REV 0

# SURROGATE EVALUATION

## NRC License SNM-33, Docket No. 70-36

## DOCUMENT NO: DO-05-005

## HEMATITE, MISSOURI

**October 2005**

*prepared by*

Science Applications International Corporation
under Contract No. SAHEM00128

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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<br>**U-238** | None<br>**U-238** | Pu-239 | Pu-239 | None | None | None | None | U-238 |
| Tc-99 | None | None | None<br>**U-238** | U-238<br>**U-238** | None | None | U-235<br>U-238 | U-235<br>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<br>U-238 | ND | ND | ND | U-235<br>U-238 | U-235<br>U-238 | U-235<br>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 |