
NB-47-31-SL	30	32	0.2	1.6	0.1	7.9	0.3	1.2	0.16
NB-39-15-SL	14	16	2.4	1.1	0	6.3	0.3	1.9	0.16
EP-14-25-SL	24	26	2.1	1.1	0	10.7	0.5	0.0	0.16
BP-17-15-SL	14	16	2.5	1.2	0	6.6	0.3	0.5	0.15
EP-20-15-SL	14	16	2.7	0.9	0	0.7	0.0	1.6	0.14
NB-39-05-SL	4	6	2.1	0.9	0	5.4	0.2	1.1	0.14
NB-51-13-SL	12	14	0.3	1.0	0	17.8	0.8	0.5	0.14
OA-19-25-SL	24	26	0.2	1.6	0.2	2.0	0.1	1.6	0.13
EP-16-05-SL	4	6	2.6	1.1	0	2.42	0.0	0.0	0.13
OA-19-05-SL	4	6	1.7	1.3	0	7.0	0.3	0.9	0.13
NB-86-05-SL	4	6	0.3	0.4	0	15.5	0.7	1.2	0.12
NB-74-17-SL	16	18	2.8	0.9	0	0.0	0.0	0.0	0.12
PL-04-23-SL	22	24	0.4	1.4	0	14.8	0.6	1.0	0.12
DM-03-05-SL	4	6	2.5	1.3	0	0.71	0.1	0.5	0.12
SW-02-15-SL	14	16	0.6	1.4	0	11.3	0.5	2.6	0.12
BP-18-15-SL	14	16	0.0	1.3	0	16.4	0.7	1.1	0.12
LF-09-03-SL	2	4	1.6	0.7	0	4.8	0.2	1.4	0.11
NB-74-25-SL	24	26	2.5	0.7	0	0.6	0.0	0.0	0.11
BD-15-17-SL	16	18	0.2	1.5	0.1	7.4	0.3	1.5	0.11
NB-48-15-SL	14	16	0.4	0.6	0	12.6	0.5	0.9	0.11
OA-18-17-SL	16	18	0.9	1.3	0	7.3	0.3	2.1	0.11
NB-49-05-SL	4	6	0.3	1.2	0	13.7	0.6	0.0	0.10
NB-73-13-SL	12	14	1.0	0.0	0	8.4	0.4	0.6	0.10
NB-73-05-SL	4	6	0.8	0.3	0	9.8	0.4	0.6	0.10
NB-45-05-SL	4	6	0.1	1.3	0	12.8	0.6	1.3	0.10
LF-07-25-SL	24	26	0.9	1.0	0	8.9	0.4	0.0	0.10
NB-48-35-SL	34	36	0.8	1.1	0	8.5	0.4	1.0	0.10
BD-16-05-SL	4	6	1.6	0.8	0	1.73	0.3	1.0	0.10
SW-06-05-SL	4	6	0.1	1.1	0	12.2	0.5	1.1	0.09

Determination of SOF for each Subsurface Soil Sample

sampleid	start_dept	end_depth	Tc-99	Th-232g	Th-232n	U-234	U-235	U-238	SOF
BD-15-31-SL	30	32	0.3	1.5	0.1	3.0	0.1	0.9	0.09
SW-06-13-SL	12	14	0.2	1.1	0	11.3	0.5	1.3	0.09
NB-62-22-SL	21	23	0.3	0.0	0	11.8	0.5	0.0	0.09
BD-14-05-SL	4	6	1.4	1.2	0	1.24	0.5	1.1	0.09
NB-62-05-SL	4	6	0.5	0.9	0	8.4	0.4	1.4	0.09
NB-84-05-SL	4	6	0.7	0.1	0	6.6	0.3	1.7	0.09
BP-19-29-SL	28	30	0.0	1.3	0	13.1	0.6	0.3	0.09
BD-15-25-SL	24	26	0.9	1.0	0	5.8	0.3	1.3	0.09
EP-14-13-SL	12	14	1.5	1.2	0	3.2	0.1	0.0	0.09
BD-16-15-SL	14	16	0.0	1.2	0	12.7	0.6	0.4	0.09
NB-56-25-SL	24	26	0.5	1.3	0	9.4	0.4	0.4	0.09
NB-54-13-SL	12	14	0.1	1.5	0.0	9.6	0.4	1.2	0.08
NB-32-27-SL	26	28	1.7	1.1	0	0.6	0.0	0.9	0.08
EP-19-31-SL	30	32	0.7	1.3	0	7.6	0.3	0.4	0.08
BP-13-25-SL	24	26	0.4	0.8	0	8.9	0.4	1.2	0.08
BD-13-30-SL	28	31	1.0	0.6	0	4.5	0.2	1.2	0.08
BP-17-23-SL	22	24	1.7	1.4	0	0.0	0.0	1.0	0.08
SW-02-23-SL	22	24	0.5	1.3	0	8.5	0.4	0.0	0.08
NB-32-15-SL	14	16	0.8	1.0	0	5.6	0.2	1.1	0.08
NB-53-23-SL	22	24	0.1	1.1	0	9.5	0.4	1.6	0.08
NB-85-15-SL	14	16	0.3	1.1	0	7.9	0.3	1.8	0.08
BLD240-03-04				1.3	0	10.1	0.4	1.3	0.08
LF-07-34-SL	33	35	1.1	0.7	0	2.8	0.1	1.4	0.08
NB-60-23-SL	22	24	0.6	0.6	0	6.7	0.3	0.6	0.08
NB-85-05-SL	4	6	0.4	0.6	0	7.8	0.3	0.6	0.08
DM-03-34-SL	33	35	0.9	0.8	0	4.5	0.2	0.7	0.07
NB-30-25-SL	24	26	0.1	1.1	0	9.5	0.4	0.6	0.07
NB-30-33-SL	32	34	0.0	0.3	0	10.4	0.5	0.5	0.07
NB-52-25-SL	24	26	0.3	1.6	0.1	0.0	0.0	0.0	0.07
BP-21-34-SL	33	35	0.0	0.4	0	10.8	0.5	0.3	0.07
NB-33-27-SL	26	28	0.6	0.4	0	7.1	0.3	0.0	0.07
PL-05-28-SL	26	28	0.2	1.3	0	9.7	0.4	0.0	0.07
NB-46-17-SL	16	18	0.6	0.8	0	6.3	0.3	0.2	0.07
NB-48-25-SL	24	26	0.5	1.1	0	6.4	0.3	1.0	0.07
NB-52-35-SL	36	38	0.0	1.0	0	9.8	0.4	0.5	0.07
EP-18-15-SL	14	16	1.5	1.1	0	0.0	0.0	0.6	0.07
PL-04-31-SL	30	32	0.9	1.2	0	3.5	0.2	0.8	0.07
NB-46-29-SL	28	30	0.5	0.9	0	5.6	0.2	1.4	0.07
NB-68-05-SL	4	6	0.2	1.2	0	8.3	0.4	0.5	0.07
BLD255-07-15				0.9	0	8.5	0.4	1.1	0.06
NB-50-25-SL	24	26	0.2	0.8	0	8.3	0.4	0.0	0.06
NB-48-05-SL	4	6	0.3	1.2	0	6.0	0.3	1.4	0.06
NB-80-27-SL	26	28	0.2	0.7	0	8.4	0.4	0.0	0.06
NB-30-15-SL	14	16	0.1	0.9	0	5.5	0.2	2.7	0.06
PL-06-13-SL	12	14	0.4	1.0	0	7.3	0.3	0.0	0.06
LF-06-13-SL	12	14	0.9	1.3	0	0.7	0.0	2.3	0.06
NB-41-19-SL	16	22	0.3	0.3	0	7.4	0.3	0.3	0.06
NB-51-37-SL	36	38	0.2	1.1	0	7.2	0.3	0.8	0.06
NB-76-24-SL	23	24	1.0	0.2	0	2.9	0.1	0.0	0.06
SW-07-15-SL	14	16	0.4	1.4	0	4.6	0.2	1.9	0.06
BD-16-25-SL	24	26	0.2	1.4	0	7.1	0.3	0.5	0.06
BD-16-19-SL	18	20	0.1	1.4	0	6.3	0.3	2.2	0.06
NB-55-13-SL	12	14	0.5	0.9	0	3.8	0.2	1.8	0.06
LF-08-15-SL	14	16	0.2	1.1	0	6.9	0.3	0.7	0.06
NB-28-04-SL	3	5	0.4	1.5	0.0	2.9	0.1	0.4	0.06
PL-04-13-SL	12	14	1.2	0.5	0	0.0	0.0	1.1	0.06
NB-54-05-SL	4	6	0.3	0.9	0	5.7	0.2	1.3	0.06
LF-09-25-SL	24	26	0.7	0.9	0	4.0	0.2	0.5	0.06
BLD240-03-19				1.3	0	8.3	0.4	0.7	0.06
OA-18-33-SL	32	34	0.8	0.9	0	1.2	0.1	1.9	0.06
NB-68-17-SL	16	18	0.3	1.1	0	6.4	0.3	0.6	0.06
BLD255-08-08				1.3	0	7.8	0.3	0.9	0.06
NB-60-13-SL	12	14	1.1	1.3	0	0.0	0.0	1.1	0.06
NB-40-25-SL	24	26	0.8	0.8	0	2.9	0.1	0.2	0.06
SW-02-09-SL	8	10	0.9	0.9	0	0.0	0.0	2.1	0.06
LF-09-31-SL	30	32	0.1	0.3	0	6.7	0.3	0.7	0.06
NB-82-05-SL	4	6	1.0	0.9	0	0.0	0.0	1.4	0.05

Determination of SOF for each Subsurface Soil Sample

sampleid	start_dept	end_depth	Tc-99	Th-232g	Th-232n	U-234	U-235	U-238	SOF
EP-18-29-SL	27	31	1.0	1.2	0	0.7	0.0	1.1	0.05
NB-46-25-SL	24	26	0.7	0.8	0	2.5	0.1	1.1	0.05
NB-31-15-SL	14	16	0.7	0.7	0	0.92	0.2	1.3	0.05
NB-50-15-SL	14	16	0.3	1.5	0.0	0.6	0.0	1.1	0.05
NB-42-05-SL	4	6	0.5	0.5	0	3.1	0.1	1.3	0.05
NB-64-05-SL	4	6	0.0	0.9	0	7.6	0.3	0.4	0.05
NB-78-18-SL	16	19	0.1	0.7	0	5.2	0.2	1.6	0.05
DM-02-17-SL	16	18	0.9	0.6	0	1.6	0.1	0.4	0.05
BLD240-04-04				1.2	0	6.9	0.3	0.9	0.05
NB-44-18-SL	17	19	0.5	0.5	0	3.7	0.2	0.7	0.05
PL-06-33-SL	32	34	1.2	0.0	0	0.0	0.0	0.0	0.05
NB-41-13-SL	12	14	0.3	0.4	0	4.7	0.2	1.2	0.05
NB-43-05-SL	4	6	0.4	0.6	0	2.3	0.1	2.4	0.05
SW-05-12-SL	11	13	0.0	0.9	0	7.7	0.3	0.0	0.05
NB-39-25-SL	24	26	0.4	0.7	0	3.3	0.1	1.4	0.05
NB-34-25-SL	24	26	0.3	0.5	0	5.2	0.2	0.3	0.05
NB-45-33-SL	32	34	0.7	0.4	0	2.6	0.1	0.2	0.05
CB-02-05-SL	4	6	0.8	1.0	0	2.48	0.1	0.0	0.05
SW-05-08-SL	7	9	0.4	1.4	0	3.3	0.1	1.6	0.05
NB-53-33-SL	32	34	0.3	1.2	0	4.6	0.2	0.8	0.05
SW-08-05-SL	4	6	0.6	0.9	0	2.6	0.1	0.9	0.05
NB-33-05-SL	4	6	0.5	1.0	0	3.9	0.2	0.0	0.05
RR-04-25-SL	24	26	0.2	0.7	0	4.4	0.2	1.4	0.05
NB-40-31-SL	30	32	0.2	0.6	0	5.8	0.3	0.0	0.05
CB-02-15-SL	14	16	0.1	0.8	0	6.4	0.3	0.0	0.05
NB-44-11-SL	10	12	0.5	0.3	0	3.1	0.1	0.7	0.05
RR-05-05-SL	4	6	0.1	0.6	0	2.80	0.6	1.1	0.05
BD-13-23-SL	22	24	0.8	1.1	0	0.0	0.0	1.3	0.05
NB-50-05-SL	4	6	0.2	1.1	0	4.5	0.2	1.1	0.05
NB-76-06-SL	5	7	1.0	0.0	0	0.0	0.0	0.0	0.04
NB-67-05-SL	4	6	0.0	0.9	0	5.2	0.2	1.3	0.04
BP-13-35-SL	34	36	0.6	0.8	0	2.9	0.1	0.0	0.04
NB-71-01-SL	0	2	0.7	0.8	0	1.70	0.2	0.0	0.04
BD-14-31-SL	30	32	0.0	0.7	0	5.8	0.3	0.7	0.04
LF-07-09-SL			0.2	1.0	0	3.7	0.2	1.6	0.04
SW-06-23-SL	22	24	0.5	1.0	0	0.0	0.0	3.0	0.04
PL-06-29-SL	28	30	0.8	0.2	0	1.1	0.0	0.0	0.04
NB-46-09-SL	8	10	0.7	1.1	0	0.0	0.0	1.4	0.04
NB-75-19-SL	18	20	0.6	0.2	0	1.7	0.1	0.8	0.04
NB-85-35-SL	34	36	0.3	0.0	0	4.2	0.2	0.0	0.04
BP-13-11-SL	10	12	0.4	1.3	0	1.9	0.1	1.4	0.04
BLD240-01-09				0.9	0	5.3	0.2	0.9	0.04
NB-61-28-SL	27	29	0.3	0.8	0	3.0	0.1	1.2	0.04
BP-13-05-SL	4	6	0.6	0.9	0	0.94	0.3	0.2	0.04
RR-05-25-SL	24	26	0.4	1.2	0	3.5	0.2	0.3	0.04
NB-79-11-SL	10	12	0.0	0.7	0	5.5	0.2	0.7	0.04
NB-78-07-SL	6	8	0.6	0.9	0	0.74	0.2	0.8	0.04
SW-07-05-SL	4	6	0.6	0.9	0	0.87	0.0	1.4	0.04
NB-79-05-SL	4	6	0.1	1.0	0	5.5	0.2	0.0	0.04
NB-42-23-SL	22	24	0.2	0.2	0	4.8	0.2	0.1	0.04
NB-32-33-SL	32	34	0.3	0.8	0	4.0	0.2	0.0	0.04
NB-66-15-SL	14	16	0.5	1.4	0	1.3	0.1	1.1	0.04
NB-59-05-SL	4	6	0.1	0.9	0	3.3	0.1	1.6	0.04
NB-66-05-SL	4	6	0.8	0.0	0	0.0	0.0	0.4	0.04
BP-21-24-SL	23	25	0.0	1.2	0	4.0	0.2	1.7	0.04
OA-18-03-SL	2	4	0.6	0.9	0	0.75	0.1	0.9	0.04
NB-65-05-SL	4	6	0.1	0.7	0	4.1	0.2	0.9	0.04
NB-33-15-SL	14	16	0.1	1.2	0	4.2	0.2	0.8	0.04
NB-28-35-SL	34	36	0.2	0.3	0	3.7	0.2	0.5	0.04
NB-34-05-SL	4	6	0.0	1.1	0	4.3	0.2	1.3	0.04
NB-53-13-SL	12	14	0.5	1.3	0	2.6	0.1	0.0	0.04
NB-37-25-SL	24	26	0.1	1.4	0	5.4	0.2	0.1	0.04
NB-79-24-SL	23	25	0.0	1.1	0	4.6	0.2	0.8	0.04
NB-83-05-SL	4	6	0.1	1.4	0	3.4	0.1	1.3	0.04
BD-16-34-SL	33	35	0.2	1.0	0	3.6	0.2	0.9	0.04
NB-60-05-SL	4	6	0.0	1.1	0	5.8	0.3	0.0	0.04
BD-13-09-SL	8	10	0.7	0.6	0	1.08	0.0	0.3	0.04

Determination of SOF for each Subsurface Soil Sample

sampleid	start_dept	end_depth	Tc-99	Th-232g	Th-232n	U-234	U-235	U-238	SOF
BP-18-25-SL	24	26	0.3	1.2	0	2.1	0.1	1.1	0.04
BD-14-13-SL	12	14	0.6	0.9	0	1.2	0.1	0.3	0.04
BP-22-23-SL	22	24	0.0	0.8	0	3.9	0.2	1.5	0.04
NB-57-34-SL	33	35	0.0	1.0	0	4.3	0.2	1.1	0.04
NB-53-05-SL	4	6	0.1	0.7	0	3.4	0.1	1.3	0.04
PL-05-15-SL	14	16	0.7	1.2	0	1.2	0.1	0.0	0.04
NB-39-30-SL	29	31	0.5	1.3	0	0.0	0.0	1.9	0.04
NB-64-17-SL	16	18	0.0	0.3	0	5.4	0.2	0.1	0.04
NB-82-20-SL	18	21	0.4	0.1	0	2.7	0.1	0.0	0.04
NB-59-25-SL	24	26	0.6	1.0	0	0.0	0.0	1.4	0.04
NB-68-13-SL	12	14	0.6	1.2	0	0.0	0.0	1.0	0.04
NB-52-13-SL	12	14	0.1	1.3	0	4.0	0.2	0.6	0.04
BD-13-15-SL	14	16	0.7	1.1	0	0.0	0.0	0.3	0.03
NB-40-17-SL	16	18	0.5	1.1	0	0.0	0.0	1.6	0.03
NB-37-15-SL	14	16	0.5	0.6	0	0.0	0.0	1.3	0.03
NB-42-13-SL	12	14	0.4	0.4	0	1.7	0.1	0.6	0.03
NB-36-15-SL	14	16	0.2	1.2	0	0.98	0.2	1.5	0.03
NB-72-05-SL	4	6	0.0	0.7	0	4.4	0.2	0.5	0.03
PL-06-07-SL	6	8	0.8	1.0	0	0.0	0.0	0.0	0.03
BP-19-25-SL	24	26	0.2	1.2	0	3.6	0.2	0.0	0.03
NB-77-13-SL	12	14	0.7	0.2	0	0.0	0.0	0.5	0.03
NB-38-09-SL	8	10	0.5	0.9	0	0.0	0.0	1.6	0.03
NB-56-33-SL	32	35	0.1	0.1	0	3.8	0.2	0.4	0.03
NB-70-15-SL	14	16	0.0	1.3	0	3.3	0.1	1.2	0.03
NB-70-33-SL	32	34	0.4	0.8	0	1.9	0.1	0.3	0.03
NB-57-15-SL	14	16	0.4	1.4	0	1.9	0.1	0.0	0.03
EP-15-29-SL	28	30	0.6	1.0	0	1.8	0.1	-1.0	0.03
OA-19-33-SL	32	34	0.0	0.4	0	4.6	0.2	0.1	0.03
BP-18-05-SL	4	6	0.0	1.1	0	4.1	0.2	0.3	0.03
EP-14-31-SL	30	32	0.5	0.7	0	0.0	0.0	0.9	0.03
NB-47-05-SL	4	6	0.3	1.3	0	2.8	0.1	0.1	0.03
NB-71-11-SL	10	12	0.0	1.5	0.0	2.6	0.1	0.8	0.03
BP-19-05-SL	4	6	0.0	0.8	0	3.4	0.1	1.0	0.03
NB-28-14-SL	13	15	0.4	1.0	0	1.4	0.1	0.6	0.03
NB-81-11-SL	10	12	0.2	1.0	0	2.9	0.1	0.0	0.03
NB-73-23-SL	22	24	0.2	0.0	0	2.5	0.1	0.5	0.03
NB-35-25-SL	24	26	0.2	1.0	0	2.9	0.1	0.2	0.03
SW-07-23-SL	22	24	0.6	0.9	0	0.0	0.0	0.5	0.03
RR-05-15-SL	14	16	0.1	0.8	0	3.8	0.2	0.0	0.03
NB-48-11-SL	10	12	0.5	1.3	0	0.0	0.0	0.6	0.03
PL-06-17-SL	16	18	0.5	0.8	0	0.0	0.0	1.1	0.03
BP-21-07-SL	6	8	0.0	1.1	0	2.7	0.1	1.2	0.03
OA-19-15-SL	14	16	0.0	1.2	0	3.3	0.1	0.7	0.03
NB-65-17-SL	16	18	0.0	0.5	0	3.5	0.2	0.6	0.03
BLD240-01-01				1.2	0	2.8	0.1	1.1	0.03
NB-34-15-SL	14	16	0.3	0.3	0	0.0	0.0	2.0	0.03
NB-51-25-SL	24	26	0.4	1.0	0	1.6	0.1	0.0	0.03
NB-58-29-SL	28	30	0.3	1.3	0	0.0	0.0	1.5	0.03
NB-49-37-SL	36	38	0.6	0.5	0	0.0	0.0	0.0	0.03
NB-54-25-SL	24	26	0.4	1.3	0	0.0	0.0	1.2	0.03
NB-58-05-SL	4	6	0.2	1.1	0	2.6	0.1	0.0	0.03
NB-58-15-SL	14	16	0.4	1.0	0	0.0	0.0	0.9	0.03
NB-38-25-SL	24	26	0.3	0.7	0	0.0	0.0	1.8	0.03
NB-56-13-SL	12	14	0.2	0.8	0	1.3	0.1	1.1	0.03
NB-75-08-SL	4	12	0.3	0.9	0	0.0	0.0	1.3	0.03
NB-45-25-SL	24	26	0.5	1.2	0	0.0	0.0	0.4	0.03
NB-47-25-SL	24	26	0.3	0.8	0	0.0	0.0	1.4	0.03
NB-44-05-SL	4	6	0.4	0.4	0	0.49	0.1	0.5	0.02
NB-76-10-SL	9	11	0.1	0.0	0	2.9	0.1	0.0	0.02
NB-63-05-SL	4	6	0.2	1.0	0	0.74	0.2	0.8	0.02
LF-06-32-SL	32	33	0.5	0.5	0	0.0	0.0	0.2	0.02
NB-61-23-SL	22	24	0.3	0.8	0	0.6	0.0	0.9	0.02
NB-52-05-SL	4	6	0.2	0.9	0	1.5	0.1	0.5	0.02
NB-56-05-SL	4	6	0.6	0.6	0	0.0	0.0	0.0	0.02
BP-17-31-SL	30	32	0.3	0.9	0	0.0	0.0	1.3	0.02
NB-72-11-SL	10	12	0.4	0.3	0	0.0	0.0	0.6	0.02
NB-35-01-SL	0	2	0.3	0.9	0	0.0	0.0	1.2	0.02

Determination of SOF for each Subsurface Soil Sample

sampleid	start_dept	end_depth	Tc-99	Th-232g	Th-232n	U-234	U-235	U-238	SOF
NB-77-05-SL	4	6	0.4	0.4	0	0.8	0.0	0.0	0.02
BP-20-19-SL	18	20	0.0	1.0	0	2.6	0.1	0.8	0.02
RR-04-15-SL	14	16	0.1	1.0	0	2.6	0.1	0.3	0.02
BLD260-06-03				1.1	0	2.8	0.1	0.6	0.02
NB-83-23-SL	22	24	0.0	0.0	0	2.5	0.1	0.8	0.02
LF-09-17-SL	16	18	0.5	1.1	0	0.0	0.0	0.0	0.02
NB-84-33-SL	32	34	0.4	0.4	0	0.0	0.0	0.6	0.02
NB-45-13-SL	12	14	0.3	1.0	0	0.0	0.0	1.3	0.02
NB-29-14-SL	13	15	0.1	0.1	0	2.7	0.1	0.0	0.02
BLD255-07-02				0.7	0	1.4	0.1	1.7	0.02
NB-60-31-SL	30	32	0.3	0.7	0	0.0	0.0	1.4	0.02
NB-29-22-SL	21	23	0.3	0.3	0	0.4	0.0	0.7	0.02
NB-37-05-SL	4	6	0.3	1.2	0	0.0	0.0	1.3	0.02
NB-70-05-SL	4	6	0.4	1.3	0	0.0	0.0	0.4	0.02
BP-13-15-SL	14	16	0.3	0.8	0	0.0	0.0	1.0	0.02
NB-31-05-SL	4	6	0.0	0.9	0	2.3	0.1	0.8	0.02
NB-63-19-SL	18	20	0.2	0.3	0	1.6	0.1	0.5	0.02
NB-74-33-SL	32	34	0.5	0.5	0	0.0	0.0	0.0	0.02
NB-86-19-SL	18	20	0.0	0.4	0	1.6	0.1	1.2	0.02
NB-43-13-SL	10	16	0.3	0.1	0	0.0	0.0	0.7	0.02
NB-54-31-SL	30	32	0.1	0.2	0	1.9	0.1	0.2	0.02
LF-06-27-SL	26	28	0.3	0.4	0	0.3	0.0	0.4	0.02
NB-86-15-SL	14	16	0.3	1.4	0	0.0	0.0	0.7	0.02
BP-22-33-SL	32	34	0.4	0.3	0	0.0	0.0	0.3	0.02
NB-55-33-SL	32	34	0.4	0.5	0	0.0	0.0	0.3	0.02
NB-69-15-SL	14	16	0.1	0.7	0	2.1	0.1	0.0	0.02
NB-72-22-SL	20	23	0.4	0.4	0	0.0	0.0	0.4	0.02
NB-51-05-SL	4	6	0.0	0.9	0	0.83	0.2	1.0	0.02
NB-69-22-SL	21	23	0.3	1.0	0	0.0	0.0	0.9	0.02
BP-18-31-SL	30	32	0.4	0.2	0	0.0	0.0	0.2	0.02
NB-35-15-SL	14	16	0.1	0.8	0	1.4	0.1	0.7	0.02
BP-21-13-SL	12	14	0.0	0.9	0	1.9	0.1	0.7	0.02
NB-85-25-SL	24	26	0.2	1.3	0	0.0	0.0	1.1	0.02
BD-14-25-SL	24	26	0.2	1.1	0	0.0	0.0	1.2	0.02
NB-57-05-SL	4	6	0.1	1.0	0	0.0	0.0	1.6	0.02
NB-32-05-SL	4	6	0.4	1.0	0	0.0	0.0	0.0	0.02
NB-67-11-SL	10	12	0.3	0.4	0	0.0	0.0	0.2	0.02
BLD240-04-02				1.1	0	0.5	0.0	1.7	0.02
NB-61-05-SL	4	6	0.1	1.0	0	1.9	0.1	0.2	0.02
BP-22-13-SL	12	14	0.1	1.0	0	1.2	0.1	0.7	0.02
NB-49-15-SL	14	16	0.0	1.1	0	0.7	0.0	1.4	0.02
NB-81-09-SL	8	10	0.1	0.8	0	0.71	0.1	0.5	0.02
NB-68-33-SL	32	34	0.4	0.1	0	0.0	0.0	0.0	0.02
NB-58-36-SL	35	37	0.2	0.5	0	0.0	0.0	1.0	0.02
SW-08-15-SL	14	16	0.3	1.1	0	0.0	0.0	0.4	0.02
NB-67-21-SL	20	22	0.2	0.4	0	0.0	0.0	0.9	0.02
LF-08-21-SL	20	22	0.2	1.1	0	0.7	0.0	0.2	0.02
BP-22-05-SL	4	6	0.0	1.0	0	0.3	0.0	1.7	0.02
NB-55-25-SL	24	26	0.3	1.1	0	0.0	0.0	0.2	0.01
NB-29-05-SL	4	6	0.3	1.1	0	0.0	0.0	0.5	0.01
NB-57-29-SL	28	30	0.0	0.7	0	0.0	0.0	1.9	0.01
BP-19-13-SL	12	14	0.0	1.1	0	2.2	0.1	0.0	0.01
NB-70-23-SL	22	24	0.1	0.9	0	0.0	0.0	1.2	0.01
SW-08-03-SL	2	4	0.2	1.2	0	0.0	0.0	0.6	0.01
LF-07-15-SL	14	16	0.2	1.0	0	0.0	0.0	0.8	0.01
NB-40-05-SL	4	6	0.1	0.8	0	0.0	0.0	1.2	0.01
NB-78-11-SL	10	12	0.0	0.5	0	2.0	0.1	0.0	0.01
NB-59-31-SL	30	32	0.1	0.8	0	0.0	0.0	0.8	0.01
BLD240-05-02				0.9	0	0.0	0.0	1.6	0.01
NB-69-05-SL	4	6	0.0	0.7	0	0.0	0.0	1.4	0.01
NB-31-32-SL	31	33	0.0	0.8	0	0.0	0.0	1.5	0.01
NB-30-05-SL	4	6	0.1	1.4	0	0.92	0.1	0.0	0.01
RR-04-07-SL	6	8	0.1	1.0	0	0.75	0.0	0.3	0.01
NB-41-05-SL	4	6	0.2	0.9	0	0.0	0.0	0.5	0.01
NB-64-13-SL	12	14	0.1	0.3	0	0.7	0.0	0.1	0.01
BLD240-05-01				0.5	0	0.0	0.0	1.4	0.01
NB-50-37-SL	36	38	0.1	0.8	0	0.0	0.0	0.6	0.01

Determination of SOF for each Subsurface Soil Sample

sampleid	start_dept	end_depth	Tc-99	Th-232g	Th-232n	U-234	U-235	U-238	SOF
NB-62-12-SL	11	13	0.0	0.1	0	0.0	0.0	1.3	0.01
NB-36-05-SL	4	6	0.1	0.7	0	0.75	0.0	0.0	0.01
NB-83-11-SL	10	12	0.2	0.2	0	0.0	0.0	0.0	0.01
NB-66-19-SL	18	20	0.0	0.4	0	0.3	0.0	1.0	0.01
NB-59-13-SL	12	14	0.1	1.3	0	0.0	0.0	0.7	0.01
NB-38-15-SL	14	16	0.1	0.7	0	0.0	0.0	0.4	0.01
NB-72-19-SL	18	20	0.1	0.3	0	0.0	0.0	0.3	0.01
NB-47-15-SL	14	16	0.0	1.4	0	0.0	0.0	0.9	0.01
BP-20-03-SL	2	4	0.0	1.0	0	0.0	0.0	1.1	0.01
NB-31-27-SL	26	28	0.0	0.7	0	0.0	0.0	1.1	0.01
NB-36-27-SL	26	28	0.0	1.3	0	0.0	0.0	1.1	0.01
NB-28-24-SL	23	25	0.1	0.7	0	0.0	0.0	0.6	0.01
NB-61-13-SL	12	14	0.0	1.1	0	0.0	0.0	0.9	0.01
NB-81-31-SL	30	32	0.1	0.4	0	0.2	0.0	0.3	0.01
NB-49-25-SL	24	26	0.2	1.0	0	0.0	0.0	0.0	0.01
NB-77-24-SL	22	25	0.0	0.1	0	0.4	0.0	0.4	0.01
OA-18-25-SL	24	26	0.0	1.2	0	0.0	0.0	0.7	0.01
PL-05-05-SL	4	6	0.0	1.3	0	1.08	0.0	0.0	0.01
BD-15-05-SL	4	6	0.1	1.1	0	0.0	0.0	0.0	0.01
NB-75-15-SL	12	18	0.0	0.6	0	0.0	0.0	0.7	0.01
EP-17-30-SL	29	31	0.1	0.3	0	0.0	0.0	0.3	0.00
NB-80-05-SL	4	6	0.0	1.0	0	0.0	0.0	0.4	0.00
NB-71-27-SL	26	28	0.0	0.6	0	0.0	0.0	0.4	0.00
NB-82-11-SL	10	12	0.0	0.1	0	0.0	0.0	0.3	0.00
SW-08-25-SL	24	26	0.1	0.0	0	0.0	0.0	0.0	0.00
NB-69-34-SL	33	35	0.0	0.6	0	0.0	0.0	0.3	0.00
NB-80-11-SL	10	12	0.1	0.3	0	0.0	0.0	0.0	0.00
NB-65-13-SL	12	14	0.0	0.7	0	0.0	0.0	0.3	0.00
NB-84-15-SL	14	16	0.0	0.6	0	0.0	0.0	0.0	0.00
BP-20-27-SL	26	28	0.0	0.7	0	0.0	0.0	0.0	0.00
NB-63-13-SL	12	14	0.0	0.6	0	0.0	0.0	0.0	0.00
NB-84-23-SL	22	24	0.0	0.3	0	0.0	0.0	0.0	0.00

[1] U-234 concentrations estimated by using a scaling factor of 22 except where actual data was available.
Shaded values are actual U-234 analytical results.
Bolded values have SOF > 1.

Determination of SOF for each Sediment Sample

sampleid	start_dept	end_depth	Tc-99	Th-232g	Th-232n	U-234	U-235	U-238	SOF
SW-06-SS	0	0.5	284.00	4.63	3.2	937.00	37.30	86.90	**21.20**
SW-01-SS	0	0.5	255.00	1.56	0.1	236.00	12.20	39.40	**13.07**
SW-07-SS	0	0.5	36.30	1.25	0	291.00	14.80	60.50	**4.03**
SW-05-SS	0	0.5	16.80	0.80	0	19.10	0.87	5.69	0.90
SW-12-SS	0	0.5	4.36	0.67	0	1.47	0.34	0.63	0.21
SW-03-SS	0	0.5	2.80	0.86	0	7.92	0.44	1.06	0.18
SW-04-SS	0	0.5	1.91	0.78	0	2.80	0.20	0.71	0.11
SW-02-SS	0	0.5	1.36	0.51	0	3.99	-0.27	0.95	0.08
SW-13-SS	0	0.5	1.54	0.63	0	0.99	0.22	-0.43	0.08
SW-10-SS	0	0.5	0.46	0.59	0	0.47	0.20	0.48	0.03
SW-11-SS	0	0.5	0.19	1.06	0	1.12	-0.01	1.27	0.02
SW-15-SS	0	0.5	0.17	0.58	0	0.55	0.11	0.99	0.02
SW-16-SS	0	0.5	0.35	0.05	0	0.28	-0.07	0.29	0.02
SW-08-SS	0	0.5	0.02	0.08	0	0.33	0.22	0.27	0.01
SW-08-SS-FD	0	0.5	0.02	0.23	0	0.32	-0.11	0.39	0.00
SW-14-SS	0	0.5	-0.23	0.01	0	0.25	0.22	0.55	0.00

Bolded values have SOF > 1.

APPENDIX D

DETERMINATION OF SCALING FACTORS FOR SURFACE SOILS

Detected Sampling Results and Scaling Factors of Individual Sample for EU-1A

Sample ID	Detected Concentration (pCi/g)				Scaling Factors	
	Np-237	Pu 239/240	Tc-99	U-238	Pu-239 /U-238	Tc-99 /U-238
BD-09-00-SL			86.9	4.26		20.40
BP-01-00-SL				2.27		
BP-02-00-SL			1.13			
BP-04-00-SL			68.3	4.43		15.42
BP-05-00-SL			2.81			
BP-06-00-SL			6.36	2.33		2.73
BP-09-00-SL				2.03		
BP-12-00-SL				1		
CB-01-00-SL			5.15	18.4		0.28
LF-01-00-SL			5.49			
LF-02-00-SL			0.902			
LF-03-00-SL			1.56			
LF-04-00-SL			2.38			
LF-05-00-SL			12.3	2.38		5.17
NB-20-00-SL			1.6			
NB-21-00-SL			1.1			
OA-01-00-SL		0.01	10.3	16.5	0.0009	0.62
OA-02-00-SL			7.39	9.1		0.81
OA-05-00-SL				3.64		
OA-06-00-SL				2.02		
OA-07-00-SL			1.59	5.76		0.28
OA-10-00-SL			20.8			
OA-11-00-SL			53	9.04		5.86
OA-12-00-SL			1.64			
OA-13-00-SL			5.85	10.8		0.54
OA-14-00-SL			12.4	5.22		2.38
OA-15-00-SL			8.22			
OA-16-00-SL			21.3			
OA-20-00-SL			52.6	2.93		17.95
OA-24-00-SL			13.1			
OA-25-00-SL			87.6	4.73		18.52
OA-28-00-SL			0.928			
OA-29-00-SL			0.907			
OA-32-00-SL				2.94		
OA-35-00-SL			1.57			
OA-36-00-SL			1.39			
OA-37-00-SL		0.01		1.08	**0.0081**	
OA-39-00-SL			1.45			
OA-40-00-SL						
PL-01-00-SL			37.9	8.15		4.65
PL-02-00-SL			1.58			
PL-03-00-SL			2.96	2.04		1.45
RR-02-00-SL			1.76	4.87		0.36

Summary Report for ProUCL Run: EU-1A Surface Soil

Data File

Variable: **Tc-99/U-238**

Raw Statistics	
Number of Valid Samples	16
Number of Unique Samples	16
Minimum	0.276042
Maximum	20.39906
Mean	6.088849
Median	2.552546
Standard Deviation	7.418214
Variance	55.02991
Coefficient of Variation	1.218328
Skewness	1.134631

Gamma Statistics	
k hat	0.650233
k star (bias corrected)	0.569981
Theta hat	9.364109
Theta star	10.68255
nu hat	20.80744
nu star	18.23938
Approx.Chi Square Value (.05)	9.562695
Adjusted Level of Significance	0.03348
Adjusted Chi Square Value	8.853869

Log-transformed Statistics	
Minimum of log data	-1.287203
Maximum of log data	3.015489
Mean of log data	0.867277
Standard Deviation of log data	1.558612
Variance of log data	2.429271

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

UCL-95 (ProUCL) = 11.614

Scaling Factor = 11.614

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.750321155
Shapiro-Wilk 5% Critical Value	0.887
Data not normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t UCL	9.339973969

Gamma Distribution Test	
A-D Test Statistic	0.623057078
A-D 5% Critical Value	0.783227704
K-S Test Statistic	0.155955545
K-S 5% Critical Value	0.224808298
Data follow gamma distribution	
at 5% significance level	
95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**11.61354855**
Adjusted Gamma UCL	12.54330892

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.913797635
Shapiro-Wilk 5% Critical Value	0.887
Data are lognormal at 5% significance level	
95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	35.08856622
95% Chebyshev (MVUE) UCL	20.64067182
97.5% Chebyshev (MVUE) UCL	26.56129475
99% Chebyshev (MVUE) UCL	38.19121203

95% Non-parametric UCLs	
CLT UCL	9.139317753
Adj-CLT UCL (Adjusted for skewness)	9.701419122
Mod-t UCL (Adjusted for skewness)	9.427650423
Jackknife UCL	9.339973969
Standard Bootstrap UCL	9.019369144
Bootstrap-t UCL	10.65542282
Hall's Bootstrap UCL	8.817088928
Percentile Bootstrap UCL	9.161309196
BCA Bootstrap UCL	9.657111043
95% Chebyshev (Mean, Sd) UCL	14.17266028
97.5% Chebyshev (Mean, Sd) UCL	17.67053208
99% Chebyshev (Mean, Sd) UCL	24.54142392

Detected Sampling Results and Scaling Factors of Individual Sample for EU-1B

Sample ID	Detected Concentration (pCi/g)				Scaling Factors		
	Np-237	Pu 239/240	Tc-99	U-238	Np-237/U-238	Pu 239/U-238	Tc-99/U-238
EP-03-00-SL	0.04		17.2	28.30	0.0014		0.61
EP-07-00-SL			23.5	4.12			5.70
EP-12-00-SL			59.9	20.30			2.95

Detected Sampling Results and Scaling Factors of Individual Sample for EU-3

	Detected Concentration (pCi/g)				Scaling Factors		
Sample ID	Np-237	Pu 239/240	Tc-99	U-238	Np-237/U-238	Pu 239/U-238	Tc-99/U-238
SW-01-00-SL			22.3	9.81			2.27
SW-02-SS			1.36	1.03			1.32
SW-03-SS			2.8	1.39			2.01
SW-04-SS			1.91	0.952			2.01
SW-05-SS			16.8	3.33			5.05
SW-08-SS				0.299			
SW-10-SS				0.517			
SW-11-SS				0.599			
SW-12-SS			4.36	0.566			7.70
SW-13-SS			1.54	0.593			2.60
SW-14-SS				0.244			
SW-15-SS				0.619			
SW-16-SS				0.262			
NB-11-00-SL			12.7	9.88			1.29
NB-13-00-SL			1.2				
NB-14-00-SL			7.43	3.53			2.10
NB-15-00-SL			1.81				

Summary Report for ProUCL Run: EU-3 Surface Soil

Data File

Variable: **Tc-99/U-238n**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	8
Minimum	1.29
Maximum	7.7
Mean	2.927778
Median	2.1
Standard Deviation	2.105207
Variance	4.431894
Coefficient of Variation	0.719046
Skewness	1.847584

Gamma Statistics	
k hat	3.037717
k star (bias corrected)	2.099219
Theta hat	0.963809
Theta star	1.394699
nu hat	54.67891
nu star	37.78594
Approx.Chi Square Value (.05)	24.70827
Adjusted Level of Significance	0.02308
Adjusted Chi Square Value	22.50191

Log-transformed Statistics	
Minimum of log data	0.254642
Maximum of log data	2.04122
Mean of log data	0.900709
Standard Deviation of log data	0.585206
Variance of log data	0.342466

RECOMMENDATION

Assuming gamma distribution (0.05)

Use Approximate Gamma UCL

UCL-95 (ProUCL) = 4.477

Scaling Factor = 4.477

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.74093573
Shapiro-Wilk 5% Critical Value	0.829
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	4.23268865

Gamma Distribution Test	
A-D Test Statistic	0.74693353
A-D 5% Critical Value	0.7267306
K-S Test Statistic	0.28122246
K-S 5% Critical Value	0.28130568
Data follow approximate gamma distibution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**4.47740059**
Adjusted Gamma UCL	4.91642034

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.87643737
Shapiro-Wilk 5% Critical Value	0.829
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	4.84293484
95% Chebyshev (MVUE) UCL	5.33600507
97.5% Chebyshev (MVUE) UCL	6.40755648
99% Chebyshev (MVUE) UCL	8.51241172

95% Non-parametric UCLs	
CLT UCL	4.08202997
Adj-CLT UCL (Adjusted for skewness)	4.5438117
Mod-t UCL (Adjusted for skewness)	4.30471727
Jackknife UCL	4.23268865
Standard Bootstrap UCL	4.03197339
Bootstrap-t UCL	7.69130835
Hall's Bootstrap UCL	11.9302082
Percentile Bootstrap UCL	4.04777778
BCA Bootstrap UCL	4.53777778
95% Chebyshev (Mean, Sd) UCL	5.98657192
97.5% Chebyshev (Mean, Sd) UCL	7.31011459
99% Chebyshev (Mean, Sd) UCL	9.90995787

APPENDIX E

DETERMINATION OF SCALING FACTORS FOR VOLUMETRIC SOILS

Detected Numetric Sampling Results and Scaling Factors of Individual Sample for EU-1A

Sample ID	Detected Concentration (pCi/g)				Scaling Factors		
	Np-237	Pu 239/240	Tc-99	U-238	Np-237 /U-238	Pu239/240 /U-238	Tc-99 /U-238
BD-09-00-SL			86.90	4.26			20.40
BD-13-09-SL				0.89			
BD-14-05-SL				0.92			
BD-15-31-SL							
BD-16-05-SL			1.61	0.87			1.86
BLD240-03-04	0.00507						
BLD253-02-04	0.00772		7.50	11.10	0.0007		0.68
BLD255-05-01	0.00552	0.01					
BLD255-07-02				1.70			
BLD255-07-15				1.10			
BLD255-08-08		0.01					
BLD260-06-01		0.00		5.04		0.0005	
BP-01-00-SL				2.27			
BP-02-00-SL			1.13				
BP-04-00-SL			68.30	4.43			15.42
BP-05-00-SL			2.81				
BP-06-00-SL			6.36	2.33			2.73
BP-09-00-SL				2.03			
BP-12-00-SL				1.00			
BP-13-05-SL				0.85			
BP-17-05-SL			4.26				
BP-17-15-SL			2.46				
BP-17-23-SL			1.66				
CB-01-00-SL			5.15	18.40			0.28
CB-02-05-SL			0.79	1.14			0.69
DM-02-33-SL				12.00			
DM-03-05-SL			2.54	0.86			2.97
DM-03-13-SL			5.84				
DM-03-25-SL			7.04				
LF-01-00-SL			5.49				
LF-02-00-SL			0.90				
LF-03-00-SL			1.56				
LF-04-00-SL			2.38				
LF-05-00-SL			12.30	2.38			5.17
LF-06-05-SL			4.26	1.42			3.00
LF-06-13-SL				2.34			
LF-08-05-SL			4.37				
LF-08-37-SL			4.21				
LF-09-03-SL			1.60				
NB-39-05-SL			2.11				
NB-39-15-SL			2.43				
NB-51-05-SL				0.81			
NB-55-05-SL				0.90			
NB-74-05-SL			7.49				
NB-74-17-SL			2.81				

Detected Volumetric Sampling Results and Scaling Factors of Individual Sample for EU-1A

Sample ID		Detected Concentration (pCi/g)				Scaling Factors	
	Np-237	Pu 239/240	Tc-99	U-238	Np-237 /U-238	Pu239/240 /U-238	Tc-99 /U-238
NB-74-25-SL			2.45				
OA-01-00-SL		0.01	10.30	16.50		0.0009	0.62
OA-02-00-SL			7.39	9.10			0.81
OA-05-00-SL				3.64			
OA-06-00-SL				2.02			
OA-07-00-SL			1.59	5.76			0.28
OA-10-00-SL			20.80				
OA-11-00-SL			53.00	9.04			5.86
OA-12-00-SL			1.64				
OA-13-00-SL			5.85	10.80			0.54
OA-14-00-SL			12.40	5.22			2.38
OA-15-00-SL			8.22				
OA-16-00-SL			21.30				
OA-18-03-SL				0.79			
OA-19-05-SL			1.67				
OA-20-00-SL			52.60	2.93			17.95
OA-24-00-SL			13.10				
OA-25-00-SL			87.60	4.73			18.52
OA-28-00-SL			0.93				
OA-29-00-SL			0.91				
OA-32-00-SL				2.94			
OA-35-00-SL			1.57				
OA-36-00-SL			1.39				
OA-37-00-SL		0.01		1.08		**0.0081**	
OA-39-00-SL			1.45				
PL-01-00-SL			37.90	8.15			4.65
PL-03-00-SL			2.96	2.04			1.45
PL-04-05-SL			4.54	1.21			3.75
PL-05-05-SL				0.90			
PL-06-33-SL			1.18				
RR-02-00-SL			1.76	4.87			0.36
RR-04-07-SL				0.76			
RR-05-05-SL				1.28			

Summary Report for ProUCL Run: EU-1A Volumetric Soil

Data File

Variable: **Tc-99/U-238**

Raw Statistics	
Number of Valid Samples	22
Number of Unique Samples	22
Minimum	0.276041667
Maximum	20.39906103
Mean	5.016462841
Median	2.552546331
Standard Deviation	6.551146361
Variance	42.91751865
Coefficient of Variation	1.305929411
Skewness	1.591293257

Gamma Statistics	
k hat	0.725300853
k star (bias corrected)	0.656699221
Theta hat	6.916389004
Theta star	7.638904813
nu hat	31.91323751
nu star	28.89476573
Approx.Chi Square Value (.05)	17.62425337
Adjusted Level of Significance	0.0386
Adjusted Chi Square Value	16.96740572

Log-transformed Statistics	
Minimum of log data	-1.287203457
Maximum of log data	3.015488872
Mean of log data	0.783581964
Standard Deviation of log data	1.376333483
Variance of log data	1.894293857

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.699734437
Shapiro-Wilk 5% Critical Value	0.911
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	7.419839715

Gamma Distribution Test	
A-D Test Statistic	0.789806487
A-D 5% Critical Value	0.785072391
K-S Test Statistic	0.143187794
K-S 5% Critical Value	0.192995161
Data follow approximate gamma distibution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**8.224434562**
Adjusted Gamma UCL	8.542821512

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.942224981
Shapiro-Wilk 5% Critical Value	0.911
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	14.29800321
95% Chebyshev (MVUE) UCL	13.2254345
97.5% Chebyshev (MVUE) UCL	16.68331875
99% Chebyshev (MVUE) UCL	23.4756628

95% Non-parametric UCLs	
CLT UCL	7.313844867
Adj-CLT UCL (Adjusted for skewness)	7.820165071
Mod-t UCL (Adjusted for skewness)	7.498815435
Jackknife UCL	7.419839715
Standard Bootstrap UCL	7.267803451
Bootstrap-t UCL	8.520985009
Hall's Bootstrap UCL	7.177520696
Percentile Bootstrap UCL	7.412523676
BCA Bootstrap UCL	7.7882378
95% Chebyshev (Mean, Sd) UCL	11.10457665
97.5% Chebyshev (Mean, Sd) UCL	13.73890836
99% Chebyshev (Mean, Sd) UCL	18.91354289

RECOMMENDATION

Assuming gamma distribution (0.05)

Use Approximate Gamma UCL

Actual UCL-95 = 8.22

Scaling Factor 8.22

Detected Volumetric Sampling Results and Scaling Factors of Individual Sample for EU-1B

Sample ID	Detected Concentration (pCi/g)					Scaling Factors		
	Np-237	Pu 239/240	Tc-99	U-238	U-238n	Np-237 /U-238	Pu239/240 /U-238	Tc-99 /U-238
EP-03-00-SL	0.04		17.20	28.30		**0.0014**		0.61
EP-07-00-SL			23.50	4.12				5.70
EP-12-00-SL			59.90	20.30				2.95
EP-13-03-SL			13.90	6.97				1.99
EP-13-13-SL			8.58					
EP-13-25-SL			6.39					
EP-14-05-SL			12.80					
EP-14-13-SL			1.53					
EP-14-25-SL			2.06					
EP-14-31-SL								
EP-15-05-SL			3.42					
EP-15-13-SL			4.31					
EP-15-25-SL			11.00					
EP-15-29-SL								
EP-16-05-SL			2.62	1.13				2.32
EP-16-15-SL			17.10					
EP-16-27-SL			5.24					
EP-17-05-SL		0.005	1.17	1.15			**0.0042**	1.02
EP-17-15-SL			3.74					
EP-17-25-SL			5.21					
EP-17-30-SL								
EP-18-09-SL		0.01	11.70	10.60			0.0007	1.10
EP-18-15-SL								
EP-18-29-SL								
EP-19-05-SL			11.40	10.10				1.13
EP-19-13-SL			10.40	9.61				1.08
EP-19-25-SL			4.77					
EP-19-31-SL								
EP-20-05-SL			3.04					
EP-20-15-SL			2.74					
EP-20-25-SL			3.93					

Summary Report for ProUCL Run: EU-1B Volumetric Soil

Data File

Variable: **Tc-99/U-238**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	9
Minimum	0.6078
Maximum	5.7039
Mean	1.989711111
Median	1.1287
Standard Deviation	1.58239178
Variance	2.503963746
Coefficient of Variation	0.795287201
Skewness	1.886987193

Gamma Statistics	
k hat	2.381885136
k star (bias corrected)	1.661997498
Theta hat	0.835351412
Theta star	1.19718057
nu hat	42.87393244
nu star	29.91595496
Approx.Chi Square Value (.05)	18.42474944
Adjusted Level of Significance	0.02308
Adjusted Chi Square Value	16.54984374

Log-transformed Statistics	
Minimum of log data	-0.497909399
Maximum of log data	1.741150151
Mean of log data	0.463623501
Standard Deviation of log data	0.682869434
Variance of log data	0.466310663

RECOMMENDATION

Data follow gamma distribution (0.05)

Use Approximate Gamma UCL

Actual UCL-95	**3.23**
Scaling Factor	**3.23**

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.781411844
Shapiro-Wilk 5% Critical Value	0.829
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	2.970555616

Gamma Distribution Test	
A-D Test Statistic	0.492333268
A-D 5% Critical Value	0.728635801
K-S Test Statistic	0.272347362
K-S 5% Critical Value	0.282044651
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	**3.230660377**
Adjusted Gamma UCL	3.596656797

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.937745595
Shapiro-Wilk 5% Critical Value	0.829
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	3.781037386
95% Chebyshev (MVUE) UCL	3.925733099
97.5% Chebyshev (MVUE) UCL	4.781532379
99% Chebyshev (MVUE) UCL	6.46258435

95% Non-parametric UCLs	
CLT UCL	2.857312065
Adj-CLT UCL (Adjusted for skewness)	3.211815849
Mod-t UCL (Adjusted for skewness)	3.025851043
Jackknife UCL	2.970555616
Standard Bootstrap UCL	2.781539496
Bootstrap-t UCL	3.839396953
Hall's Bootstrap UCL	6.34547219
Percentile Bootstrap UCL	2.799666667
BCA Bootstrap UCL	3.163244444
95% Chebyshev (Mean, Sd) UCL	4.288873064
97.5% Chebyshev (Mean, Sd) UCL	5.283722278
99% Chebyshev (Mean, Sd) UCL	7.237910917

Detected Numetric Sampling Results and Scaling Factors of Individual Sample for EU-3

Sample ID	Detected Concentration (pCi/g)			Scaling Factors	
	Np-237	Tc-99	U-238	Np-237 /U-238n	Tc-99 /U-238n
SW-01-00-SL		22.30	9.81		2.2732
SW-02-09-SL		0.91			
SW-02-15-SL					
SW-02-23-SL					
SW-02-SS		1.36	1.03		1.3204
SW-03-00-SL					
SW-03-SS		2.80	1.39		2.0144
SW-04-00-SL					
SW-04-SS		1.91	0.95		2.0063
SW-05-08-SL					
SW-05-12-SL					
SW-05-SS		16.80	3.33		5.0450
SW-06-05-SL					
SW-06-13-SL					
SW-06-23-SL			2.95		
SW-07-05-SL			0.83		
SW-07-15-SL					
SW-07-23-SL					
SW-08-03-SL					
SW-08-05-SL					
SW-08-15-SL					
SW-08-25-SL					
SW-08-SS			0.30		
SW-10-SS			0.52		
SW-11-SS			0.60		
SW-12-SS		4.36	0.57		7.7032
SW-13-SS		1.54	0.59		2.5970
SW-14-SS			0.24		
SW-15-SS			0.62		
SW-16-SS			0.26		
NB-10-00-SL					
NB-11-00-SL		12.70	9.88		1.2854
NB-12-00-SL			0.90		
NB-13-00-SL		1.20			
NB-14-00-SL		7.43	3.53		2.1048
NB-15-00-SL		1.81			

Summary Report for ProUCL Run: EU-3 Numetric Soil

Data File

Variable: **Tc-99/U-238**

Raw Statistics	
Number of Valid Samples	9
Number of Unique Samples	9
Minimum	1.285
Maximum	7.703
Mean	2.92755556
Median	2.105
Standard Deviation	2.10561215
Variance	4.43360253
Coefficient of Variation	0.71923901
Skewness	1.84882333

Gamma Statistics	
k hat	3.03538411
k star (bias corrected)	2.09766348
Theta hat	0.96447614
Theta star	1.39562689
nu hat	54.6369139
nu star	37.7579426
Approx.Chi Square Value (.05)	24.6856059
Adjusted Level of Significance	0.02308
Adjusted Chi Square Value	22.4803563

Log-transformed Statistics	
Minimum of log data	0.25075872
Maximum of log data	2.04160986
Mean of log data	0.90049293
Standard Deviation of log data	0.58557117
Variance of log data	0.34289359

RECOMMENDATION

Data are lognormal (0.05)

Use H-UCL

Actual UCL-95	**4.85**
Scaling Factor	**4.85**

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.741572887
Shapiro-Wilk 5% Critical Value	0.829
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	4.232717864

Gamma Distribution Test	
A-D Test Statistic	0.741697448
A-D 5% Critical Value	0.726734893
K-S Test Statistic	0.281875772
K-S 5% Critical Value	0.281307801
Data do not follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	4.477851392
Adjusted Gamma UCL	4.917113991

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.877941195
Shapiro-Wilk 5% Critical Value	0.829
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	4.845093815
95% Chebyshev (MVUE) UCL	5.337427273
97.5% Chebyshev (MVUE) UCL	6.409632991
99% Chebyshev (MVUE) UCL	8.515773504

95% Non-parametric UCLs	
CLT UCL	4.08203015
Adj-CLT UCL (Adjusted for skewness)	4.544210732
Mod-t UCL (Adjusted for skewness)	4.304808694
Jackknife UCL	4.232717864
Standard Bootstrap UCL	4.015222267
Bootstrap-t UCL	7.951456372
Hall's Bootstrap UCL	11.8518122
Percentile Bootstrap UCL	4.138888889
BCA Bootstrap UCL	4.412222222
95% Chebyshev (Mean, Sd) UCL	5.986939081
97.5% Chebyshev (Mean, Sd) UCL	7.310736777
99% Chebyshev (Mean, Sd) UCL	9.911081012

APPENDIX F

DETERMINATION OF SCALING FACTORS FOR URANIUM ISOTOPES

Detected Uranium Isotopes Sampling Results and Scaling Factors for Individual Sample

Sample ID	Alph Spec Results (pCi/g)		Scaling Factor,k
	Uranium-234	Uranium-235	U-234/U-235
BD-13-09-SL	1.08	0.0884	12.22
BD-14-05-SL	1.24	0.081	15.31
BD-16-05-SL	1.73	0.0741	23.35
BLD253-02-04	172	7.74	22.22
BLD255-08-01	604	23.1	26.15
BLD260-06-01	17.8	0.79	22.53
BP-12-00-SL	2.35	0.157	14.97
BP-13-05-SL	0.943	0.0476	19.81
CB-02-05-SL	2.48	0.14	17.71
DM-02-22-SL	157	6.38	24.61
DM-03-05-SL	0.712	0.0574	12.40
EP-11-00-SL	103	4.26	24.18
EP-16-05-SL	2.42	0.154	15.71
EP-17-05-SL	2.67	0.148	18.04
LF-06-05-SL	5.62	0.24	23.42
NB-02-00-SL	0.759	0.026	29.19
NB-06-00-SL	0.888	0.0565	15.72
NB-12-00-SL	1.45	0.08	18.13
NB-14-00-SL	52.3	1.98	26.41
NB-17-00-SL	1.09	0.0328	33.23
NB-23-00-SL	1.12	0.0843	13.29
NB-30-05-SL	0.917	0.0363	25.26
NB-31-15-SL	0.923	0.0356	25.93
NB-36-05-SL	1.06	0.232	4.57
NB-36-15-SL	0.976	0.0268	36.42
NB-44-05-SL	0.494	0.0344	14.36
NB-51-05-SL	0.83	0.0458	18.12
NB-55-05-SL	0.836	0.059	14.17
NB-63-05-SL	0.738	0.035	21.09
NB-71-01-SL	1.7	0.058	29.31
NB-78-07-SL	0.736	0.0446	16.50
NB-81-09-SL	0.713	0.0228	31.27
OA-08-00-SL	472	19.5	24.21
OA-18-03-SL	0.747	0.0233	32.06
OA-37-00-SL	1.93	0.127	15.20
PL-04-05-SL	4.44	0.25	17.76
PL-05-05-SL	1.08	0.111	9.73
RR-04-07-SL	0.751	0.0561	13.39
RR-05-05-SL	2.8	0.157	17.83
SW-01-SS	236	10.6	22.26
SW-02-01-SL	240	12.8	18.75
SW-02-SS	3.99	0.175	22.80
SW-03-SS	7.92	0.402	19.70
SW-04-SS	2.8	0.093	30.11
SW-05-SS	19.1	0.785	24.33
SW-06-SS	937	41.7	22.47

Detected Uranium Isotopes Sampling Results and Scaling Factors for Individual Sample

Sample ID	Alph Spec Results (pCi/g)		Scaling Factor,k
	Uranium-234	Uranium-235	U-234/U-235
SW-07-05-SL	0.87	0.0414	21.01
SW-07-SS	291	14.1	20.64
SW-08-SS	0.331		
SW-10-SS	0.468		
SW-11-SS	1.12		
SW-12-SS	1.47	0.076	19.34
SW-13-SS	0.989	0.0488	20.27
SW-14-SS	0.25	0.024	10.42
SW-15-SS	0.548	0.0272	20.15
SW-16-SS	0.28		

Summary Report for ProUCL Run

Data File

Variable: **K=U-234/U-235**

Raw Statistics	
Number of Valid Samples	52
Number of Unique Samples	52
Minimum	4.57
Maximum	36.42
Mean	20.53903846
Median	20.21
Standard Deviation	6.422548898
Variance	41.24913435
Coefficient of Variation	0.31269959
Skewness	0.181293835

Gamma Statistics	
k hat	9.10741691
k star (bias corrected)	8.594809525
Theta hat	2.255199105
Theta star	2.389702576
nu hat	947.1713587
nu star	893.8601906
Approx.Chi Square Value (.05)	825.4545125
Adjusted Level of Significance	0.045384615
Adjusted Chi Square Value	823.5910562

Log-transformed Statistics	
Minimum of log data	1.519513205
Maximum of log data	3.595118074
Mean of log data	2.966423605
Standard Deviation of log data	0.360065007
Variance of log data	0.129646809

RECOMMENDATION

Data are normal (0.05)

Use Student's-t UCL

UCL-95 (ProUCL) = 22.031

Scaling Factor = 22.031

Normal Distribution Test	
Lilliefors Test Statisitic	0.051549365
Lilliefors 5% Critical Value	0.122866094
Data are normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	**22.03112614**

Gamma Distribution Test	
A-D Test Statistic	0.271832154
A-D 5% Critical Value	0.750554654
K-S Test Statistic	0.084347796
K-S 5% Critical Value	0.123169195
Data follow gamma distribution	
at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	22.24111511
Adjusted Gamma UCL	22.29143784

Lognormal Distribution Test	
Lilliefors Test Statisitic	0.110387937
Lilliefors 5% Critical Value	0.122866094
Data are lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	22.68046818
95% Chebyshev (MVUE) UCL	25.32121352
97.5% Chebyshev (MVUE) UCL	27.32269101
99% Chebyshev (MVUE) UCL	31.25420598

95% Non-parametric UCLs	
CLT UCL	22.00402288
Adj-CLT UCL (Adjusted for skewness)	22.02794874
Mod-t UCL (Adjusted for skewness)	22.03485809
Jackknife UCL	22.03112614
Standard Bootstrap UCL	21.97853372
Bootstrap-t UCL	22.05682944
Hall's Bootstrap UCL	22.02995562
Percentile Bootstrap UCL	22.06442308
BCA Bootstrap UCL	22.0025
95% Chebyshev (Mean, Sd) UCL	24.42127996
97.5% Chebyshev (Mean, Sd) UCL	26.10112896
99% Chebyshev (Mean, Sd) UCL	29.40086704