ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

EAST TRAINING AREA

SURVEY UNIT 10203B

REVISION 1

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LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
AMCG	Average Member of the Critical Group
BcDCGL	Base Case Derived Concentration Guideline Level
BcSOF	Base Case Sum of Fractions
C/LT	Characterization/License Termination
cpm	Counts per minute
DQO	Data Quality Objective
DCGL	Derived Concentration Guideline Level
EMC	Elevated Measurement Comparison
FSS	Final Status Survey
GPS	Global Positioning System
HTD	Hard-to-Detect
HSA	Historical Site Assessment
IC	Insignificant Contributor
LBGR	Lower Bound of the Gray Region
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Count Rate
NAD	North American Datum
NaI	Sodium Iodide
OpDCGL	Operational Derived Concentration Guideline Level
OpSOF	Operational Sum of Fractions
QC	Quality Control
RE	Radiological Engineer
ROC	Radionuclides of Concern
SOF	Sum of Fractions
TEDE	Total Effective Dose Equivalent

TSD	Technical Support Document
UBGR	Upper Bound of the Gray Region
VSP	Visual Sample Plan
ZNPS	Zion Nuclear Power Station
ZSRP	Zion Station Restoration Project

1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for Survey Unit 10203B, "East Training Area," has been generated for the Zion Station Restoration Project (ZSRP) in accordance with Zion*Solutions* procedure ZS-LT-300-001-005, *"Final Status Survey Data Reporting"* (Reference 1) and satisfies the requirements of Section 5.11 of the *"Zion Station Restoration Project License Termination Plan"* (LTP) (Reference 2).

An FSS package (L1-10203B-F) was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, *"Final Status Survey Package Development"* (Reference 3), the ZSRP LTP, and guidance from NUREG-1575, "*Multi-Agency Radiation Survey and Site Investigation Manual"* (MARSSIM) (Reference 4).

This open land survey unit has a MARSSIM classification of one. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I (α) and Type II (β) decision error rates were set at 0.05. Seventeen (17) systematic surface soil samples were acquired from the survey unit. In addition, surface scanning was performed on 100% of the total surface area in the survey unit. No areas of elevated activity were detected during the scans. The analytical results for all soil samples taken in survey unit 10203B indicate that the Sum of Fractions (SOF) for each sample, when compared to the Operational Derived Concentration Guideline Levels (OpDCGL), was less than 1.0, with a maximum Operational SOF (OpSOF) of 0.127. The mean OpSOF for the systematic samples was 0.050. The mean Base Case SOF (BcSOF), when the analytical results were compared to the Base Case DCGLs (BcDCGL), was 0.013, which results in a dose assigned to the survey unit of 0.321 mrem/yr Total Effective Dose Equivalent (TEDE). Therefore, the null hypothesis is rejected and survey unit 10203B is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 10203B, "East Training Area," is a Class 1 open land survey unit and is 1,977 m^2 in size. It is bounded on the west by survey unit 10203A, the east by survey units 10203C and 10203D, the north by survey unit 10203C, and the south by survey unit 10203F.

The topography of the survey unit is mainly flat with some small dips and depressions. The soil is mostly loam.

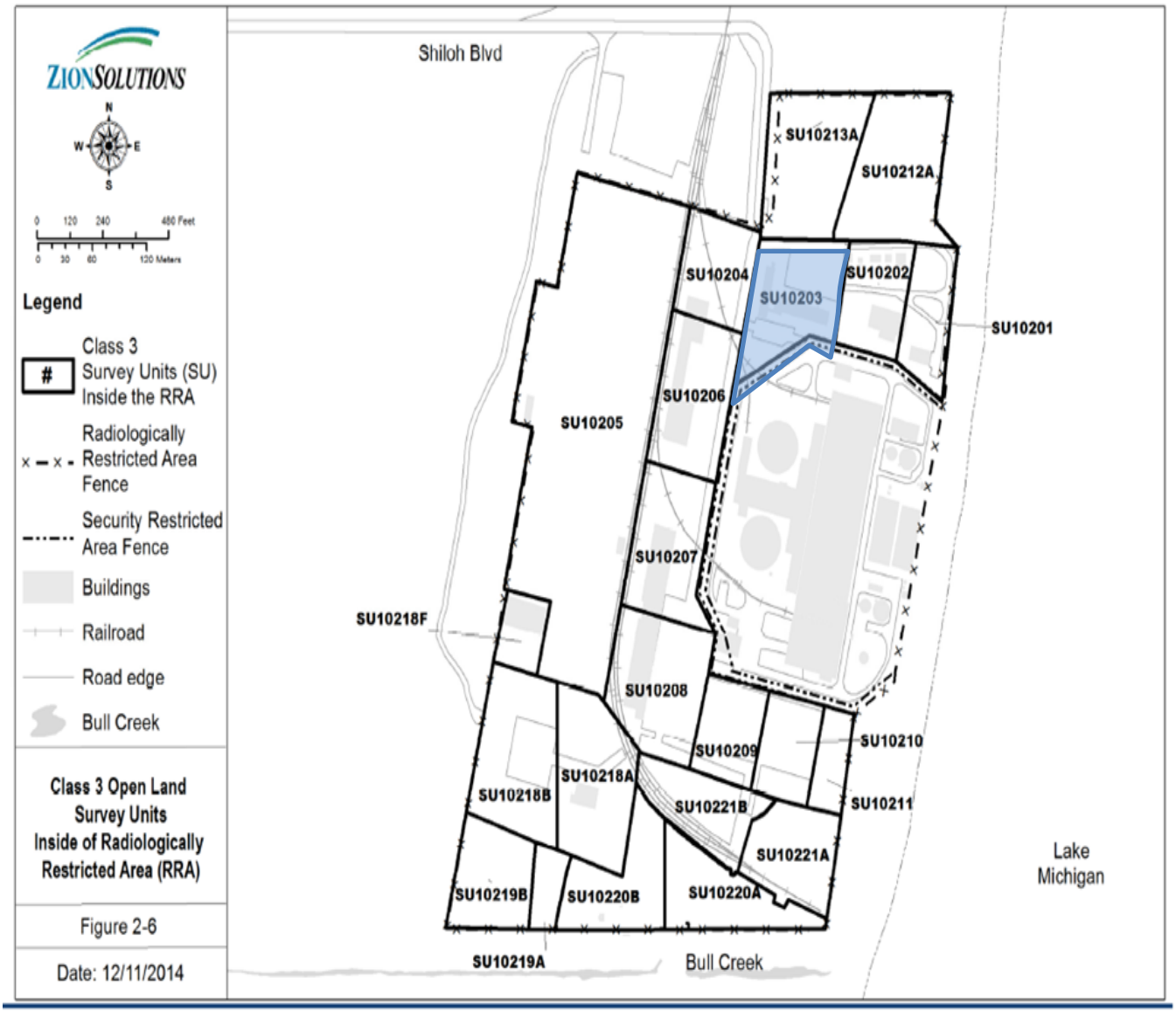
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 10203B was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 5).

The area encompassing this survey unit was described in the *"Zion Station Historical Site Assessment"* (HSA) (Reference 6) as the "East Training Area" and was located within survey unit 10203. This area was also described as the "East Training Area" (survey unit 10203) in Table 2-4 of the LTP as represented in Figure 2-6 of the LTP, which is replicated below as Figure 1.

Figure 1 - Class 3 Open Land Survey Units from Figure 2-6 of the LTP



The HSA states that this area contained the East Training Building and was also used as a storage area for the Reactor Coolant Pump Stands by the north parking lot. There were no documented instances of process events, spills or radiological incidents.

Characterization surveys were performed in June and July of 2013 for the Class 3 survey unit 10203. The following data was obtained:

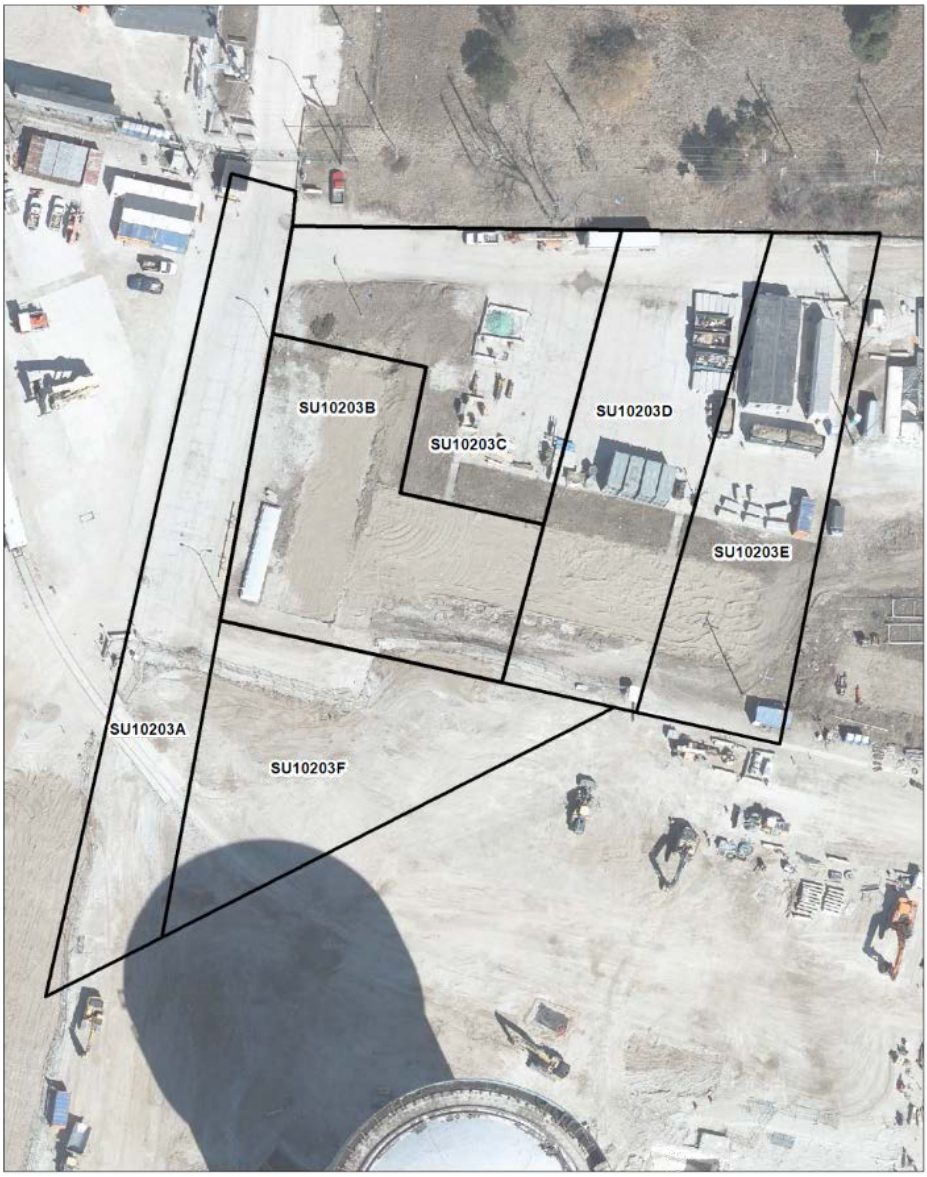
- Five (5) random surface samples.
- Thirteen (13) judgmental surface samples and two (2) judgmental subsurface samples taken at the direction of the cognizant Radiological Engineer (RE).
- Two (2) investigation surface samples taken in areas identified by scan alarms.
- Sodium iodide (NaI) walkover scans of approximately 25% of the survey unit.

The results of the characterization survey were:

- Two (2) of the five (5) random surface samples were positive for Cs-137 with the highest activity being 0.16 pCi/g.
- Two (2) of the thirteen (13) judgmental surface samples were positive for Cs-137 with the highest activity being 0.14 pCi/g. Both judgmental subsurface samples were less than the Minimum Detectable Concentration (MDC) for the Radionuclides of Concern (ROC).
- One (1) of the two (2) investigation surface samples, taken in locations identified by scan alarms, were positive for Cs-137 with an activity of 0.08 pCi/g.

On June 15, 2016, due to changing radiological and operational conditions brought about by site decommissioning activities inside or adjacent to this area, survey unit 10203 was reclassified as a Class 1, and divided into five survey units: 10203B, 10203C, 102063D, 10203E and 10203F. A sixth survey unit, 10203A, was incorporated into the area from the east sides of the Class 3 survey units 10204 and 10206. Figure 2 below shows the boundaries of the resulting Class 1 survey units. The change in classification was a conservative response and ensured that the survey unit would be surveyed with the appropriate rigor.

Figure 2 - Class 1 Open Land Survey Units Created from the Original Class 3 Survey Unit 10203 and the One Class 1 Survey Unit Created from East Sides of Survey Units 10204 and 10206



An RE and a Characterization/License Termination (C/LT) Supervisor performed a visual inspection and walk-down of the survey unit on November 18, 2019, prior to performing FSS. The purpose of the walk-down was to assess the physical condition of the survey unit, evaluate access points and travel paths, and identify potentially hazardous conditions. A final classification assessment was performed in accordance with ZS-LT-300-001-002, as part of the survey design for FSS. The assessment confirmed that survey unit 10203B was correctly classified as Class 1.

4. DATA QUALITY OBJECTIVES

FSS planning and design hinges on coherence with the Data Quality Objective (DQO) process to ensure, through compliance with explicitly defined inputs and boundaries, that the primary objective of the survey is satisfied. The DQO process, utilized in accordance with MARSSIM, is described in the LTP. The appropriate design for a given survey is developed using the DQO process as outlined in Appendix D of MARSSIM.

The DQO process incorporated hypothesis testing and probabilistic sampling distributions to control decision errors during data analysis. Hypothesis testing is a process based on the scientific method that compares a baseline condition to an alternate condition. The baseline condition is technically known as the null hypothesis. Hypothesis testing rests on the premise that the null hypothesis is true and that sufficient evidence must be provided for rejection. In designing the survey plan, the underlying assumption, or null hypothesis, was that residual activity in the survey unit exceeded the release criteria. Rejection of the null hypothesis would indicate that residual activity within the survey unit does not exceed the release criteria. Therefore, the survey unit would satisfy the primary objective of the FSS sample plan.

The primary objective of the FSS sample plan is to demonstrate that the level of residual radioactivity in survey unit 10203B does not exceed the release criteria specified in the LTP and that the potential dose from residual radioactivity is As Low As Reasonably Achievable (ALARA).

Zion*Solutions* Technical Support Document (TSD) 11-001, *"Technical Support Document for Potential Radionuclides of Concern During the Decommissioning of the Zion Station"* (Reference 7), established the basis for an initial suite of potential ROC for the decommissioning of the Zion Nuclear Power Station (ZNPS).

Zion*Solutions* TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* (Reference 8), was written to refine the initial selection of ROC for decommissioning at the ZSRP. The list of ROC was evaluated using Containment and Auxiliary Building concrete core analysis data to evaluate the dose significance of each radionuclide in the end state model. Section 4.4 of TSD 14-019 evaluated the results of the characterization data of surveys taken of soils. The following conclusion was reached: *"The results of surface and subsurface soil characterization in the impacted area surrounding Zion indicate that there is minimal residual radioactivity in soil. Essentially all of the soil results were reported as non-detectable. Other than Cs-137 at very low levels, and Co-60 at a concentration of 0.24 pCi/g in one sample, the results for all radionuclides were less than MDC. Therefore, the direct determination of radionuclide mixture fractions for initial suite radionuclides in soil is not technically feasible due to the MDC biasing issues discussed above. Based on a generalized assumption that the contaminated water that caused concrete contamination would be similar to the source of soil contamination, the ROC and radionuclide mixture derived for the Auxiliary Building concrete was considered to be reasonably representative of soils for FSS planning and implementation.*"

The ROC for surface soils are listed in Table 1 below (from Table 5-2 of the LTP):

Table 1 - Dose Significant Radionuclides and Mixture

Radionuclide	Auxiliary Building % of Total Activity (normalized) (1)(2)
Co-60	0.92%
Ni-63	23.71%
Sr-90	0.05%
Cs-134	0.01%
Cs-137	75.32%

(1) Based on maximum percent of total activity from Table 20 of TSD 14-019, normalized to one for the dose significant radionuclides
(2) Does not include dose significant radionuclides for activated concrete (H-3, Eu-152, Eu-154).

A fundamental precursor to survey design is to establish a relationship between the release criteria and some measurable quantity. This is done through the development of DCGLs. The DCGLs represent average levels of radioactivity above background levels and are presented in terms of surface or mass activity concentrations. Chapter 6 of the LTP describes in detail the modeling used to develop the DCGLs for soils.

Surface soil is defined as soil residing in the first 0.15 m (6 inches) layer of soil. A subsurface soil category, which is defined as a layer of soil beginning at the surface but extending to a depth of 1 m, is also assessed to allow for flexibility in compliance demonstration if contamination deeper than 0.15 m is encountered. Site-specific DCGLs for soil were calculated for both the 0.15 m and 1 m thicknesses. Based on characterization data and historical information, there are no expectations of encountering a source term geometry that is comprised of a clean surface layer of soil over a contaminated subsurface soil layer. Zion*Solutions* TSD 14-011, *"Soil Area Factors"* (Reference 9) and LTP Section 6.8 provide the exposure scenarios and modeling parameters that were used to calculate the site-specific DCGLs for soils (referred to as BcDCGL in this Release Record).

At ZNPS, compliance is demonstrated through the summation of dose from four distinct source terms (basements, soils, buried pipe and groundwater) for the end-state. Basements are comprised of the summation of four structural source terms (surfaces, embedded pipe, penetrations and fill). When applied to soil, the DCGLs are expressed in units of activity per unit of mass (pCi/g). The "unity rule" is applied when there is more than one ROC. The measurement results for each singular ROC present in the mixture are compared against their respective DCGL to derive a dose fraction.

The surface and subsurface soil BcDCGLs for the unrestricted release of open land survey units are listed in Tables 5-5 and 5-6 of the LTP and are provided in Table 2 and Table 3, respectively.

The Insignificant Contributor (IC) dose percentage of 10% was used to adjust the DCGLs in soils to account for the dose from the eliminated IC radionuclides.

Table 2 - Base Case DCGLs for Surface Soils (BcDCGL$_{SS}$)

Radionuclide	Surface Soil DCGL (pCi/g)
Co-60	4.26
Cs-134	6.77
Cs-137	14.18
Ni-63	3,572.10
Sr-90	12.09

Table 3 - Base Case DCGLs for Subsurface Soils (BcDCGL$_{SB}$)

Radionuclide	Subsurface Soil DCGL (pCi/g)
Co-60	3.44
Cs-134	4.44
Cs-137	7.75
Ni-63	763.02
Sr-90	1.66

Each radionuclide-specific BcDCGL is equivalent to the level of residual radioactivity (above background levels) that could, when considered independently, result in a TEDE of 25 mrem/year to an Average Member of the Critical Group (AMCG). To ensure that the summation of dose from each source term is 25 mrem/year or less after all FSS is completed, the BcDCGLs are reduced based on an expected, or *a priori*, fraction of the 25 mrem/year dose limit from each source term. The reduced DCGLs, or "Operational" DCGLs, can be related to the BcDCGLs as an expected fraction of dose based on an *a priori* assessment of what the expected dose should be based on the results of site characterization, process knowledge and the extent of planned remediation. The OpDCGL is then used as the DCGL for the FSS design of the survey unit (calculation of surrogate DCGLs, investigations levels, etc.). Details of the OpDCGLs derived for each dose component and the basis for the applied *a priori* dose fractions are provided in Zion*Solutions* TSD 17-004, *"Operational Derived Concentration Guideline Levels for Final Status Survey"* (Reference 10)

The OpDCGLs for the FSS of surface and subsurface soils are listed in Tables 5-7 and 5-8 of the LTP and are presented in Table 4 and Table 5, respectively.

Table 4 - Operational DCGLs for Surface Soils (OpDCGL$_{SS}$)

Radionuclide	Surface Soil DCGL (pCi/g)
Co-60	1.091
Cs-134	1.733
Cs-137	3.630
Ni-63	914.458
Sr-90	3.095

Table 5 - Operational DCGLs for Subsurface Soils (OpDCGL$_{SB}$)

Radionuclide	Subsurface Soil DCGL (pCi/g)
Co-60	0.881
Cs-134	1.137
Cs-137	1.984
Ni-63	195.333
Sr-90	0.425

In accordance with NUREG-1757, Appendix G, if the HSA indicates that there is no likelihood of substantial subsurface residual radioactivity, subsurface surveys are not necessary. The HSA, as well as the results of the extensive characterization of subsurface soils in the impacted area surrounding the Zion facility, have shown that there is minimal residual radioactivity in subsurface soil. Consequently, the ZSRP performed minimal subsurface sampling during FSS.

Instrument DQOs included a verification of the ability of the survey instrument to detect the radiation(s) of interest at the required scan MDC, which for Class 1 open land survey units is the *a priori* DCGL Elevated Measurement Comparison (DCGL$_{EMC}$). Survey instrument response checks were required prior to issuance and after the instrument had been used. Control and accountability of survey instruments was required to ensure the quality and prevent the loss of data.

As part of the DQOs applied to laboratory processes, analysis results were reported as actual calculated results. The actual recorded value was used as the recorded FSS result for measurement and/or sample values that are less than MDC. Negative values were recorded as "zero." For radionuclides less than MDC, the value representing the highest abundance was selected. Results were not reported as "less than MDC." Sample report summaries included unique sample identification, analytical method, radionuclide, result, uncertainty, laboratory data qualifiers, units, and the observed MDC.

In accordance with the LTP, for laboratory analysis, MDCs less than 10% of the OpDCGL were preferable while MDCs up to 50% of the OpDCGL were acceptable. The maximum acceptable MDC for measurements obtained using field instruments was the *a priori* $DCGL_{EMC}$, which was calculated using the methodology described in the LTP, Section 5.6.4.3.

5. SURVEY DESIGN

The level of effort associated with planning a survey is based on the complexity of the survey and nature of the hazards. Guidance for preparing FSS plans is provided in ZS-LT-300-001-001, *"Final Status Survey Package Development."*

The DQO process determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 would be the ROC in survey unit 10203B. During FSS, concentrations for Hard-to-Detect (HTD) ROC Ni-63 and Sr-90 were inferred using a surrogate approach. Cs-137 is the principle surrogate radionuclide for Sr-90, and Co-60 is the principle surrogate radionuclide for Ni-63. The mean, maximum and 95% Upper Confidence Level (UCL) of the surrogate ratios for concrete core samples taken in the Auxiliary Building basement were calculated in TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms,"* and are presented in Table 6. The maximum ratios were used in the surrogate calculations during FSS unless area specific ratios are determined by continuing characterization.

Table 6 - Surrogate Ratios

Ratios	Auxiliary Building		
	Mean	Max	95%UCL
Ni-63/Co-60	44.143	180.450	154.632
Sr-90/Cs-137	0.001	0.002	0.002

For the FSS of survey unit 10203B, the surrogate OpDCGLs for Co-60 and Cs-137 were computed based on the maximum ratios from Table 6. The equation for calculating a surrogate DCGL is as follows:

Equation 1

$$Surrogate_{DCGL} = \frac{1}{\left[\left(\frac{1}{DCGL_{Sur}}\right) + \left(\frac{R_2}{DCGL_2}\right) + \left(\frac{R_3}{DCGL_3}\right) + \cdots \left(\frac{R_n}{DCGL_n}\right)\right]}$$

Where: $DCGL_{Sur}$ = Surrogate radionuclide DCGL

$DCGL_{2,3\ldots n}$ = DCGL for radionuclides to be represented by the surrogate

R_n = Ratio of concentration (or nuclide mixture fraction) of radionuclide "n" to surrogate radionuclide

Using the OpDCGLs for surface soils presented in Table 4 and the maximum ratios from Table 6, the following surrogate calculations for surface soils were performed:

Equation 2

$$Surrogate_{DCGL\ (Cs-137)} = \frac{1}{\left[\left(\frac{1}{3.630_{(Cs-137)}}\right) + \left(\frac{0.002}{3.095_{(Sr-90)}}\right)\right]} = 3.622\ pCi/g$$

The surrogate Operational DCGL for surface soils that was used for Cs-137 in this survey unit for direct comparison of surface soil sample results to demonstrate compliance is 3.622 pCi/g.

Equation 3

$$Surrogate_{DCGL\ (Co-60)} = \frac{1}{\left[\left(\frac{1}{1.091_{(Co-60)}}\right) + \left(\frac{180.45}{914.458_{(Ni-63)}}\right)\right]} = 0.898\ pCi/g$$

The surrogate OpDCGL for surface soils that was used for Co-60 in this survey unit for direct comparison of surface soil sample results to demonstrate compliance is 0.898 pCi/g.

Using the BcDCGLs presented in Table 2 and the maximum ratios from Table 6, the following surrogate calculations were performed:

Equation 4

$$Surrogate_{DCGL\,(Cs-137)} = \frac{1}{\left[\left(\frac{1}{14.18_{(Cs-137)}}\right) + \left(\frac{0.002}{12.09_{(Sr-90)}}\right)\right]} = 14.15\ pCi/g$$

The surrogate BcDCGL for surface soils that was used for Cs-137 in this survey unit for calculating the $DCGL_{EMC}$ is 14.15 pCi/g.

Equation 5

$$Surrogate_{DCGL\,(Co-60)} = \frac{1}{\left[\left(\frac{1}{4.26_{(Co-60)}}\right) + \left(\frac{180.45}{3572.10_{(Ni-63)}}\right)\right]} = 3.51\ pCi/g$$

The surrogate BcDCGL for surface soils that was used for Co-60 in this survey unit for calculating the $DCGL_{EMC}$ is 3.51 pCi/g.

For this Class 1 open land survey unit, the "Investigation Levels" for area scanning and soil sample measurement results are those levels specified in LTP Chapter 5, Table 5-25, and are reproduced below in Table 7.

Table 7 - Investigation Levels

Classification	Scan Investigation Levels	Direct Investigation Levels
Class 1	>Operational DCGL or >MDC_{scan} if MDC_{scan} is greater than Operational DCGL	> Operational DCGL

The MDC_{scan} for the 2350-1/44-10 was calculated using the methodology of Zion*Solutions* TSD-11-004, *"Ludlum Model 44-10 Detector Sensitivity"* (Reference 11) with the following parameters:

- background count rate of 5,000 counts per minute (cpm)
- scan speed of 0.5 m/sec
- distance from detector to surface of 2 inches
- isotopic mix of 95% Cs-137 and 5% Co-60

The calculated MDC_{scan} value was 3.75 pCi/g, which was greater than the calculated Surrogate DCGLs; therefore, the scan investigation level was set at the MDC_{scan} of the 2350-1/44-10. The collimator was used during the scan surveys to lower the background count rate.

The Sign Test was selected as the non-parametric statistical test. The use of the Sign Test did not require the selection or use of a background reference area, which simplified survey design and implementation. This approach was conservative since it included background Cs-137 as part of the sample set.

The number of soil samples for FSS was determined in accordance with ZS-LT-300-001-001. The relative shift (Δ/σ) for the survey unit data set is defined as shift (Δ), which is the Upper Bound of the Gray Region (UBGR), or the DCGL (SOF of 1), minus the Lower Bound of the Gray Region (LBGR) (SOF of 0.5), divided by sigma (σ), which is the standard deviation of the data set used for survey design. The optimal value for Δ/σ should range between one and three. The largest value the Δ/σ can have is three. If the Δ/σ exceeds three, then the value of three will be used for Δ/σ. A conservative estimate of the sample variability of 0.30 was used as the coefficient of variation to calculate Δ/σ.

The calculated relative shift was 1.67. Both the Type I error, or α value, and the Type II error, or β value, was set at 0.05. The sample size from Table 5.5 of MARSSIM that equates to the Type I and Type II error of 0.05 for use with the Sign Test is an N value of 17.

The computer program Visual Sample Plan (VSP) was used to generate the sample map, in accordance with ZS-LT-300-001-001. The map used was provided by the Survey Mapping/Computer Assisted Design Specialist, with coordinates based on the Illinois State Plane NAD 1983 standard topographical grid coordinate system. The number of samples generated by VSP for a systematic triangular grid was seventeen. The Prospective Power Curve generated by VSP showed adequate power for the survey design.

In accordance with Section 5.6.4.3 of the LTP, the *a priori* $DCGL_{EMC}$ values were calculated for the gamma-emitting ROC to ensure that the MDC_{scan} of the selected instrument was sufficient to detect small areas of elevated activity in the survey unit. The calculations were:

- To calculate the area bounded by the systematic samples: $A = \frac{A_{SU}}{N} = \frac{1977}{17} = 116.3\ m^2$
- From the LTP, Table 5-16, the Area Factors for the next larger area (300 m^2) were used:
  - Cs-137 - 1.46
  - Cs-134 - 1.30
  - Co-60 - 1.16
- The $DCGL_{EMC}$ is the Surrogate Base Case DCGL times the Area Factor:
  - The $DCGL_{EMC}$ for Cs-137 = $1.46 * 14.15 = 20.66\ pCi/g$
  - The $DCGL_{EMC}$ for Cs-134 = $1.30 * 6.77 = 8.80\ pCi/g$
  - The $DCGL_{EMC}$ for Co-60 = $1.16 * 3.51 = 4.07\ pCi/g$

The calculated MDC_{scan}, 3.75 pCi/g, is less than the $DCGL_{EMC}$ values calculated above; therefore, the spacing of the statistical systematic sampling and measurement locations was adequate to detect small areas of elevated radioactivity. No adjustment to the sample number was required.

The implementation of quality control (QC) measures as referenced by LTP, Section 5.9 and Zion*Solutions* procedure ZS-LT-01, "*Quality Assurance Project Plan (for Characterization and FSS)*" (QAPP) (Reference 12) includes the collection of a soil sample for "split sample" analysis on 5% of the soil samples taken in a survey unit with the locations selected at random. One (1) surface soil sample (L1-10203B-FQGS-005-SS) was selected randomly for split sample analysis for the FSS of this survey unit. One (1) additional QC split sample was obtained at judgmental sample location L1-10203B-FJGS-001-SS (L1-10203B-QJGS-001-SS).

In accordance with Section 5.7.1.6.2 of the LTP, a subsurface soil sample was taken at 10% of the systematic surface soil sample locations in the survey unit with the location(s) selected at random. Locations L1-10203B-FSGS-004-SB and L1-10203B-FSGS-008-SB were selected for this survey unit.

The locations of the seventeen (17) systematic samples and two (2) subsurface samples are listed in Table 8. A map of the systematic sample locations is included in Attachment 1.

Table 8 - Systematic Sample Measurement Locations

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L1-10203B-FSGS-001-SS	641929.99	343652.96
L1-10203B-FSGS-002-SS	641940.03	343612.40
L1-10203B-FSGS-003-SS	641940.03	343623.98
L1-10203B-FSGS-004-SS	641940.03	343635.57
L1-10203B-FSGS-005-SS	641940.03	343647.16
L1-10203B-FSGS-006-SS	641940.03	343658.75
L1-10203B-FSGS-007-SS	641950.07	343618.19
L1-10203B-FSGS-008-SS	641950.07	343629.78
L1-10203B-FSGS-009-SS	641950.07	343641.37
L1-10203B-FSGS-010-SS	641950.07	343652.96
L1-10203B-FSGS-011-SS	641960.10	343623.98
L1-10203B-FSGS-012-SS	641960.10	343635.57
L1-10203B-FSGS-013-SS	641970.14	343618.19
L1-10203B-FSGS-014-SS	641970.14	343629.78
L1-10203B-FSGS-015-SS	641970.14	343641.37
L1-10203B-FSGS-016-SS	641980.18	343623.98
L1-10203B-FSGS-017-SS	641980.18	343635.57
L1-10203B-FSGS-004-SB	641940.03	343635.57
L1-10203B-FSGS-008-SB	641950.07	343629.78

ZSRP LTP, Section 5.1 states that soil samples will be collected during FSS to confirm the HTD to surrogate radionuclide ratios (provided in Table 6). Ten percent (10%) of the FSS samples collected from open land survey units will be analyzed for HTD ROC. Only HTD radionuclides included as ROC (Ni-63 and Sr-90 for soils) will be analyzed in the FSS confirmatory samples. For soil samples with positive results for both an HTD ROC and the corresponding surrogate radionuclide (Cs-137 or Co-60), the HTD surrogate ratio will be derived and compared against the maximum ratio. The maximum ratios will be used unless specific survey information supports the use of a surrogate ratio that is specific to the area. In these cases, the survey unit-specific radiological data and the derived surrogate ratios will be submitted to the NRC for approval. If approved, then the survey unit-specific ratios used and the survey data serving as the basis for the surrogate ratios will be documented in the release record for the survey unit.

In addition, LTP, Section 5.1 states that if levels of residual gamma radioactivity in an individual soil sample exceed an OpSOF of 0.1, then the sample(s) will be analyzed for HTD ROC. Three (3) of the samples (L1-10203B-FSGS-005-SS, L1-10203B-FSGS-010-SS, and L1-10203B-FSGS-004-SB) exceeded an OpSOF of 0.1 during the FSS of survey unit 10203B.

Three (3) soil samples were selected to meet the requirement that 10% of the samples collected for the FSS of survey unit 10203B be analyzed for HTD ROC. Sample numbers L1-10203B-FSGS-005-SS, L1-10203B-FSGS-010-SS and L1-10203B-FSGS-013-SS were selected based on exhibiting the highest concentration of Cs-137 among the remaining samples. Each selected sample was sent off-site (Eberline Analytical) for analysis of the HTD ROC as specified in LTP, Section 5.1. Eberline analytical reports are provided in Attachment 8. Table 9 provides a synopsis of the survey design for survey unit 10203B.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	1,977 m^2	GPS measurements of area
Number of Surface Soil Samples	17 (Systematic)	• σ = 0.30 • UBGR = SOF of 1 • LBGR = SOF of 0.5 • Type I error = 0.05 • Type II error = 0.05 • Δ/σ = 1.67 (MARSSIM Table 5.5)
Grid Spacing	11.6 m	(LTP, Section 5.6.4.5.2)
DCGLs	• Co-60 – 1.091 pCi/g • Cs-134 – 1.733 pCi/g • Cs-137 – 3.630 pCi/g • Ni-63 – 914.458 pCi/g • Sr-90 – 3.095 pCi/g	Operational DCGLs for Surface Soils, (LTP Chapter 5, Table 5-7)
HTD ROC Analysis	Three (3) soil samples selected for HTD ROC analysis	(LTP, Section 5.1)
Measurement Investigation Level	Operational DCGL	(LTP Chapter 5, Table 5-25)
Scan Survey Area Coverage	100%	(LTP Chapter 5, Table 5-24)
QC	Two (2) samples selected randomly for split sample analysis	(LTP, Section 5.9)
Number of Subsurface Soil Samples	Two (2) - systematic surface soil sample locations 4 and 8	(LTP, Section 5.7.1.6.2)

6. SURVEY IMPLEMENTATION

Survey instructions for this FSS were incorporated into and performed in accordance with FSS sample plan L1-10203B-F, which was developed in accordance with ZS-LT-300-001-001. The FSS unit was inspected and controlled in accordance with Zion*Solutions* procedure ZS-LT-300-001-003, "*Isolation and Control for Final Status Survey*" (Reference 13).

For survey unit 10203B, compliance with the unrestricted release criteria was demonstrated through a combination of surface scanning with a Ludlum Model 44-10 gamma detector and the

sampling of surface soil for isotopic analysis. In accordance with the LTP Chapter 5, two (2) subsurface samples were obtained and analyzed. Also, if during the performance of FSS, the analysis of a surface soil sample, or the results of a surface gamma scan indicated the potential presence of residual radioactivity at a concentration of 75% of the subsurface OpDCGL, then a biased subsurface soil sample(s) would have been taken to the appropriate depth within the area of concern as part of the investigation. This threshold was not encountered during the FSS of survey unit 10203B.

FSS field activities were conducted under FSS sample plan L1-10203B-F. A "Field Log" (ZS-LT-300-001-001, Attachment 14) was used to document field activities and other information pertaining to the performance of the FSS. FSS field activities were projected to take four (4) working days to complete. Daily briefings were conducted to discuss the expectations for job performance and to review safety aspects of the job. The survey required field activities were performed during normal working hours starting on November 19, 2019, and concluding on November 22, 2019. On January 14, 2020, technicians re-scanned the first 10 meters of rows 1 and 2 because the original scan data was suspect. No elevated areas were identified during the re-scan.

The seventeen (17) systematic surface sample locations were marked with flags based on GPS coordinates provided by VSP. None of the systematic surface soil sample locations required relocating.

Gamma scans were performed on 100% of the surface area of the survey unit using a Ludlum 2350-1 paired with a Model 44-10 (2" x 2") NaI detector operated in the rate-meter mode and using audio response. The probe was positioned within 2 inches of the ground and was moved at a scan speed of approximately 0.5 meters per second. No areas of elevated activity were detected on the scans in excess of the alarm set point; however, one location was identified with suspected higher than normal background readings. A separate scan was performed in this area and a surface soil sample was obtained at the location with the highest scan reading. The sample was identified as L1-10203B-FJGS-006-SS. Scan locations are depicted in Attachment 1.

Daily, prior to and following use, each detector was subjected to an Operational Response Check in accordance with Zion*Solutions* procedure ZS-RP-108-004-011, *"Operation of the Ludlum Model 2350-1 Data Logger"* (Reference 14). The daily Operational Response Check compared the background response and the response to check sources ranges established for normal background and detector source response to ensure that the detector was working properly.

The instruments and detectors used for this survey are presented in Table 10. The instruments and detectors were verified to be properly calibrated prior to use.

Table 10 - Instruments and Detectors

Instrument/Detector Type	Serial #	Calibration Due Date
Ludlum 2350-1/Ludlum 44-10	216173/ES0118	10/07/2020
Ludlum 2350-1/Ludlum 44-10	266656/PR311750	07/24/2020
Ludlum 2350-1/Ludlum 44-10	304726/PR363452	08/28/2020
Ludlum 2350-1/Ludlum 44-10	266669/PR311756	10/28/2020
Ludlum 2350-1/Ludlum 44-10	304730/PR375273	01/16/2020
Ludlum 2350-1/Ludlum 44-10	304708/PR321892	09/04/2020
Ludlum 2350-1/Ludlum 44-10	304718/PR363311	09/19/2020
Ludlum 2350-1/Ludlum 44-10	304711/PR321902	01/18/2020
Ludlum 2350-1/Ludlum 44-10	216188/PR372152	12/03/2019

In accordance with the survey design, seventeen (17) surface soil samples were collected at the designated systematic sample points. In addition, two (2) subsurface samples were collected at the randomly selected sample locations. Five (5) judgmental surface samples were taken in an area that had been used to collect water being pumped from the adjacent survey units, and one (1) judgmental surface sample was collected in an area with a higher background.

Three (3) surface soil samples (L1-10203B-FSGS-005-SS, L1-10203B-FSGS-010-SS, and L1-10203B-FSGS-013-SS) and one (1) subsurface soil sample (L1-10203B-FSGS-004-SB) were selected for HTD radionuclide analysis.

Two (2) samples (L1-10203B-FQGS-005-SS and L1-10203B-QJGS-001-SS) were selected for QC split sample analysis.

7. SURVEY RESULTS

One hundred percent (100%) of the surface area of the survey unit was scanned for elevated radiation levels. Fifty (50) 1-meter wide scan rows, as shown on the map in Attachment 1, were marked in the field and scanned with the 2350-1/44-10 using latching mode. Readings were recorded at approximately 10-meter intervals during the scans. No elevated measurement locations in excess of the alarm set-point was identified by surface scan. Table 11 provides a synopsis of the scan results. Complete scan results are provided in Attachment 2.

Table 11 - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level [1] (cpm)	# of Scan Alarms	Investigation Samples
1	3223	3594	None	None
2	3047	3594	None	None
3	2524	2774	None	None
4	2382	2774	None	None
5	2203	2774	None	None
6	2292	2663	None	None
7	2233	2663	None	None
8	2198	2663	None	None
9	2302	2663	None	None
10	2248	2663	None	None
11	2453	2836	None	None
12	2419	2836	None	None
13	2483	2836	None	None
14	2358	2836	None	None
15	2242	2836	None	None
16	2130	2505	None	None
17	2047	2505	None	None
18	2131	2505	None	None
19	2033	2505	None	None
20	2044	2505	None	None
21	2420	2705	None	None
22	2373	2705	None	None
23	2417	2705	None	None
24	2393	2705	None	None
25	2343	2705	None	None
26	2458	2705	None	None
27	2115	2569	None	None
28	2153	2569	None	None
29	2238	2569	None	None
30	2201	2569	None	None
31	2376	2564	None	None
32	2494	2564	None	None
33	2301	2564	None	None
34	2273	2564	None	None
35	2353	2564	None	None
36	2442	2564	None	None
37	2313	2564	None	None
38	2157	2564	None	None
39	2248	2581	None	None
40	2325	2581	None	None

Table 7-1 (continued) - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level (1) (cpm)	# of Scan Alarms	Investigation Samples
41	2157	2581	None	None
42	2282	2581	None	None
43	2245	2581	None	None
44	2203	2581	None	None
45	2260	2581	None	None
46	2350	2729	None	None
47	2407	2729	None	None
48	2295	2729	None	None
49	2619	2729	None	None
50	2362	2729	None	None

1) The action level is based on the measurement Minimum Detectable Count Rate (MDCR) plus background in accordance with the FSS plan

The seventeen (17) soil samples taken for non-parametric statistical testing, the two (2) subsurface soil samples, and the six (6) judgmental samples were analyzed using the on-site gamma spectroscopy system. Summaries of the sample analysis results are provided in Tables 12, 13 and 14, respectively. The basic statistics for the systematic sample population are summarized in Table 21. The gamma spectroscopy results for surface soil revealed five (5) samples with activity levels above MDC for Cs-137 and no samples with activity levels above MDC for Co-60 or Cs-134. The gamma spectroscopy results for subsurface soil revealed one sample above the MDC for Cs-137 and no samples with activity levels above MDC for Co-60 or Cs-134. The gamma spectroscopy results for the judgmental samples revealed no samples with activity levels above MDC for Cs-137, Co-60 or Cs-134. None of the judgmental sample results identified an OpSOF that exceeded 0.1. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6. The mean of the gamma spectroscopic analysis results for the sample population indicated that Cs-137 was present at levels lower than the concentrations of Cs-137 expected to be found in off-site soil in the vicinity of the ZNPS as presented in Zion*Solutions* TSD 13-004, "*Examination of Cs-137 Global Fallout In Soils At Zion Station*" (Reference 15). The complete gamma spectroscopy reports are presented in Attachment 7.

Table 12 - Summary of Gamma Spectroscopy Results for Surface Soil Samples Comprising the Statistical Sample Population

MEASUREMENT ID	Co-60[1] (pCi/g)	Cs-134[1] (pCi/g)	Cs-137[1] (pCi/g)	Ni-63[2] (pCi/g)	Sr-90[2] (pCi/g)
L1-10203B-FSGS-001-SS	1.50E-02	2.64E-02	0.00E+00	2.71E+00	0.00E+00
L1-10203B-FSGS-002-SS	3.52E-02	3.42E-02	4.66E-02	6.35E+00	9.32E-05
L1-10203B-FSGS-003-SS	0.00E+00	1.48E-02	1.01E-02	0.00E+00	2.02E-05
L1-10203B-FSGS-004-SS	0.00E+00	2.71E-02	**6.30E-02**	0.00E+00	1.26E-04
L1-10203B-FSGS-005-SS	6.13E-02	3.24E-02	**1.45E-01**	1.11E+01	2.90E-04
L1-10203B-FSGS-006-SS	3.74E-02	8.73E-03	**4.77E-02**	6.75E+00	9.54E-05
L1-10203B-FSGS-007-SS	1.32E-02	3.21E-02	0.00E+00	2.38E+00	0.00E+00
L1-10203B-FSGS-008-SS	1.06E-02	1.91E-02	3.41E-02	1.91E+00	6.82E-05
L1-10203B-FSGS-009-SS	2.38E-02	9.83E-03	1.69E-02	4.29E+00	3.38E-05
L1-10203B-FSGS-010-SS	3.75E-02	2.52E-02	**2.18E-01**	6.77E+00	4.36E-04
L1-10203B-FSGS-011-SS	5.24E-02	0.00E+00	3.91E-02	9.46E+00	7.82E-05
L1-10203B-FSGS-012-SS	0.00E+00	0.00E+00	1.56E-02	0.00E+00	3.12E-05
L1-10203B-FSGS-013-SS	6.48E-02	1.50E-02	**1.09E-01**	1.17E+01	2.18E-04
L1-10203B-FSGS-014-SS	0.00E+00	5.00E-03	4.09E-02	0.00E+00	8.18E-05
L1-10203B-FSGS-015-SS	0.00E+00	5.33E-02	3.51E-02	0.00E+00	7.02E-05
L1-10203B-FSGS-016-SS	0.00E+00	2.73E-02	4.31E-02	0.00E+00	8.62E-05
L1-10203B-FSGS-017-SS	2.38E-02	1.70E-03	1.45E-02	4.29E+00	2.90E-05

Note: (1) Bold font indicates ROC positively detected at concentration greater than MDC.
(2) Ni-63 and Sr-90 are inferred concentrations using the maximum HTD ratio.

Table 13 - Summary of Gamma Spectroscopy Results for Judgmental Surface Soil Samples

MEASUREMENT ID	Co-60[1] (pCi/g)	Cs-134[1] (pCi/g)	Cs-137[1] (pCi/g)	Ni-63[2] (pCi/g)	Sr-90[2] (pCi/g)
L1-10203B-FJGS-001-SS	4.93E-02	9.34E-03	0.00E+00	8.90E+00	0.00E+00
L1-10203B-FJGS-002-SS	2.33E-05	1.98E-02	0.00E+00	4.20E-03	0.00E+00
L1-10203B-FJGS-003-SS	2.59E-02	0.00E+00	0.00E+00	4.67E+00	0.00E+00
L1-10203B-FJGS-004-SS	3.04E-02	1.44E-02	2.52E-02	5.49E+00	5.04E-05
L1-10203B-FJGS-005-SS	1.67E-02	5.05E-03	1.70E-02	3.01E+00	3.40E-05
L1-10203B-FJGS-006-SS	4.97E-02	3.36E-02	2.49E-02	8.97E+00	4.98E-05

Note: (1) Bold font indicates ROC positively detected at concentration greater than MDC.
(2) Ni-63 and Sr-90 are inferred concentrations using the maximum HTD ratio.

Table 14 - Summary of Gamma Spectroscopy Results for Subsurface Soil Samples

MEASUREMENT ID	Co-60(1) (pCi/g)	Cs-134(1) (pCi/g)	Cs-137(1) (pCi/g)	Ni-63(2) (pCi/g)	Sr-90(2) (pCi/g)
L1-10203B-FSGS-004-SB	4.21E-02	9.57E-03	**6.27E-02**	7.60E+00	1.25E-04
L1-10203B-FSGS-008-SB	2.90E-02	1.80E-02	4.24E-02	5.23E+00	8.48E-05

Note: (1) Bold font indicates ROC positively detected at concentration greater than MDC.
(2) Ni-63 and Sr-90 are inferred concentrations using the maximum HTD ratio.

The off-site laboratory, Eberline Analytical, processed the four (4) samples selected for HTD ROC analysis as specified in the survey design (L1-10203B-FSGS-005-SS, L1-10203B-FSGS-010-SS, L1-10203B-FSGS-013-SS and L1-10203B-FSGS-004-SB). Only HTD radionuclides included as ROC (Ni-63 and Sr-90 for soils) were included in the analysis. All analyses met the required MDC, and for both samples, no analyses positively identified a ROC at a concentration greater than MDC. Consequently, comparison of existing ratios versus the maximum ratios from Table 6 was not required. The off-site analysis results are provided in Table 15.

Table 15 - Off-Site Analysis Results

Sample # L1-10203B-FSGS-005-SS

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	5.95E-04	4.90E-02	7.44E-02	No
Cs-134	5.28E-03	2.34E-02	7.43E-02	No
Cs-137	1.68E-01	6.18E-02	8.83E-02	Yes
Ni-63	1.74E-01	1.92E+00	3.30E+00	No
Sr-90	3.25E-01	3.12E-01	8.19E-01	No

Sample # L1-10203B-FSGS-010-SS

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	2.50E-02	4.21E-02	6.88E-02	No
Cs-134	2.31E-03	1.39E-02	5.42E-02	No
Cs-137	2.78E-01	7.13E-02	9.16E-02	Yes
Ni-63	-6.98E-01	1.90E+00	3.31E+00	No
Sr-90	4.18E-01	2.96E-01	7.57E-01	No

Table 15 (continued) - Off-Site Analysis Results

Sample # L1-10203B-FSGS-013-SS

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	4.15E-02	5.50E-02	8.46E-02	No
Cs-134	7.90E-03	2.33E-02	7.66E-02	No
Cs-137	2.13E-01	7.67E-02	1.09E-01	Yes
Ni-63	-1.10E+00	1.98E+00	3.46E+00	No
Sr-90	2.51E-01	3.83E-01	1.03E+00	No

Sample # L1-10203B-FSGS-004-SB

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	9.76E-03	3.79E-02	5.20E-02	No
Cs-134	2.79E-02	2.36E-02	6.07E-02	No
Cs-137	5.81E-02	4.18E-02	6.69E-02	No
Ni-63	6.59E-01	1.83E+00	3.12E+00	No
Sr-90(1)	5.10E-02	3.17E-02	6.17E-02	No

(1) Sr-90 recounted February 19, 2020, to achieve adequate MDC

The implementation of survey specific QC measures included the collection of two (2) samples (L1-10203B-FQGS-005-SS and L1-10203B-QJGS-001-SS) for "split sample" analysis. The on-site laboratory analyzed the designated QC samples using the on-site gamma spectroscopy system. Gamma spectroscopy results (summarized in Table 16) indicate that one (1) of the samples contained concentrations for Cs-137 in excess of the MDC, and no samples identified Co-60 and Cs-134 in concentrations greater than MDC. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6.

Table 16 - Summary of Gamma Spectroscopy Results for QC Soil Samples

MEASUREMENT ID	Co-60(1) (pCi/g)	Cs-134(1) (pCi/g)	Cs-137(1) (pCi/g)	Ni-63(2) (pCi/g)	Sr-90(2) (pCi/g)
L1-10203B-FQGS-005-SS	3.21E-02	0.00E+00	**6.68E-02**	5.79E+00	1.34E-04
L1-10203B-QJGS-001-SS	4.93E-02	9.34-03	0.00E+00	5.63E+00	1.31E-04

Note: (1) Bold font indicates ROC positively detected at concentration greater than MDC.
(2) Ni-63 and Sr-90 are inferred concentrations using the maximum HTD ratio.

The SOF or "unity rule" is the mathematical test used to evaluate compliance with radiological criteria for license termination when more than one radionuclide has been determined to be potentially present.

The equation for the unity rule is:

Equation 6

$$\frac{C_1}{DCGL_1}+\frac{C_2}{DCGL_2}+\ldots\ldots\ldots\frac{C_n}{DCGL_n}\leq 1$$

Where: C_n = concentration of radionuclide *n*

$DCGL_n$ = DCGL of radionuclide *n*.

The results of the unity rule calculations for the ROC in the systematic sample population when compared against the OpDCGLs for surface soils for survey unit 10203B are provided in Table 17. The results of the unity rule calculations for the ROC for the judgmental sample are provided in Table 18, the results for subsurface samples are provided in Table 19, and the results for the QC samples are presented in Table 20.

Table 17 - Sum of Fractions for Systematic Surface Soil Samples compared to the OpDCGLs

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-10203B-FSGS-001-SS	1.37E-02	1.52E-02	0.00E+00	2.96E-03	0.00E+00	0.032
L1-10203B-FSGS-002-SS	3.23E-02	1.97E-02	1.28E-02	6.95E-03	3.01E-05	0.072
L1-10203B-FSGS-003-SS	0.00E+00	8.54E-03	2.78E-03	0.00E+00	6.53E-06	0.011
L1-10203B-FSGS-004-SS	0.00E+00	1.56E-02	1.74E-02	0.00E+00	4.07E-05	0.033
L1-10203B-FSGS-005-SS	5.62E-02	1.87E-02	3.99E-02	1.21E-02	9.37E-05	0.127
L1-10203B-FSGS-006-SS	3.43E-02	5.04E-03	1.31E-02	7.38E-03	3.08E-05	0.060
L1-10203B-FSGS-007-SS	1.21E-02	1.85E-02	0.00E+00	2.60E-03	0.00E+00	0.033
L1-10203B-FSGS-008-SS	9.72E-03	1.10E-02	9.39E-03	2.09E-03	2.20E-05	0.032
L1-10203B-FSGS-009-SS	2.18E-02	5.67E-03	4.66E-03	4.70E-03	1.09E-05	0.037
L1-10203B-FSGS-010-SS	3.44E-02	1.45E-02	6.01E-02	7.40E-03	1.41E-04	0.117
L1-10203B-FSGS-011-SS	4.80E-02	0.00E+00	1.08E-02	1.03E-02	2.53E-05	0.069
L1-10203B-FSGS-012-SS	0.00E+00	0.00E+00	4.30E-03	0.00E+00	1.01E-05	0.004
L1-10203B-FSGS-013-SS	5.94E-02	8.66E-03	3.00E-02	1.28E-02	7.04E-05	0.111
L1-10203B-FSGS-014-SS	0.00E+00	2.89E-03	1.13E-02	0.00E+00	2.64E-05	0.014
L1-10203B-FSGS-015-SS	0.00E+00	3.08E-02	9.67E-03	0.00E+00	2.27E-05	0.040
L1-10203B-FSGS-016-SS	0.00E+00	1.58E-02	1.19E-02	0.00E+00	2.79E-05	0.028
L1-10203B-FSGS-017-SS	2.18E-02	9.81E-04	3.99E-03	4.70E-03	9.37E-06	0.031

Systematic Measurements

Number of Systematic Measurements =	17
# of Systematic Measurements with OpSOF ≥ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	3
Max Individual Systematic Measurement OpSOF =	0.1270
Mean Systematic Measurement OpSOF =	0.0501

Table 18 - Sum of Fractions for Judgmental Surface Soil Samples compared to the OpDCGLs

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-10203B-FJGS-001-SS	4.52E-02	5.39E-03	0.00E+00	9.73E-03	0.00E+00	0.060
L1-10203B-FJGS-002-SS	2.14E-05	1.14E-02	0.00E+00	4.60E-06	0.00E+00	0.011
L1-10203B-FJGS-003-SS	2.37E-02	0.00E+00	0.00E+00	5.11E-03	0.00E+00	0.029
L1-10203B-FJGS-004-SS	2.79E-02	8.31E-03	6.94E-03	6.00E-03	1.63E-05	0.049
L1-10203B-FJGS-005-SS	1.53E-02	2.91E-03	4.68E-03	3.30E-03	1.10E-05	0.026
L1-10203B-FJGS-006-SS	4.56E-02	1.94E-02	6.86E-03	9.81E-03	1.61E-05	0.082

Table 19 - Sum of Fractions for Subsurface Soil Samples compared to the OpDCGLs

MEASUREMENT ID	Fraction of the OpDCGLs for Subsurface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-10203B-FSGS-004-SB	4.78E-02	8.42E-03	3.16E-02	3.89E-02	2.95E-04	0.127
L1-10203B-FSGS-008-SB	3.29E-02	1.58E-02	2.14E-02	2.68E-02	2.00E-04	0.097

Table 20 - Sum of Fractions for QC Surface Soil Samples, when compared to the OpDCGLs

MEASUREMENT ID	Fraction of the OpDCGLs for Surface soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-10203B-FQGS-005-SS	2.94E-02	0.00E+00	1.84E-02	6.33E-03	4.32E-05	0.054
L1-10203B-QJGS-001-SS	1.79E-02	0.00E+00	1.03E-02	3.87E-03	2.00E-05	0.032

Table 21 - Basic Statistical Properties of Systematic Sample Population

ROC	Mean (pCi/g)	Median (pCi/g)	Max (pCi/g)	Min (pCi/g)	Std. Dev. (pCi/g)	BcDCGL (pCi/g)	Avg. SOF per ROC	Avg. Dose Per ROC
Co-60	2.21E-02	1.50E-02	6.48E-02	0.00E+00	0.023	4.26	5.18E-03	1.29E-01
Cs-134	1.95E-02	1.91E-02	5.33E-02	0.00E+00	0.015	6.77	2.89E-03	7.22E-02
Cs-137	5.17E-02	3.91E-02	2.18E-01	0.00E+00	0.057	14.18	3.65E-03	9.11E-02
Ni-63	3.98E+00	2.71E+00	1.17E+01	0.00E+00	4.065	3572.1	1.11E-03	2.79E-02
Sr-90	1.03E-04	7.82E-05	4.36E-04	0.00E+00	0.000	12.09	8.55E-06	2.14E-04

The mean BcSOF for survey unit 10203B is 0.013 which equates to a dose of 0.321 mrem/year TEDE.

The mean values for of all identified isotopes are less than the Consultation Triggers for Residential and Commercial/Industrial Soil Contamination depicted in Table H.1 of NUREG 1757, Vol. 1, (MOU Table 1). The full table is included in Attachment 3 of this Release Record.

8. QUALITY CONTROL

The on-site laboratory processed two (2) split samples, L1-10203B-FQGS-005-SS and L1-10203B-QJGS-01-SS. The data was evaluated using acceptance criteria specified in ZS-LT-01, *"Quality Assurance Project Plan (for Characterization and FSS)."* For sample L1-10203B-FQGS-005-SS, there was not acceptable agreement between the standard sample and QC sample when using Cs-137. This is due to the fact that Cs-137 was present at low concentrations in both samples. However, when using K-40, which is present in the samples at a higher concentration, there was acceptable agreement. For sample L1-10203B-QJGS-001-SS, the standard sample and QC sample did not both have a positive result for a gamma-emitting ROC, therefore K-40 was used in the QC comparison. There was acceptable agreement when using K-40. Refer to Attachment 5 for data and QC analysis results.

9. INVESTIGATIONS AND RESULTS

During the gamma scan, one (1) location was identified with suspected higher than normal background readings. A separate scan was performed in this area (first ten meters within rows 1 and 2) and a surface soil sample was obtained at the location with the highest scan reading. The sample was identified as L1-10203B-FJGS-006-SS. The judgmental sample location is identified in Attachment 1. The gamma spectroscopy results for sample L1-10203B-FJGS-006-SS revealed no activity levels above MDC for Cs-137, Co-60 or Cs-134. No further action was necessary.

10. REMEDIATION AND RESULTS

No remediation was performed in survey unit 10203B.

11. CHANGES FROM THE SURVEY PLAN

There were no addendums to the FSS sample plan.

12. DATA QUALITY ASSESSMENT

The DQO sample design and data were reviewed in accordance with Zion*Solutions* procedure ZS-LT-300-001-004, *"Final Status Survey Data Assessment"* (Reference 16) for completeness and consistency. Documentation was complete and legible. Surveys and sample collection were consistent with the DQOs. The sampling design had adequate power as indicated by the Retrospective Power Curve.

The analytical results of all samples were less than an OpSOF of one when compared to the OpDCGLs.

Although MARSSIM states that the Sign Test need not be performed in the instance that no measurements surpass the DCGL, the test was conducted to demonstrate coherence to the statistical principles of the DQO process. The Sign Test was performed on the data and compared to the original assumptions of the DQOs. The evaluation of the Sign Test results clearly demonstrates that the survey unit passes the unrestricted release criteria, thus, the null hypothesis is rejected. The Sign Test is included in Attachment 4.

The preliminary data review consisted of calculating basic statistical quantities (e.g., mean, median, standard deviation). All data was considered valid including negative values, zeros, values reported below the MDC, and values with uncertainties greater than two standard deviations. The mean and median values for each ROC were well below the respective OpDCGLs. Also, the retrospective power curve shows that a sufficient number of samples were collected to achieve the desired power. Therefore, the survey unit meets the unrestricted release criteria with adequate power as required by the DQOs.

The data for Co-60 and Cs-137 is represented graphically through a frequency plot and a quantile plot. All graphical representations are provided in Attachment 6.

13. ANOMALIES

No anomalies were observed during the performance or analyses of the survey.

14. CONCLUSION

Survey unit 10203B has met the DQOs of the FSS sample plan. The ALARA criteria for soils as specified in Chapter 4 of the LTP were achieved. The EMC for soils was not needed for this survey unit, and remediation was not required.

All identified ROC were used for statistical testing to determine the adequacy of the survey unit for FSS. Evaluation of the data shows that none of the ROC concentration values exceed the OpDCGL or any investigational levels; therefore, in accordance with the LTP Section 5.10, the survey unit meets the release criterion.

The sample data passed the Sign Test. The null hypothesis was rejected. The Retrospective Power Curve showed that adequate power was achieved.

The mean BcSOF, when the analytical results were compared to the BcDCGLs, was 0.013, which results in a dose contribution from soil in survey unit 10203B of 0.321 mrem/yr TEDE, based on the average concentration of the ROC in samples used for non-parametric statistical sampling.

The conclusion of this Release Record is that survey unit 10203B is acceptable for unrestricted release.

15. REFERENCES

1. Zion*Solutions* procedure ZS-LT-300-001-005, "Final Status Survey Data Reporting"
2. Zion Station Restoration Project License Termination Plan
3. Zion*Solutions* procedure ZS-LT-300-001-001, "Final Status Survey Package Development"
4. NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual"
5. Zion*Solutions* procedure ZS-LT-300-001-002, "Survey Unit Classification"
6. "Zion Station Historical Site Assessment"
7. Zion*Solutions* TSD 11-001, "Technical Support Document for Potential Radionuclides of Concern During the Decommissioning of the Zion Station"
8. Zion*Solutions* TSD 14-019, "Radionuclides of Concern for Soil and Basement Fill Model Source Terms"
9. Zion*Solutions* TSD 14-011, "Soil Area Factors"
10. Zion*Solutions* TSD 17-004, "Operational Derived Concentration Guideline Levels for Final Status Survey"
11. Zion*Solutions* TSD 11-004, "Ludlum Model 44-10 Detector Sensitivity"
12. Zion*Solutions* procedure ZS-LT-01, "Quality Assurance Project Plan (for Characterization and FSS)"
13. Zion*Solutions* procedure ZS-LT-300-001-003, "Isolation and Control for Final Status Survey"
14. Zion*Solutions* procedure ZS-RP-108-004-011, "Operation of the Ludlum Model 2350-1 Data Logger"
15. Zion*Solutions* TSD 13-004, "Examination of Cs-137 Global Fallout in Soils at Zion Station"
16. Zion*Solutions* procedure ZS-LT-300-001-004, "Final Status Survey Data Assessment"

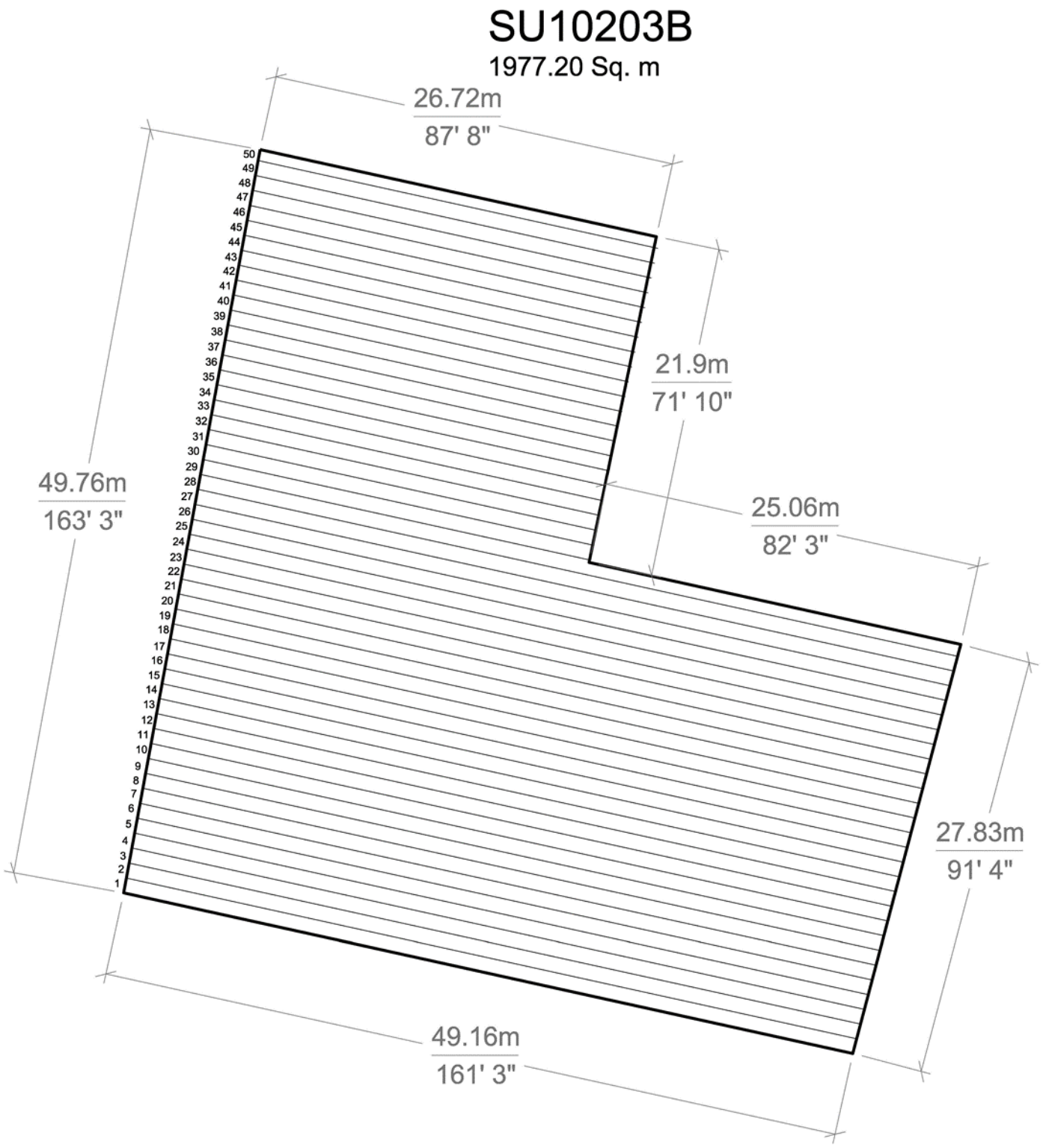
16. ATTACHMENTS

1. Attachment 1 - Figures and Map
2. Attachment 2 - Scan Data
3. Attachment 3 - Consultation Triggers for Residential and Commercial/Industrial Soil Contamination
4. Attachment 4 - Sign Test
5. Attachment 5 - QC Sample Assessment
6. Attachment 6 - Graphical Presentations
7. Attachment 7 - Sample Analytical Reports
8. Attachment 8 - Eberline Analytical Reports

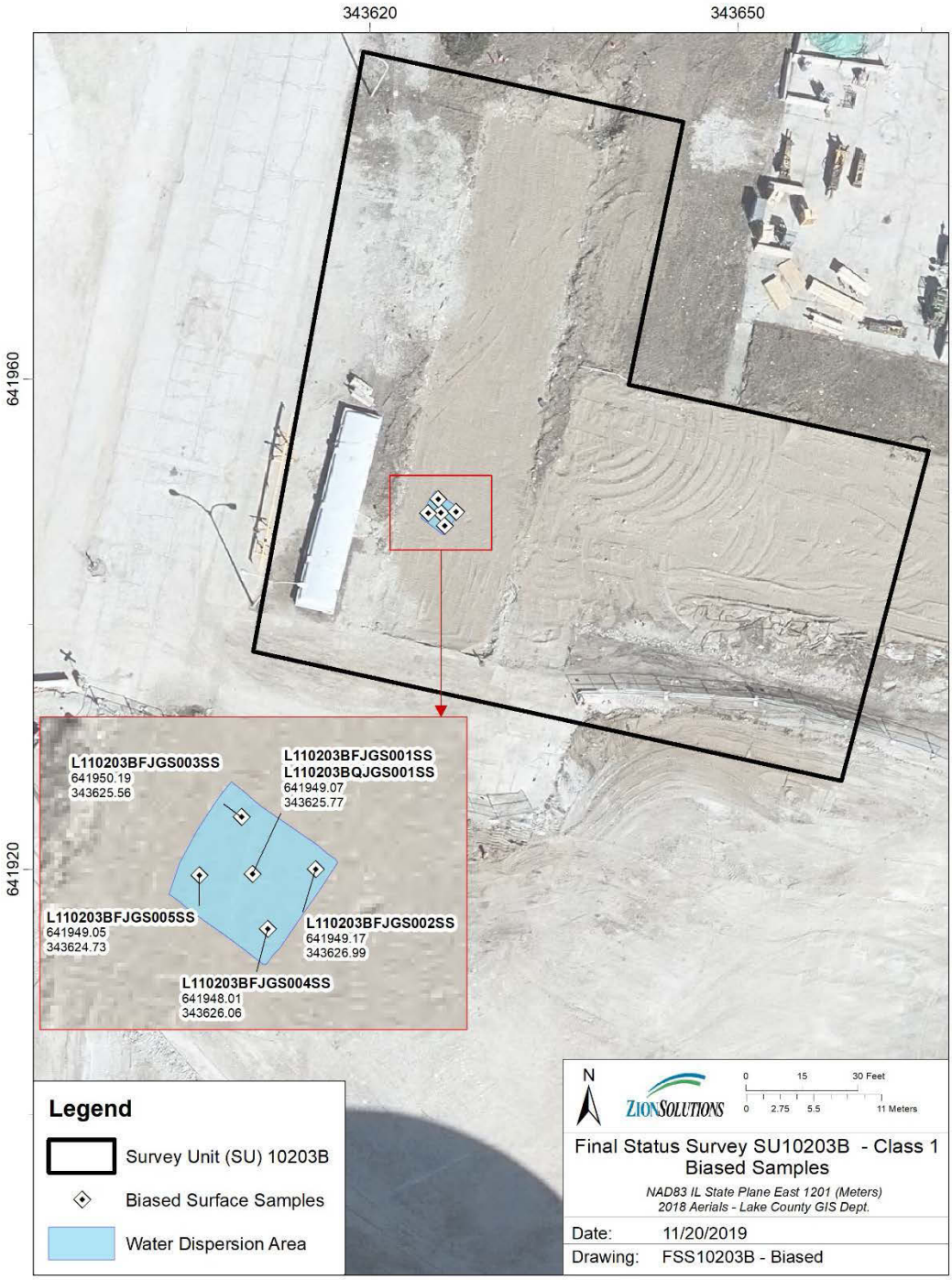
ATTACHMENT 1
FIGURES AND MAP

Survey Unit 10203B Final Status Survey Boundaries and Systematic Sample Points

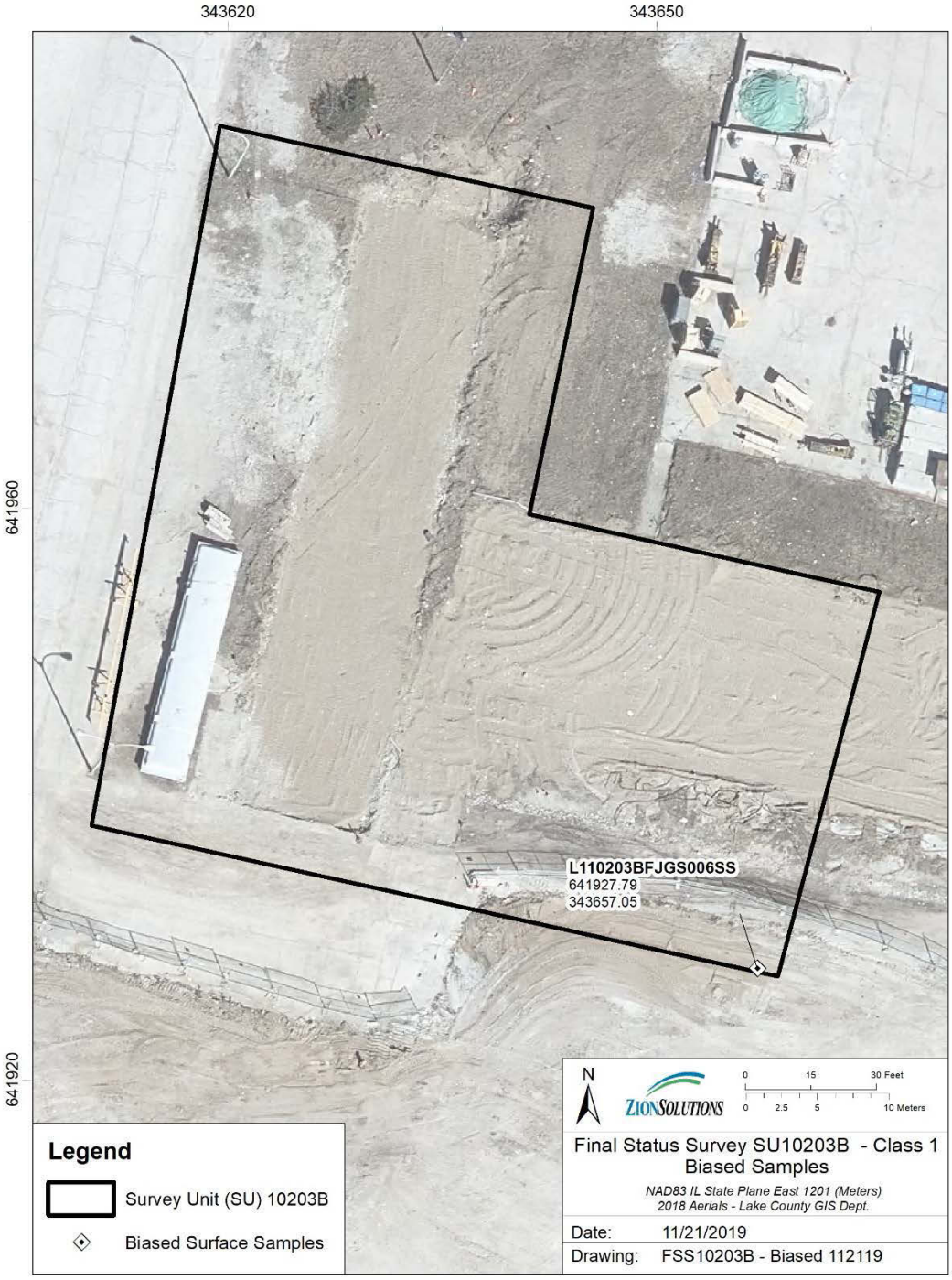
Survey Unit 10203B Final Status Survey Scan Rows



Survey Unit 10203B Judgmental Sample Locations



Survey Unit 10203B Judgmental Sample Locations (continued)



ATTACHMENT 2
SCAN DATA

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR311750	266656	10203B	GS001	11/19/2019 12:56	2356	2084	2774	No
44-10	7/24/2020	19-0747		GS001	11/19/2019 13:00	2135	2084	2774	No
44-10	PA			GS001	11/19/2019 13:02	2251	2084	2774	No
44-10				GS001	11/19/2019 13:05	2134	2084	2774	No
44-10				GS002	11/19/2019 13:08	2109	2084	2774	No
44-10				GS002	11/19/2019 13:12	2089	2084	2774	No
44-10				GS002	11/19/2019 13:15	2096	2084	2774	No
44-10				GS002	11/19/2019 13:17	2435	2084	2774	No
44-10				GS003	11/19/2019 13:20	2524	2084	2774	No
44-10				GS003	11/19/2019 13:23	2278	2084	2774	No
44-10				GS003	11/19/2019 13:26	2081	2084	2774	No
44-10				GS003	11/19/2019 13:28	2163	2084	2774	No
44-10				GS003	11/19/2019 13:30	2175	2084	2774	No
44-10				GS004	11/19/2019 13:33	2251	2084	2774	No
44-10				GS004	11/19/2019 13:35	2185	2084	2774	No
44-10				GS004	11/19/2019 13:38	2130	2084	2774	No
44-10				GS004	11/19/2019 13:40	2156	2084	2774	No
44-10				GS004	11/19/2019 13:42	2382	2084	2774	No
44-10				GS005	11/19/2019 13:46	2186	2084	2774	No
44-10				GS005	11/19/2019 13:48	2174	2084	2774	No
44-10				GS005	11/19/2019 13:51	2203	2084	2774	No
44-10				GS005	11/19/2019 13:54	2106	2084	2774	No
44-10				GS005	11/19/2019 13:56	2117	2084	2774	No
44-10				GS001	11/19/2019 14:11	3223	2795	3594	No
44-10				GS002	11/19/2019 14:15	3047	2795	3594	No
44-10	ES0118	216173	10203B	GS006	11/19/2019 12:34	2115	1989	2663	No
44-10	10/7/2020	19-0740		GS006	11/19/2019 12:36	2127	1989	2663	No
44-10	MC			GS006	11/19/2019 12:39	2179	1989	2663	No
44-10				GS006	11/19/2019 12:41	2168	1989	2663	No
44-10				GS006	11/19/2019 12:44	2292	1989	2663	No
44-10				GS007	11/19/2019 12:46	2212	1989	2663	No
44-10				GS007	11/19/2019 12:49	2233	1989	2663	No
44-10				GS007	11/19/2019 12:51	2092	1989	2663	No
44-10				GS007	11/19/2019 12:53	2134	1989	2663	No
44-10				GS007	11/19/2019 12:56	2162	1989	2663	No
44-10				GS008	11/19/2019 12:58	2092	1989	2663	No
44-10				GS008	11/19/2019 13:01	2066	1989	2663	No
44-10				GS008	11/19/2019 13:03	2130	1989	2663	No
44-10				GS008	11/19/2019 13:05	2198	1989	2663	No
44-10				GS008	11/19/2019 13:10	2192	1989	2663	No
44-10				GS009	11/19/2019 13:12	2301	1989	2663	No
44-10				GS009	11/19/2019 13:15	2244	1989	2663	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10				GS009	11/19/2019 13:17	2302	1989	2663	No
44-10				GS009	11/19/2019 13:19	2118	1989	2663	No
44-10				GS009	11/19/2019 13:22	2138	1989	2663	No
44-10				GS010	11/19/2019 13:24	2021	1989	2663	No
44-10				GS010	11/19/2019 13:26	2105	1989	2663	No
44-10				GS010	11/19/2019 13:29	2132	1989	2663	No
44-10				GS010	11/19/2019 13:31	2111	1989	2663	No
44-10				GS010	11/19/2019 13:34	2248	1989	2663	No
44-10	PR363452	304726	10203B	GS011	11/19/2019 12:40	2350	2137	2836	No
44-10	8/28/2020	19-0748		GS011	11/19/2019 12:43	2410	2137	2836	No
44-10	KW			GS011	11/19/2019 12:45	2205	2137	2836	No
44-10				GS011	11/19/2019 12:47	2453	2137	2836	No
44-10				GS011	11/19/2019 12:50	2300	2137	2836	No
44-10				GS012	11/19/2019 12:54	2419	2137	2836	No
44-10				GS012	11/19/2019 12:57	2379	2137	2836	No
44-10				GS012	11/19/2019 12:59	2279	2137	2836	No
44-10				GS012	11/19/2019 13:02	2224	2137	2836	No
44-10				GS012	11/19/2019 13:07	2188	2137	2836	No
44-10				GS013	11/19/2019 13:11	2288	2137	2836	No
44-10				GS013	11/19/2019 13:16	2483	2137	2836	No
44-10				GS013	11/19/2019 13:18	2141	2137	2836	No
44-10				GS013	11/19/2019 13:20	2403	2137	2836	No
44-10				GS013	11/19/2019 13:23	2259	2137	2836	No
44-10				GS014	11/19/2019 13:25	2358	2137	2836	No
44-10				GS014	11/19/2019 13:28	2258	2137	2836	No
44-10				GS014	11/19/2019 13:32	2171	2137	2836	No
44-10				GS014	11/19/2019 13:34	2241	2137	2836	No
44-10				GS015	11/19/2019 13:37	2197	2137	2836	No
44-10				GS015	11/19/2019 13:39	2180	2137	2836	No
44-10				GS015	11/19/2019 13:41	2242	2137	2836	No
44-10				GS015	11/19/2019 13:44	2236	2137	2836	No
44-10				GS015	11/19/2019 13:46	2199	2137	2836	No
44-10				GS014	11/19/2019 13:48	2183	2137	2836	No
44-10	PR311756	266669	10203B	GS016	11/19/2019 12:22	2130	1854	2505	No
44-10	10/28/2020	19-0743		GS016	11/19/2019 12:24	1997	1854	2505	No
44-10	RD			GS016	11/19/2019 12:26	1977	1854	2505	No
44-10				GS016	11/19/2019 12:28	2055	1854	2505	No
44-10				GS016	11/19/2019 12:30	2045	1854	2505	No
44-10				GS017	11/19/2019 12:33	2047	1854	2505	No
44-10				GS017	11/19/2019 12:35	1979	1854	2505	No
44-10				GS017	11/19/2019 12:37	1946	1854	2505	No
44-10				GS017	11/19/2019 12:39	2042	1854	2505	No
44-10				GS017	11/19/2019 12:41	1897	1854	2505	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10				GS018	11/19/2019 12:44	2131	1854	2505	No
44-10				GS018	11/19/2019 12:46	2071	1854	2505	No
44-10				GS018	11/19/2019 12:48	1988	1854	2505	No
44-10				GS018	11/19/2019 12:50	2112	1854	2505	No
44-10				GS018	11/19/2019 12:52	2018	1854	2505	No
44-10				GS019	11/19/2019 12:55	2028	1854	2505	No
44-10				GS019	11/19/2019 12:57	1982	1854	2505	No
44-10				GS019	11/19/2019 12:59	2033	1854	2505	No
44-10				GS019	11/19/2019 13:01	1926	1854	2505	No
44-10				GS019	11/19/2019 13:03	1929	1854	2505	No
44-10				GS020	11/19/2019 13:06	2044	1854	2505	No
44-10				GS020	11/19/2019 13:08	2030	1854	2505	No
44-10				GS020	11/19/2019 13:10	1976	1854	2505	No
44-10				GS020	11/19/2019 13:12	2038	1854	2505	No
44-10				GS020	11/19/2019 13:14	1986	1854	2505	No
44-10	PR375273	304730	10203B	GS021	11/19/2019 12:18	2281	2024	2705	No
44-10	1/16/2020	19-0745		GS021	11/19/2019 12:20	2420	2024	2705	No
44-10	JT			GS021	11/19/2019 12:22	2243	2024	2705	No
44-10				GS021	11/19/2019 12:24	2255	2024	2705	No
44-10				GS021	11/19/2019 12:26	2197	2024	2705	No
44-10				GS022	11/19/2019 12:28	2223	2024	2705	No
44-10				GS022	11/19/2019 12:30	2345	2024	2705	No
44-10				GS022	11/19/2019 12:32	2216	2024	2705	No
44-10				GS022	11/19/2019 12:34	2340	2024	2705	No
44-10				GS022	11/19/2019 12:36	2373	2024	2705	No
44-10				GS023	11/19/2019 12:38	2417	2024	2705	No
44-10				GS023	11/19/2019 12:40	2299	2024	2705	No
44-10				GS023	11/19/2019 12:42	2278	2024	2705	No
44-10				GS023	11/19/2019 12:44	2295	2024	2705	No
44-10				GS023	11/19/2019 12:46	2359	2024	2705	No
44-10				GS024	11/19/2019 12:48	2350	2024	2705	No
44-10				GS024	11/19/2019 12:50	2393	2024	2705	No
44-10				GS024	11/19/2019 12:52	2286	2024	2705	No
44-10				GS024	11/19/2019 12:54	2241	2024	2705	No
44-10				GS024	11/19/2019 12:56	2345	2024	2705	No
44-10				GS025	11/19/2019 12:58	2343	2024	2705	No
44-10				GS025	11/19/2019 13:00	2276	2024	2705	No
44-10				GS025	11/19/2019 13:02	2247	2024	2705	No
44-10				GS025	11/19/2019 13:04	2276	2024	2705	No
44-10				GS025	11/19/2019 13:06	2280	2024	2705	No
44-10				GS026	11/19/2019 13:08	2458	2024	2705	No
44-10				GS026	11/19/2019 13:10	2409	2024	2705	No
44-10				GS026	11/19/2019 13:12	2332	2024	2705	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10				GS026	11/19/2019 13:14	2311	2024	2705	No
44-10				GS026	11/19/2019 13:16	2382	2024	2705	No
44-10	PR321892	304708	10203B	GS027	11/19/2019 12:29	1994	1909	2569	No
44-10	9/4/2020	19-0742		GS027	11/19/2019 12:31	2065	1909	2569	No
44-10	JR			GS027	11/19/2019 12:33	2080	1909	2569	No
44-10				GS027	11/19/2019 12:35	2038	1909	2569	No
44-10				GS027	11/19/2019 12:37	2115	1909	2569	No
44-10				GS028	11/19/2019 12:39	2153	1909	2569	No
44-10				GS028	11/19/2019 12:41	2111	1909	2569	No
44-10				GS028	11/19/2019 12:43	2049	1909	2569	No
44-10				GS028	11/19/2019 12:45	2109	1909	2569	No
44-10				GS028	11/19/2019 12:47	2050	1909	2569	No
44-10				GS029	11/19/2019 12:49	2238	1909	2569	No
44-10				GS029	11/19/2019 12:51	2029	1909	2569	No
44-10				GS029	11/19/2019 12:53	2213	1909	2569	No
44-10				GS030	11/19/2019 12:55	2201	1909	2569	No
44-10				GS030	11/19/2019 12:57	2126	1909	2569	No
44-10				GS030	11/19/2019 12:59	2014	1909	2569	No
44-10	PR363311	304718	10203B	GS031	11/19/2019 12:32	2235	1905	2564	No
44-10	9/19/2020	19-0746		GS031	11/19/2019 12:34	2102	1905	2564	No
44-10	PS			GS031	11/19/2019 12:36	2376	1905	2564	No
44-10				GS032	11/19/2019 12:38	2494	1905	2564	No
44-10				GS032	11/19/2019 12:40	2161	1905	2564	No
44-10				GS032	11/19/2019 12:42	2227	1905	2564	No
44-10				GS033	11/19/2019 12:44	2292	1905	2564	No
44-10				GS033	11/19/2019 12:46	2300	1905	2564	No
44-10				GS033	11/19/2019 12:49	2301	1905	2564	No
44-10				GS034	11/19/2019 12:52	2273	1905	2564	No
44-10				GS034	11/19/2019 12:54	2181	1905	2564	No
44-10				GS034	11/19/2019 12:56	2230	1905	2564	No
44-10				GS035	11/19/2019 12:58	2353	1905	2564	No
44-10				GS035	11/19/2019 13:00	2145	1905	2564	No
44-10				GS035	11/19/2019 13:02	2260	1905	2564	No
44-10				GS036	11/19/2019 13:04	2442	1905	2564	No
44-10				GS036	11/19/2019 13:06	2080	1905	2564	No
44-10				GS036	11/19/2019 13:08	2187	1905	2564	No
44-10				GS037	11/19/2019 13:10	2250	1905	2564	No
44-10				GS037	11/19/2019 13:12	2313	1905	2564	No
44-10				GS037	11/19/2019 13:14	2296	1905	2564	No
44-10				GS038	11/19/2019 13:16	2124	1905	2564	No
44-10				GS038	11/19/2019 13:18	2074	1905	2564	No
44-10				GS038	11/19/2019 13:20	2157	1905	2564	No
44-10	PR321902	304711	10203B	GS039	11/19/2019 12:33	2130	1919	2581	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	1/18/2020	19-0744		GS039	11/19/2019 12:35	2013	1919	2581	No
44-10	AB			GS039	11/19/2019 12:37	2248	1919	2581	No
44-10				GS040	11/19/2019 12:39	2325	1919	2581	No
44-10				GS040	11/19/2019 12:41	2129	1919	2581	No
44-10				GS040	11/19/2019 12:43	2074	1919	2581	No
44-10				GS041	11/19/2019 12:45	2144	1919	2581	No
44-10				GS041	11/19/2019 12:47	2064	1919	2581	No
44-10				GS041	11/19/2019 12:49	2157	1919	2581	No
44-10				GS042	11/19/2019 12:51	2041	1919	2581	No
44-10				GS042	11/19/2019 12:53	2030	1919	2581	No
44-10				GS042	11/19/2019 12:55	2282	1919	2581	No
44-10				GS043	11/19/2019 12:57	2245	1919	2581	No
44-10				GS043	11/19/2019 12:59	2019	1919	2581	No
44-10				GS043	11/19/2019 13:01	2130	1919	2581	No
44-10				GS044	11/19/2019 13:03	2186	1919	2581	No
44-10				GS044	11/19/2019 13:05	2114	1919	2581	No
44-10				GS044	11/19/2019 13:07	2203	1919	2581	No
44-10				GS045	11/19/2019 13:09	2260	1919	2581	No
44-10				GS045	11/19/2019 13:11	2024	1919	2581	No
44-10				GS045	11/19/2019 13:13	1985	1919	2581	No
44-10	PR372152	216188	10203B	GS046	11/19/2019 12:34	2253	2045	2729	No
44-10	12/3/2019	19-0741		GS046	11/19/2019 12:36	2223	2045	2729	No
44-10	LL			GS046	11/19/2019 12:38	2350	2045	2729	No
44-10				GS047	11/19/2019 12:40	2407	2045	2729	No
44-10				GS047	11/19/2019 12:42	2210	2045	2729	No
44-10				GS047	11/19/2019 12:44	2254	2045	2729	No
44-10				GS048	11/19/2019 12:46	2129	2045	2729	No
44-10				GS048	11/19/2019 12:48	2295	2045	2729	No
44-10				GS048	11/19/2019 12:50	2284	2045	2729	No
44-10				GS049	11/19/2019 12:52	2377	2045	2729	No
44-10				GS049	11/19/2019 12:54	2276	2045	2729	No
44-10				GS049	11/19/2019 12:56	2619	2045	2729	No
44-10				GS050	11/19/2019 12:58	2217	2045	2729	No
44-10				GS050	11/19/2019 13:00	2264	2045	2729	No
44-10				GS050	11/19/2019 13:02	2362	2045	2729	No
44-10	PR363311	304718	10203B	G001	1/14/2020 11:23	2030	1823	2468	No
44-10	9/19/2020	20-0001		G002	1/14/2020 11:27	2126	1823	2468	No
44-10	VB								No

ATTACHMENT 3

CONSULTATION TRIGGERS FOR RESIDENTIAL AND COMMERCIAL/INDUSTRIAL SOIL CONTAMINATION

Table H.1 Consultation Triggers for Residential and Commercial/Industrial Soil Contamination (MOU Table 1)

Except for radium-226, thorium-232, or total uranium, concentrations should be aggregated using a sum of the fraction approach to determine site-specific consultation trigger concentrations. This table is based on single contaminant concentrations for residential and commercial/industrial land use when using generally accepted exposure parameters. Table users should select the appropriate column based on the site's reasonably anticipated land use.

Radionuclide	Residential Soil Concentration	Industrial/Commercial Soil Concentration
H-3	228 pCi/g	423 pCi/g
C-14	46 pCi/g	123,000 pCi/g
Na-22	9 pCi/g	14 pCi/g
S-35	19,600 pCi/g	32,200,000 pCi/g
Cl-36	6 pCi/g	10,700 pCi/g
Ca-45	13,500 pCi/g	3,740,000 pCi/g
Sc-46	105 pCi/g	169 pCi/g
Mn-54	69 pCi/g	112 pCi/g
Fe-55	269,000 pCi/g	2,210,000 pCi/g
Co-57	873 pCi/g	1,420 pCi/g
Co-60	4 pCi/g	6 pCi/g
Ni-59	20,800 pCi/g	1,230,000 pCi/g
Ni-63	9,480 pCi/g	555,000 pCi/g
Sr-90+D	23 pCi/g	1,070 pCi/g
Nb-94	2 pCi/g	3 pCi/g
Tc-99	25 pCi/g	89,400 pCi/g
I-129	60 pCi/g	1,080 pCi/g
Cs-134	16 pCi/g	26 pCi/g
Cs-137+D	6 pCi/g	11 pCi/g
Eu-152	4 pCi/g	7 pCi/g
Eu-154	5 pCi/g	8 pCi/g
Ir-192	336 pCi/g	544 pCi/g
Pb-210+D	15 pCi/g	123 pCi/g
Ra-226	5 pCi/g	5 pCi/g
Ac-227+D	10 pCi/g	21 pCi/g
Th-228+D	15 pCi/g	25 pCi/g
Th-232	5 pCi/g	5 pCi/g
U-234	401 pCi/g	3,310 pCi/g
U-235+D	20 pCi/g	39 pCi/g
U-238+D	74 pCi/g	179 pCi/g
total uranium	47 mg/kg	1230 mg/kg
Pu-238	297 pCi/g	1,640 pCi/g
Pu-239	259 pCi/g	1,430 pCi/g
Pu-241	40,600 pCi/g	172,000 pCi/g
Am-241	187 pCi/g	568 pCi/g
Cm-242	32,200 pCi/g	344,000 pCi/g
Cm-243	35 pCi/g	67 pCi/g

ATTACHMENT 4
SIGN TEST

Survey Area: No. 10200 **Description:** Radiological Restricted Area Grounds

Survey Unit: No. 10203B **Description:** East Training Area

Classification: 1 **Type I (α) Error:** 0.05 **Number of Samples:** 17

#	Fraction of the Release Criterion						Weighted Sum (W_s)	1-W_s	Sign
	Radionuclides of Concern					Activity or SOF (as applicable)			
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90				
1	1.37E-02	1.52E-02	0.00E+00	2.96E-03	0.00E+00	SOF	0.032	0.968	+
2	3.23E-02	1.97E-02	1.28E-02	6.95E-03	3.01E-05	SOF	0.072	0.928	+
3	0.00E+00	8.54E-03	2.78E-03	0.00E+00	6.53E-06	SOF	0.011	0.989	+
4	0.00E+00	1.56E-02	1.74E-02	0.00E+00	4.07E-05	SOF	0.033	0.967	+
5	5.62E-02	1.87E-02	3.99E-02	1.21E-02	9.37E-05	SOF	0.127	0.873	+
6	3.43E-02	5.04E-03	1.31E-02	7.38E-03	3.08E-05	SOF	0.060	0.940	+
7	1.21E-02	1.85E-02	0.00E+00	2.60E-03	0.00E+00	SOF	0.033	0.967	+
8	9.72E-03	1.10E-02	9.39E-03	2.09E-03	2.20E-05	SOF	0.032	0.968	+
9	2.18E-02	5.67E-03	4.66E-03	4.70E-03	1.09E-05	SOF	0.037	0.963	+
10	3.44E-02	1.45E-02	6.01E-02	7.40E-03	1.41E-04	SOF	0.117	0.883	+
11	4.80E-02	0.00E+00	1.08E-02	1.03E-02	2.53E-05	SOF	0.069	0.931	+
12	0.00E+00	0.00E+00	4.30E-03	0.00E+00	1.01E-05	SOF	0.004	0.996	+
13	5.94E-02	8.66E-03	3.00E-02	1.28E-02	7.04E-05	SOF	0.111	0.889	+
14	0.00E+00	2.89E-03	1.13E-02	0.00E+00	2.64E-05	SOF	0.014	0.986	+
15	0.00E+00	3.08E-02	9.67E-03	0.00E+00	2.27E-05	SOF	0.040	0.960	+
16	0.00E+00	1.58E-02	1.19E-02	0.00E+00	2.79E-05	SOF	0.028	0.972	+
17	2.18E-02	9.81E-04	3.99E-03	4.70E-03	9.37E-06	SOF	0.031	0.969	+

Critical Value (Table I.3 of MARSSIM) = **12** Number of Positive Differences (S+) = **17**

The survey unit ☑ (meets) ☐ (does not meet) the acceptance criteria.

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #:	10200	Survey Unit #:	10203B	Survey Unit Name:	East Training Area
Sample Plan#:		L1-10203B-F			

Sample Description: Comparison of split samples collected from systematic surface soil sample location #5 and judgmental surface soil sample #1. The samples were analyzed using gamma spectroscopy by on-site HPGe system. The standard/comparison samples were L1-10203B-FSGS-005SS/L1-10203B-FQGS-005SS and L1-10203B-FJGS-001SS/L1-10203B-QJGS-001SS.

	STANDARD				COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
Systematic Sample #5								
Cs-137	1.45E-01	2.16E-02	6.71	0.5-2.0	6.68E-02	1.44E-02	2.17	N
K-40	6.36E+00	4.77E-01	13.33	0.6-1.66	6.21E+00	4.80E-01	1.02	Y
Judgmental Sample #1								
K-40	7.24E+00	5.16E-01	14.03	0.6-1.66	7.38E+00	5.24E-01	0.98	Y

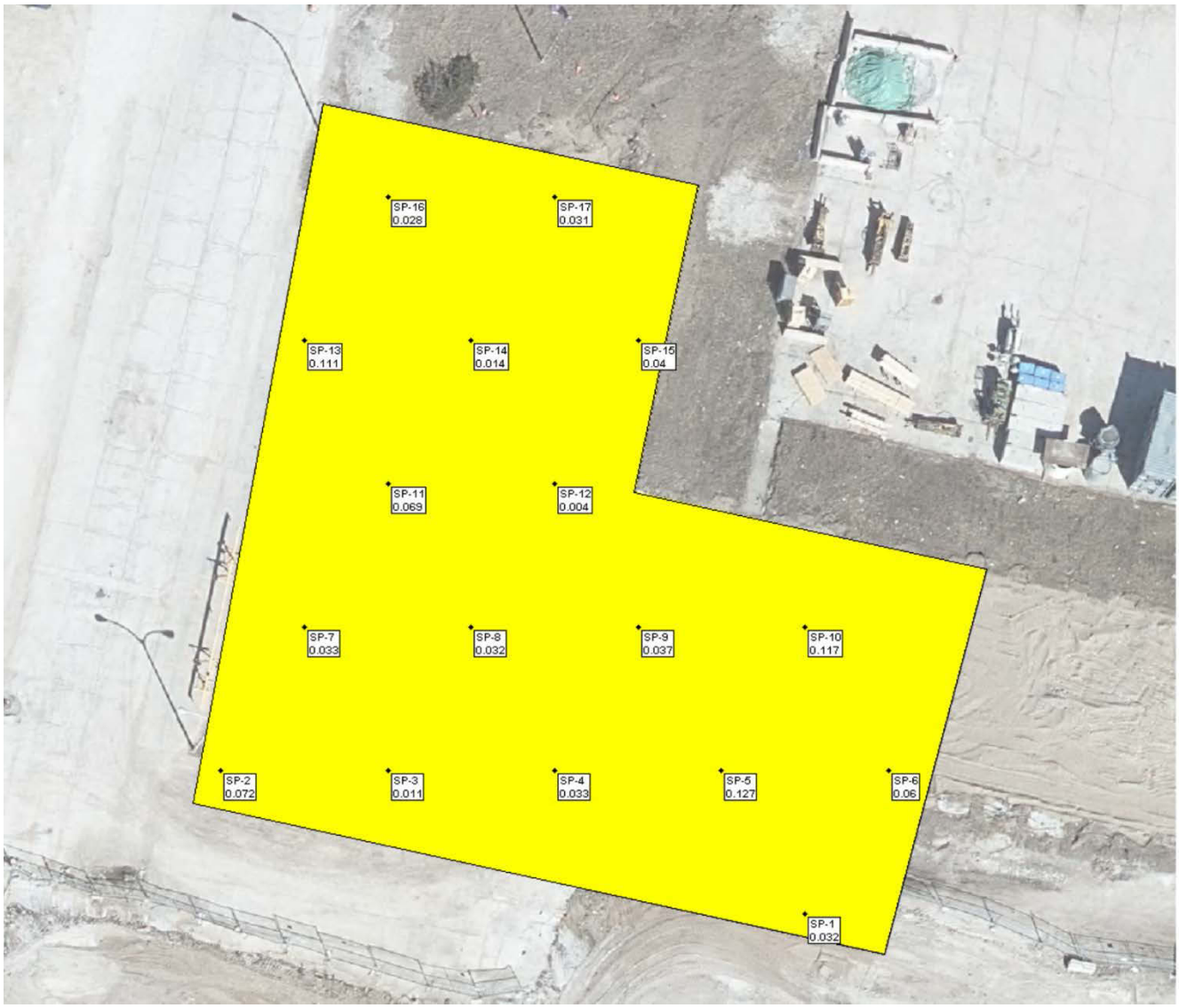
Comments/Corrective Actions:
For systematic sample #5, there was not acceptable agreement between the standard sample and QC sample when using Cs-137. This is due to the fact that Cs-137 is present at very low concentrations in both samples. However, when using K-40, which is present in the samples at a higher concentration, there was acceptable agreement. No further action is necessary.
For judgmental sample #1, the standard sample and QC sample did not both have a positive result for a gamma emitting ROC, therefore K-40 was used in the QC comparison. There was acceptable agreement when using K-40. No further action is necessary.

Table 4-1 from the QAPP is reproduced below to show acceptance criteria used to assess split samples.

Resolution	Acceptable Ratio
<4	not comparable
4-7	0.5-2.0
8-15	0.6-1.66
16-50	0.75-1.33
51-200	0.80-1.25
>200	0.85-1.18

ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot

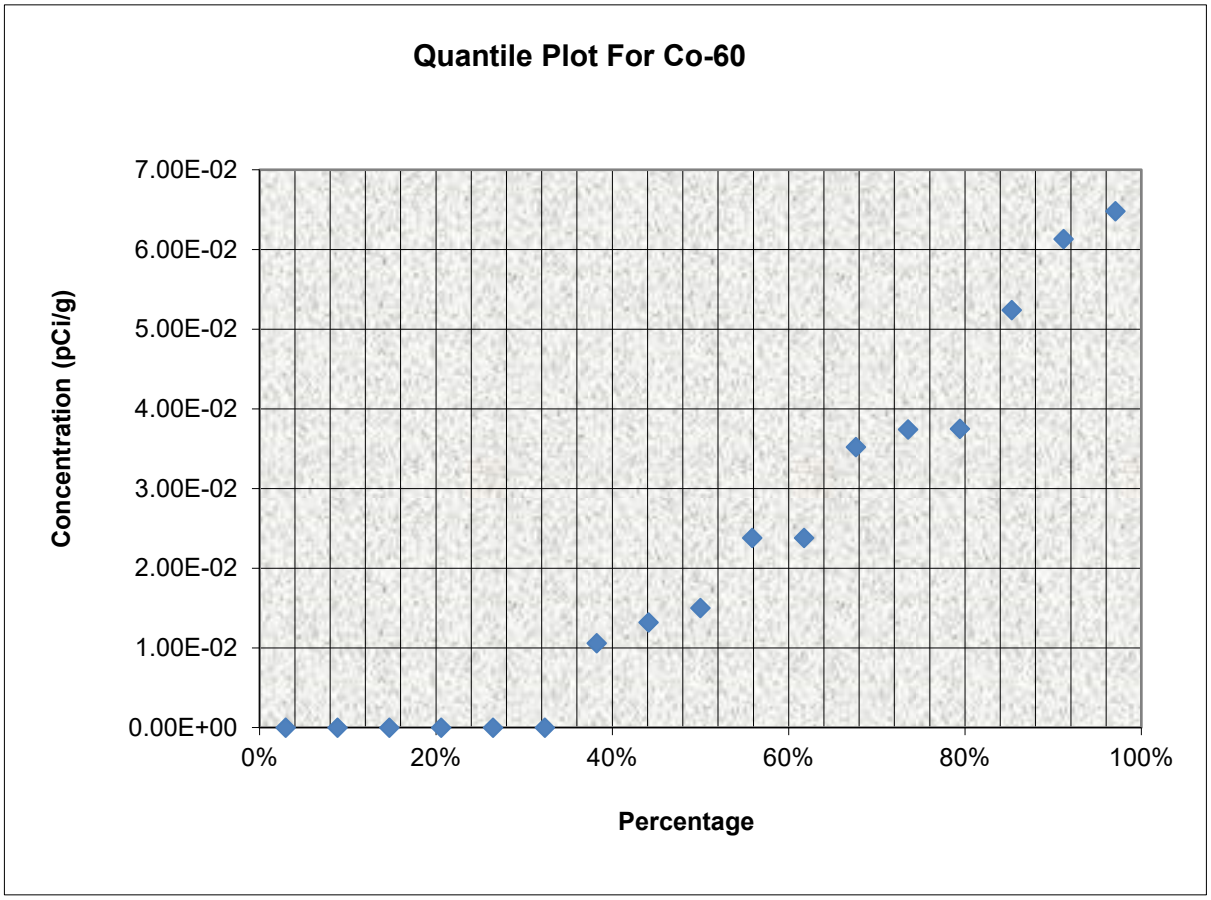


QUANTILE PLOT FOR Co-60

Survey Unit: 10203B

Survey Unit Name: East Training Area

Mean: 2.21E-02 pCi/g

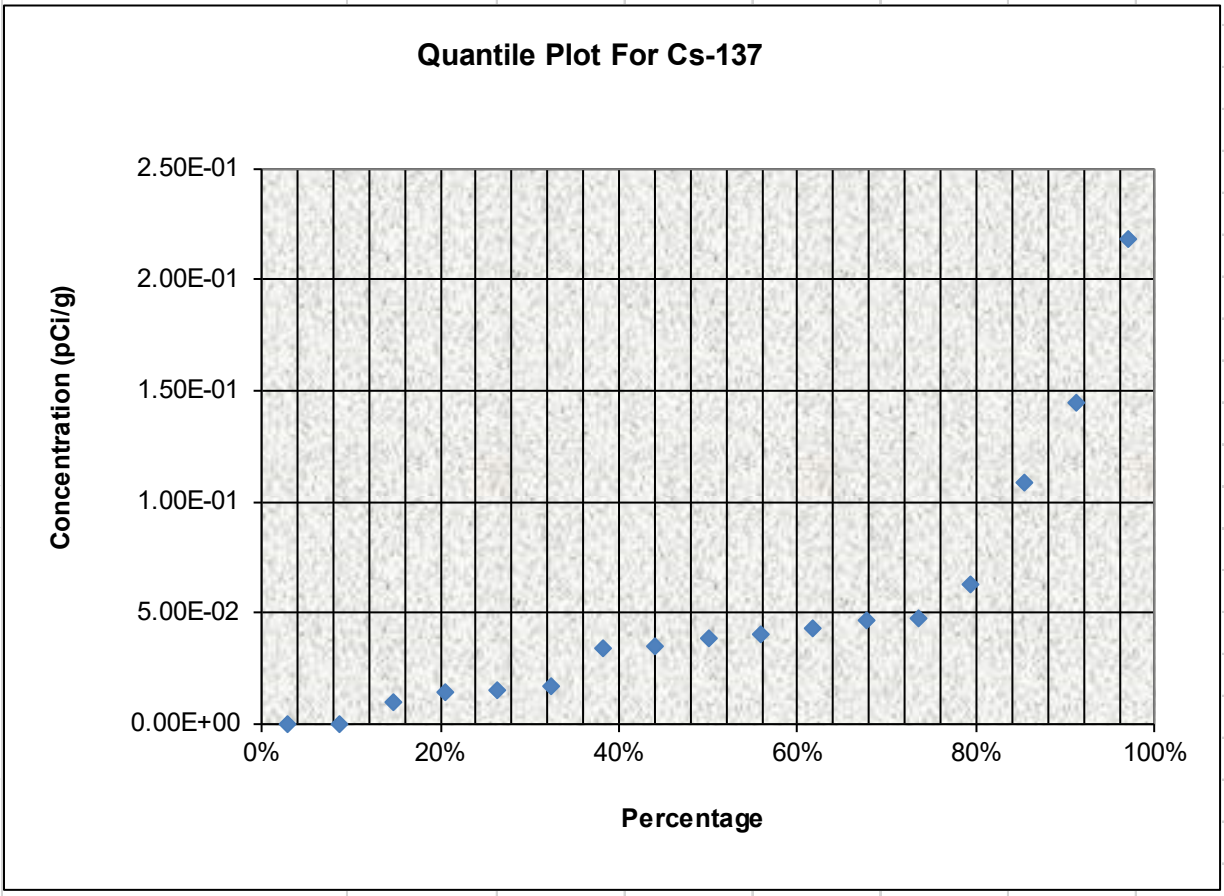


QUANTILE PLOT FOR Cs-137

Survey Unit: 10203B

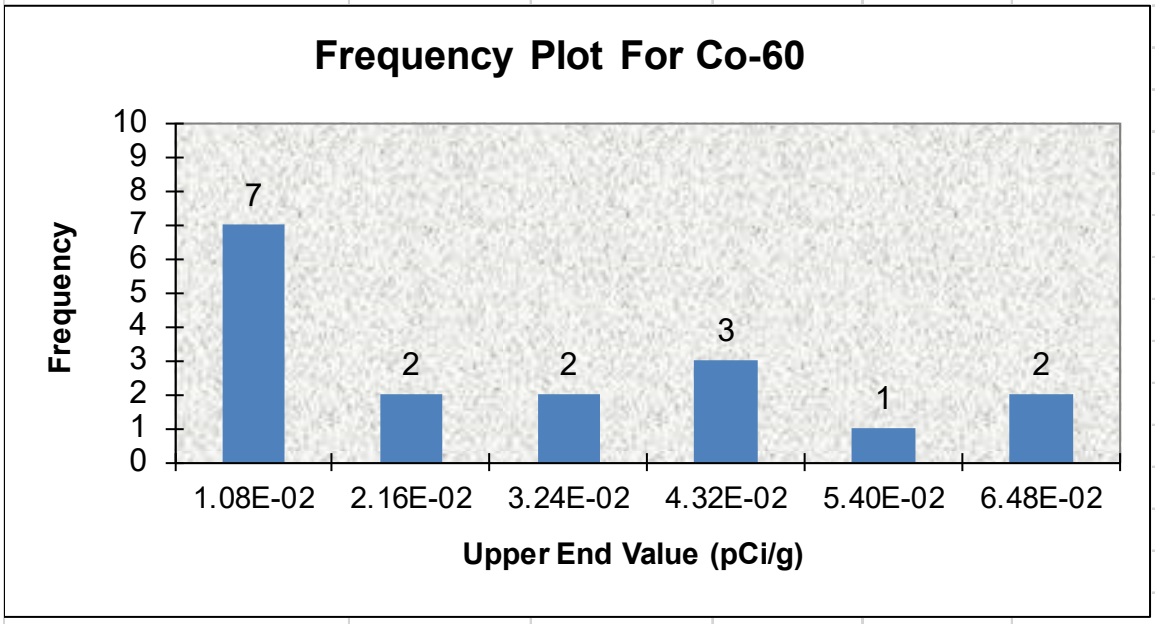
Survey Unit Name: East Training Area

Mean: 5.17E-02 pCi/g



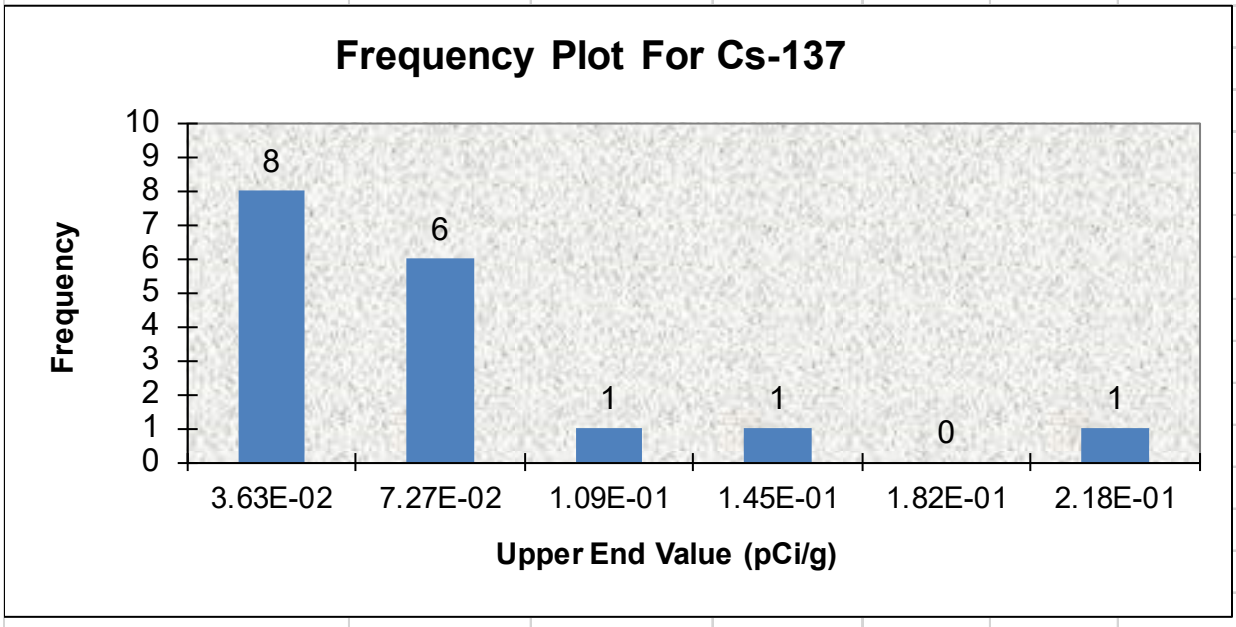
HISTOGRAM FOR Co-60		
Survey Unit:	10203B	
Survey Unit Name:	East Training Area	
Mean:	2.21E-02	pCi/g
Median:	1.50E-02	pCi/g
ST DEV:	0.023	
Skew:	0.676	

Upper Value	Observation Frequency	Observation %
1.08E-02	7	41%
2.16E-02	2	12%
3.24E-02	2	12%
4.32E-02	3	18%
5.40E-02	1	6%
6.48E-02	2	12%
TOTAL	17	100%

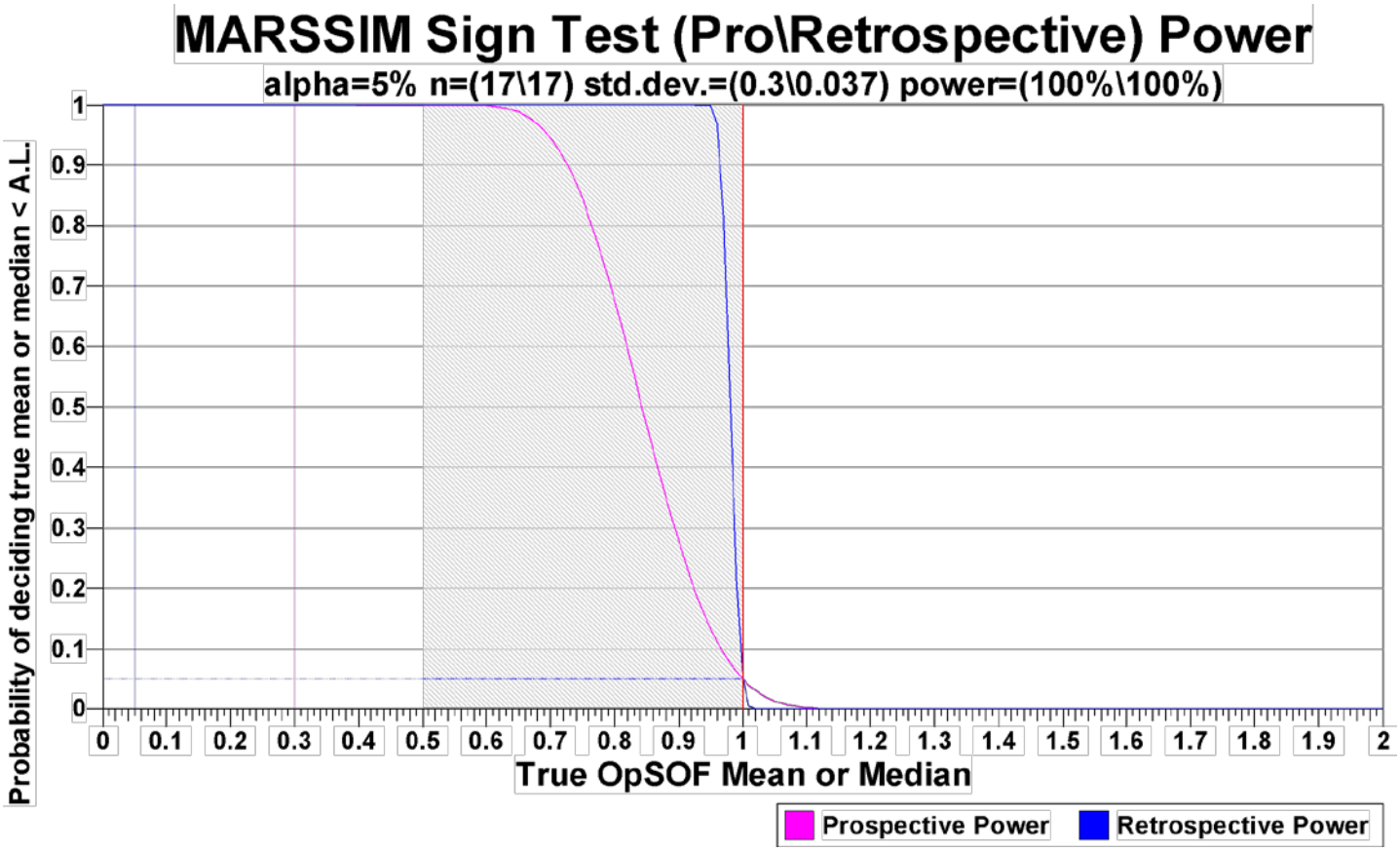


HISTOGRAM FOR Cs-137		
Survey Unit:	10203B	
Survey Unit Name:	East Training Area	
Mean:	5.17E-02	pCi/g
Median:	3.91E-02	pCi/g
ST DEV:	0.057	
Skew:	1.965	

Upper Value	Observation Frequency	Observation %
3.63E-02	8	47%
7.27E-02	6	35%
1.09E-01	1	6%
1.45E-01	1	6%
1.82E-01	0	0%
2.18E-01	1	6%
TOTAL	17	100%



Prospective and Retrospective Power Curves for Survey Unit 10203B



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 21-Nov-19-10011

L1-10203B-FSGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10011
Sample Description	: L1-10203B-FSGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.728E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:00:00AM
Acquisition Started	: 11/21/2019 9:22:56AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81484
Fill Height	: 1728.36 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 9:37:59AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10011

L1-10203B-FSGS-001SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	75.17	297 -	316	301.22	2.20E+01	5.43	4.62E+01	0.23
m	2	77.50	297 -	316	310.53	3.95E+01	8.20	5.99E+01	0.24
	3	238.69	950 -	961	954.36	1.14E+02	17.23	6.97E+01	1.15
	4	295.40	1175 -	1187	1180.89	2.30E+01	10.19	3.00E+01	0.89
	5	352.09	1400 -	1415	1407.38	8.89E+01	11.99	1.81E+01	0.97
	6	477.48	1902 -	1916	1908.41	6.26E+01	10.41	1.54E+01	1.11
	7	609.08	2428 -	2439	2434.35	5.90E+01	10.57	2.10E+01	1.52
	8	1119.87	4471 -	4482	4476.90	9.94E+00	5.36	7.06E+00	0.29
	9	1460.03	5825 -	5851	5838.07	4.52E+02	21.26	0.00E+00	1.61

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	6.62E-01	1.20E-01
K-40	0.90	1460.82	*	10.66	9.82E+00	6.28E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.78E-01	3.04E-02
		300.09		3.30		
Pb212-XR	0.98	74.82	*	10.28	2.76E-01	7.39E-02
		77.11	*	17.10	2.73E-01	6.32E-02
		87.35		3.97		

Analysis Report for 21-Nov-19-10011

L1-10203B-FSGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.98	89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.66E-01	3.14E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	1.29E-01	6.95E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	9.63E-02	4.33E-02
		351.93	*	35.60	2.19E-01	3.43E-02
		785.96		1.06		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
BE-7	0.998	6.62E-01	1.20E-01	
K-40	0.905	9.82E+00	6.28E-01	
Pb-212	0.999	1.78E-01	3.04E-02	
Pb212-XR	0.981	2.74E-01	4.80E-02	

Analysis Report for 21-Nov-19-10011

L1-10203B-FSGS-001SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	Bi-214	0.992	1.60E-01	2.87E-02	
	Pb-214	0.996	1.72E-01	2.69E-02	
X	Pb214-XR	0.981			

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10011

L1-10203B-FSGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 9:37:59AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.14E-02	5.36E-02	5.36E-02
+	BE-7	477.60	*	10.44	6.62E-01	2.73E-01	2.73E-01
+	K-40	1460.82	*	10.66	9.82E+00	6.25E-02	6.25E-02
	Mn-54	834.85		99.98	-6.21E-02	4.90E-02	4.90E-02
	Co-60	1173.23		99.85	-9.83E-03	5.49E-02	6.38E-02
		1332.49		99.98	1.50E-02		5.49E-02
	Nb-94	702.65		99.81	-4.79E-03	4.19E-02	4.19E-02
		871.09		99.89	7.35E-03		4.39E-02
	Ag-108m	79.13		6.60	-3.93E-01	4.25E-02	1.08E+00
		433.94		90.50	2.47E-02		4.25E-02
		614.28		89.80	-8.88E-02		5.57E-02
		722.94		90.80	3.80E-03		4.96E-02
	Sb-125	176.31		6.84	3.01E-02	1.11E-01	4.72E-01
		380.45		1.52	-7.45E-01		2.35E+00
		427.87		29.60	-9.49E-02		1.11E-01
		463.36		10.49	2.87E-01		3.85E-01
		600.60		17.65	2.23E-02		2.10E-01
		606.71		4.98	2.36E+00		1.40E+00
		635.95		11.22	1.72E-01		3.49E-01

Analysis Report for 21-Nov-19-10011

L1-10203B-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.42E-03	1.11E-01	2.13E+00
Ba-133	79.61	2.65	-1.12E+00	7.00E-02	2.60E+00
	81.00	32.90	-9.91E-02		1.71E-01
	276.40	7.16	-1.23E-02		4.79E-01
	302.85	18.34	7.49E-03		1.80E-01
	356.01	62.05	-1.01E-02		7.00E-02
	383.85	8.94	-1.43E-01		4.05E-01
Cs-134	475.36	1.48	-1.63E+00	5.24E-02	3.78E+00
	563.25	8.34	-3.32E-01		4.51E-01
	569.33	15.37	9.37E-02		2.68E-01
	604.72	97.62	-2.67E-02		6.17E-02
	795.86	85.46	2.64E-02		5.24E-02
	801.95	8.69	1.37E-02		5.49E-01
	1038.61	0.99	-3.72E+00		4.99E+00
	1167.97	1.79	-2.91E+00		3.13E+00
	1365.19	3.02	1.24E+00		1.65E+00
Cs-137	661.66	85.10	-1.66E-03	5.54E-02	5.54E-02
Eu-152	121.78	28.67	1.73E-02	1.22E-01	1.22E-01
	244.70	7.61	1.53E-01		4.82E-01
	295.94	0.45	-2.04E-01		8.25E+00
	344.28	26.60	6.88E-03		1.25E-01
	367.79	0.86	2.58E+00		4.42E+00
	411.12	2.24	5.29E-01		1.73E+00
	443.96	2.83	-6.48E-01		1.32E+00
	488.68	0.42	2.09E-01		8.75E+00
	563.99	0.49	-4.27E+00		7.45E+00
	586.26	0.46	8.62E+00		1.05E+01
	678.62	0.47	3.14E+00		7.43E+00
	688.67	0.86	3.02E+00		5.21E+00
	719.35	0.28	4.15E-01		1.43E+01
	778.90	12.96	2.02E-01		3.51E-01
	810.45	0.32	6.92E+00		1.63E+01
	867.37	4.26	4.49E-01		9.69E-01
	919.33	0.43	7.21E+00		1.04E+01
	964.08	14.65	1.96E-01		4.67E-01
	1085.87	10.24	1.60E-01		5.85E-01
	1089.74	1.73	2.04E+00		3.76E+00
	1112.07	13.69	7.72E-02		4.03E-01
	1212.95	1.43	-2.24E+00		5.34E+00
	1249.94	0.19	-5.89E+00		3.56E+01
	1299.14	1.63	2.75E+00		3.25E+00
	1408.01	21.07	2.67E-02		2.36E-01
	1457.64	0.50	2.05E+02		4.83E+01
	1528.10	0.28	-1.91E+01		1.06E+01
Eu-154	123.07	40.40	-7.68E-02	8.17E-02	8.17E-02
	247.93	6.89	-7.19E-02		4.31E-01
	591.76	4.95	-3.66E-01		6.32E-01
	692.42	1.78	-3.57E-01		2.46E+00
	723.30	20.06	6.01E-02		2.30E-01
	756.80	4.52	-6.52E-01		8.17E-01
	873.18	12.08	3.52E-01		4.00E-01

Analysis Report for 21-Nov-19-10011

L1-10203B-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.90E-01	8.17E-02	4.82E-01
	1004.76	18.01	-2.16E-01		2.87E-01
	1274.43	34.80	1.35E-01		2.05E-01
	1596.48	1.80	-2.83E+00		1.33E+00
Eu-155	45.30	1.31	3.48E-01	1.84E-01	1.18E+01
	60.01	1.22	8.34E-01		1.23E+01
	86.55	30.70	6.60E-02		1.84E-01
	105.31	21.10	3.08E-02		2.03E-01
Ra-226	186.21	3.64	4.45E-01	9.34E-01	9.34E-01
Pa-231	27.36	10.30	7.94E-01	1.19E+00	1.19E+00
	283.69	1.70	2.30E-01		1.88E+00
	300.07	2.47	-6.32E-02		1.27E+00
	302.65	2.20	1.18E-01		1.50E+00
	330.06	1.40	-4.70E-01		2.50E+00
U-235	143.76	10.96	-7.92E-02	5.87E-02	3.08E-01
	163.33	5.08	2.91E-01		6.27E-01
	185.71	57.20	1.35E-03		5.87E-02
	202.11	1.08	1.02E+00		3.27E+00
	205.31	5.01	-6.22E-01		6.25E-01
Am-241	59.54	35.90	2.09E-01	4.40E-01	4.40E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10012

L1-10203B-FSGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10012
Sample Description	: L1-10203B-FSGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.654E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:02:00AM
Acquisition Started	: 11/21/2019 9:23:05AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81485
Fill Height	: 1653.71 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 9:38:07AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10012

L1-10203B-FSGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.96	738 -	749	744.55	4.02E+01	14.07	6.28E+01	0.87
2	238.57	947 -	960	954.75	1.32E+02	17.57	6.45E+01	0.70
3	295.32	1176 -	1187	1181.49	3.96E+01	10.82	3.04E+01	0.94
4	351.92	1401 -	1414	1407.69	1.07E+02	12.60	1.80E+01	1.29
5	583.07	2326 -	2340	2331.60	5.58E+01	9.44	1.13E+01	0.93
6	609.26	2430 -	2444	2436.31	6.37E+01	9.32	8.27E+00	1.03
7	1460.60	5829 -	5855	5842.76	3.53E+02	18.79	0.00E+00	1.61

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.24E+00	4.97E-01
Tl-208	0.99	583.19	*	85.00	7.85E-02	1.41E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.03E-01	3.18E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.72E-01	2.73E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 21-Nov-19-10012

L1-10203B-FSGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.63E-01	4.63E-02
		351.93	*	35.60	2.57E-01	3.65E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	6.65E-01	2.39E-01
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.23E-02	1.52E-02
		202.11		1.08		
		205.31		5.01		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.992	7.24E+00	4.97E-01	
	Tl-208	0.998	7.85E-02	1.41E-02	
X	Bi-211	0.890			
	Pb-212	0.999	2.03E-01	3.18E-02	

Analysis Report for 21-Nov-19-10012

L1-10203B-FSGS-002SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	Bi-214	1.000	1.72E-01	2.73E-02	
	Pb-214	1.000	2.21E-01	2.87E-02	
?	Ra-226	0.990	6.65E-01	2.39E-01	
?	U-235	0.993	4.23E-02	1.52E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10012

L1-10203B-FSGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 9:38:07AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.43E-02	5.49E-02	5.49E-02
	BE-7	477.60		10.44	4.49E-02	3.82E-01	3.82E-01
+	K-40	1460.82	*	10.66	7.24E+00	5.90E-02	5.90E-02
	Mn-54	834.85		99.98	7.34E-03	5.03E-02	5.03E-02
	Co-60	1173.23		99.85	3.52E-02	5.59E-02	7.00E-02
		1332.49		99.98	3.19E-02		5.59E-02
	Nb-94	702.65		99.81	-1.01E-03	4.12E-02	4.12E-02
		871.09		99.89	-4.17E-02		4.66E-02
	Ag-108m	79.13		6.60	3.24E-01	4.07E-02	1.58E+00
		433.94		90.50	3.29E-03		4.07E-02
		614.28		89.80	-3.06E-02		6.16E-02
		722.94		90.80	7.96E-03		4.98E-02
	Sb-125	176.31		6.84	1.02E-01	1.14E-01	4.93E-01
		380.45		1.52	-1.40E+00		2.29E+00
		427.87		29.60	-4.54E-02		1.14E-01
		463.36		10.49	1.28E-01		3.83E-01
		600.60		17.65	1.50E-01		2.61E-01
		606.71		4.98	1.61E+00		1.27E+00
		635.95		11.22	-3.15E-02		3.09E-01

Analysis Report for 21-Nov-19-10012

L1-10203B-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-9.90E-01	1.14E-01	2.35E+00
Ba-133	79.61	2.65	-2.19E-01	7.69E-02	3.74E+00
	81.00	32.90	-3.28E-01		2.68E-01
	276.40	7.16	8.73E-02		5.08E-01
	302.85	18.34	-5.92E-02		1.91E-01
	356.01	62.05	-3.72E-02		7.69E-02
	383.85	8.94	-6.71E-02		4.00E-01
Cs-134	475.36	1.48	8.68E-01	5.95E-02	2.86E+00
	563.25	8.34	-2.14E-02		4.50E-01
	569.33	15.37	-3.07E-02		2.46E-01
	604.72	97.62	-4.52E-02		6.29E-02
	795.86	85.46	3.42E-02		5.95E-02
	801.95	8.69	2.71E-01		5.94E-01
	1038.61	0.99	1.85E+00		5.58E+00
	1167.97	1.79	-1.35E+00		3.56E+00
	1365.19	3.02	-8.63E-02		1.39E+00
Cs-137	661.66	85.10	4.66E-02	5.77E-02	5.77E-02
Eu-152	121.78	28.67	3.62E-02	1.38E-01	1.38E-01
	244.70	7.61	8.88E-02		5.11E-01
	295.94	0.45	1.49E+01		9.80E+00
	344.28	26.60	-4.57E-03		1.41E-01
	367.79	0.86	4.24E-01		3.90E+00
	411.12	2.24	-1.95E-01		1.78E+00
	443.96	2.83	-1.61E+00		1.23E+00
	488.68	0.42	5.33E+00		8.98E+00
	563.99	0.49	-2.27E+00		7.45E+00
	586.26	0.46	1.33E+01		1.26E+01
	678.62	0.47	-5.51E+00		8.63E+00
	688.67	0.86	2.56E+00		5.10E+00
	719.35	0.28	-3.82E+00		1.41E+01
	778.90	12.96	-4.01E-01		3.15E-01
	810.45	0.32	-2.07E+01		1.22E+01
	867.37	4.26	-3.82E-01		1.30E+00
	919.33	0.43	-1.86E+01		1.03E+01
	964.08	14.65	1.84E-01		4.02E-01
	1085.87	10.24	5.25E-02		4.78E-01
	1089.74	1.73	2.47E+00		3.33E+00
	1112.07	13.69	-3.95E-01		3.93E-01
	1212.95	1.43	2.38E+00		5.14E+00
	1249.94	0.19	-1.70E+01		3.37E+01
	1299.14	1.63	-2.48E+00		3.26E+00
	1408.01	21.07	1.01E-01		2.23E-01
	1457.64	0.50	1.51E+02		4.06E+01
	1528.10	0.28	-1.65E+00		1.38E+01
Eu-154	123.07	40.40	1.89E-02	9.78E-02	9.78E-02
	247.93	6.89	-3.46E-01		4.91E-01
	591.76	4.95	4.27E-01		8.73E-01
	692.42	1.78	-9.57E-02		2.41E+00
	723.30	20.06	7.83E-02		2.28E-01
	756.80	4.52	-5.53E-01		9.80E-01
	873.18	12.08	-3.10E-01		3.81E-01

Analysis Report for 21-Nov-19-10012

L1-10203B-FSGS-002SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-3.69E-01	9.78E-02	4.72E-01
		1004.76		18.01	1.46E-01		2.96E-01
		1274.43		34.80	4.14E-02		1.42E-01
		1596.48		1.80	-3.90E+00		1.90E+00
	Eu-155	45.30		1.31	-8.53E+00	2.29E-01	1.75E+01
		60.01		1.22	-2.82E+00		2.20E+01
		86.55		30.70	1.32E-02		2.44E-01
		105.31		21.10	1.36E-01		2.29E-01
+	Ra-226	186.21	*	3.64	6.65E-01	7.53E-01	7.53E-01
	Pa-231	27.36		10.30	1.39E+00	1.57E+00	2.27E+00
		283.69		1.70	2.95E-02		2.04E+00
		300.07		2.47	7.59E-01		1.57E+00
		302.65		2.20	-8.10E-02		1.62E+00
		330.06		1.40	-2.99E-01		2.64E+00
+	U-235	143.76		10.96	-2.73E-02	4.79E-02	3.42E-01
		163.33		5.08	-5.54E-01		6.56E-01
		185.71	*	57.20	4.23E-02		4.79E-02
		202.11		1.08	-2.56E+00		3.08E+00
		205.31		5.01	-3.12E-01		6.60E-01
	Am-241	59.54		35.90	1.38E-01	7.81E-01	7.81E-01

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10013

L1-10203B-FSGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10013
Sample Description	: L1-10203B-FSGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.630E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:04:00AM
Acquisition Started	: 11/21/2019 9:46:25AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.15 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81486
Fill Height	: 1630.15 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 10:01:29AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10013

L1-10203B-FSGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.67	951 -	961	954.75	1.18E+02	16.25	5.90E+01	1.12
2	352.12	1399 -	1413	1408.22	7.78E+01	13.69	3.82E+01	0.87
3	583.23	2327 -	2338	2332.11	3.64E+01	8.09	1.16E+01	1.04
4	609.31	2431 -	2443	2436.40	5.52E+01	9.13	1.08E+01	0.80
5	911.15	3637 -	3649	3643.55	4.17E+01	7.63	6.30E+00	1.00
6	1460.91	5832 -	5853	5843.47	3.06E+02	18.06	5.50E+00	1.71

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.48E+00	5.49E-01
Tl-208	1.00	583.19	*	85.00	5.98E-02	1.38E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.09E-01	3.33E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.75E-01	3.08E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 21-Nov-19-10013

L1-10203B-FSGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.15E-01	4.16E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.06E-01	5.75E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 21-Nov-19-10013

L1-10203B-FSGS-003SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.999	7.48E+00	5.49E-01	
Tl-208	1.000	5.98E-02	1.38E-02	
Pb-212	1.000	2.09E-01	3.33E-02	
Bi-214	1.000	1.75E-01	3.08E-02	
Pb-214	0.997	2.15E-01	4.16E-02	
Ac-228	1.000	3.06E-01	5.75E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10013

L1-10203B-FSGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 10:01:29AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.56E-02	6.13E-02	6.13E-02
	BE-7	477.60		10.44	3.41E-01	4.70E-01	4.70E-01
+	K-40	1460.82	*	10.66	7.48E+00	4.48E-01	4.48E-01
	Mn-54	834.85		99.98	8.03E-03	4.79E-02	4.79E-02
	Co-60	1173.23		99.85	-3.70E-03	6.05E-02	6.82E-02
		1332.49		99.98	-4.72E-02		6.05E-02
	Nb-94	702.65		99.81	3.09E-02	4.70E-02	4.70E-02
		871.09		99.89	3.79E-03		5.34E-02
	Ag-108m	79.13		6.60	8.27E-01	4.76E-02	1.95E+00
		433.94		90.50	1.08E-02		4.76E-02
		614.28		89.80	-3.65E-02		6.46E-02
		722.94		90.80	-1.40E-02		5.49E-02
	Sb-125	176.31		6.84	8.52E-02	1.41E-01	5.84E-01
		380.45		1.52	-8.75E-01		2.41E+00
		427.87		29.60	9.15E-02		1.41E-01
		463.36		10.49	-1.50E-02		3.74E-01
		600.60		17.65	1.34E-01		2.69E-01
		606.71		4.98	1.97E+00		1.43E+00
		635.95		11.22	-2.62E-03		3.49E-01

Analysis Report for 21-Nov-19-10013

L1-10203B-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.12E+00	1.41E-01	2.35E+00
Ba-133	79.61	2.65	-9.70E-01	8.90E-02	4.53E+00
	81.00	32.90	-1.93E-02		3.28E-01
	276.40	7.16	-6.12E-02		5.68E-01
	302.85	18.34	1.05E-01		2.16E-01
	356.01	62.05	-1.47E-02		8.90E-02
	383.85	8.94	2.68E-01		4.69E-01
Cs-134	475.36	1.48	1.70E+00	6.84E-02	3.30E+00
	563.25	8.34	2.33E-01		5.57E-01
	569.33	15.37	-1.75E-01		2.76E-01
	604.72	97.62	-9.42E-03		6.84E-02
	795.86	85.46	1.48E-02		7.01E-02
	801.95	8.69	-5.05E-01		5.27E-01
	1038.61	0.99	3.19E-01		4.97E+00
	1167.97	1.79	-9.28E-01		4.05E+00
	1365.19	3.02	-2.74E-02		1.76E+00
Cs-137	661.66	85.10	1.01E-02	5.60E-02	5.60E-02
Eu-152	121.78	28.67	-4.92E-02	1.38E-01	1.56E-01
	244.70	7.61	7.22E-02		6.01E-01
	295.94	0.45	-1.07E+00		1.10E+01
	344.28	26.60	-8.11E-02		1.38E-01
	367.79	0.86	1.34E+00		4.00E+00
	411.12	2.24	-7.70E-01		1.84E+00
	443.96	2.83	1.25E+00		1.48E+00
	488.68	0.42	-2.67E+00		9.57E+00
	563.99	0.49	3.78E+00		9.35E+00
	586.26	0.46	8.26E+00		1.31E+01
	678.62	0.47	-7.39E-01		9.13E+00
	688.67	0.86	-1.16E+00		5.15E+00
	719.35	0.28	-6.66E+00		1.63E+01
	778.90	12.96	2.38E-02		3.39E-01
	810.45	0.32	-6.85E+00		1.56E+01
	867.37	4.26	2.79E-01		1.23E+00
	919.33	0.43	-4.75E+00		8.97E+00
	964.08	14.65	3.03E-01		4.66E-01
	1085.87	10.24	-5.33E-02		5.68E-01
	1089.74	1.73	-1.40E+00		3.48E+00
	1112.07	13.69	3.22E-02		4.74E-01
	1212.95	1.43	2.36E+00		5.27E+00
	1249.94	0.19	2.81E+01		3.49E+01
	1299.14	1.63	-3.07E-02		3.42E+00
	1408.01	21.07	-3.31E-02		2.17E-01
	1457.64	0.50	1.62E+02		4.57E+01
	1528.10	0.28	-1.01E+00		1.30E+01
Eu-154	123.07	40.40	-4.30E-02	1.11E-01	1.11E-01
	247.93	6.89	-1.28E-02		5.94E-01
	591.76	4.95	4.08E-02		9.03E-01
	692.42	1.78	-6.41E-01		2.33E+00
	723.30	20.06	1.17E-01		2.52E-01
	756.80	4.52	5.04E-01		1.08E+00
	873.18	12.08	-5.70E-02		4.43E-01

Analysis Report for 21-Nov-19-10013

L1-10203B-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.88E-02	1.11E-01	5.06E-01
	1004.76	18.01	1.77E-02		3.27E-01
	1274.43	34.80	-1.80E-01		1.58E-01
	1596.48	1.80	-2.09E+00		2.12E+00
Eu-155	45.30	1.31	1.01E+00	2.65E-01	2.95E+01
	60.01	1.22	-8.09E+00		3.27E+01
	86.55	30.70	-2.11E-01		2.65E-01
	105.31	21.10	1.75E-01		2.84E-01
Ra-226	186.21	3.64	-7.50E-02	1.16E+00	1.16E+00
Pa-231	27.36	10.30	2.33E+00	1.70E+00	3.56E+00
	283.69	1.70	1.20E+00		2.33E+00
	300.07	2.47	-1.98E+00		1.70E+00
	302.65	2.20	7.54E-02		1.78E+00
	330.06	1.40	3.99E-02		2.92E+00
U-235	143.76	10.96	9.92E-02	7.42E-02	4.07E-01
	163.33	5.08	3.08E-01		8.80E-01
	185.71	57.20	1.07E-02		7.42E-02
	202.11	1.08	9.93E-02		3.58E+00
	205.31	5.01	-5.75E-01		7.17E-01
Am-241	59.54	35.90	-1.55E-01	1.20E+00	1.20E+00

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10014

L1-10203B-FSGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10014
Sample Description	: L1-10203B-FSGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.467E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:06:00AM
Acquisition Started	: 11/21/2019 9:46:32AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81487
Fill Height	: 1466.76 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 10:01:34AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10014

L1-10203B-FSGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.71	949 -	960	954.41	9.94E+01	16.34	6.56E+01	0.94
2	295.21	1174 -	1188	1180.12	5.22E+01	11.78	2.98E+01	0.63
3	338.12	1344 -	1359	1351.55	4.98E+01	10.24	1.82E+01	0.81
4	351.95	1400 -	1415	1406.81	9.97E+01	13.24	2.53E+01	0.89
5	558.41	2227 -	2236	2231.83	2.07E+01	6.81	1.13E+01	0.31
6	582.89	2323 -	2335	2329.67	3.64E+01	8.64	1.46E+01	1.15
7	608.97	2427 -	2440	2433.91	6.75E+01	11.61	2.45E+01	1.34
8	661.40	2638 -	2649	2643.51	3.80E+01	9.65	2.20E+01	0.81
9	911.50	3639 -	3648	3643.47	1.81E+01	7.80	1.59E+01	0.42
10	1460.07	5827 -	5850	5838.21	2.68E+02	18.08	1.48E+01	2.03

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.91	1460.82	*	10.66	6.09E+00	4.89E-01
Cs-137	0.99	661.66	*	85.10	6.30E-02	1.64E-02
Tl-208	0.98	583.19	*	85.00	5.54E-02	1.36E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.59E-01	2.92E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.98E-01	3.60E-02

Analysis Report for 21-Nov-19-10014

L1-10203B-FSGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.25E-01	5.39E-02
		351.93	*	35.60	2.53E-01	3.93E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.88E-01	8.59E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.23E-01	5.33E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 21-Nov-19-10014

L1-10203B-FSGS-004SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.913	6.09E+00	4.89E-01	
	Cs-137	0.990	6.30E-02	1.64E-02	
	Tl-208	0.986	5.54E-02	1.36E-02	
X	Bi-211	0.884			
	Pb-212	0.999	1.59E-01	2.92E-02	
	Bi-214	0.992	1.98E-01	3.60E-02	
	Pb-214	1.000	2.44E-01	3.17E-02	
	Ac-228	0.995	1.97E-01	4.53E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10014

L1-10203B-FSGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 10:01:34AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
5	558.41	2.29514E-02	32.99		

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	8.08E-02	6.05E-02	6.05E-02
	BE-7	477.60		10.44	9.07E-02	4.54E-01	4.54E-01
+	K-40	1460.82	*	10.66	6.09E+00	6.55E-01	6.55E-01
	Mn-54	834.85		99.98	2.66E-03	4.97E-02	4.97E-02
	Co-60	1173.23		99.85	-9.48E-03	3.90E-02	6.66E-02
		1332.49		99.98	-1.76E-03		3.90E-02
	Nb-94	702.65		99.81	-2.45E-03	4.23E-02	4.42E-02
		871.09		99.89	3.70E-03		4.23E-02
	Ag-108m	79.13		6.60	6.82E-01	4.39E-02	1.28E+00
		433.94		90.50	1.04E-02		4.39E-02
		614.28		89.80	-6.48E-02		5.97E-02
		722.94		90.80	3.95E-02		5.66E-02
	Sb-125	176.31		6.84	1.06E-01	1.26E-01	4.86E-01
		380.45		1.52	9.22E-01		2.43E+00
		427.87		29.60	3.94E-02		1.26E-01
		463.36		10.49	1.25E-01		4.21E-01
		600.60		17.65	1.31E-01		2.37E-01
		606.71		4.98	1.70E+00		1.47E+00

Analysis Report for 21-Nov-19-10014

L1-10203B-FSGS-004SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	635.95		11.22	-3.51E-02	1.26E-01	3.62E-01
		671.44		1.79	1.50E-01		2.32E+00
	Ba-133	79.61		2.65	9.08E-01	7.08E-02	3.05E+00
		81.00		32.90	-1.48E-01		2.11E-01
		276.40		7.16	1.76E-01		5.13E-01
		302.85		18.34	2.57E-02		1.98E-01
		356.01		62.05	-1.31E-02		7.08E-02
		383.85		8.94	-3.57E-01		3.97E-01
	Cs-134	475.36		1.48	2.95E+00	5.03E-02	3.31E+00
		563.25		8.34	-5.70E-01		4.92E-01
		569.33		15.37	7.87E-02		2.34E-01
		604.72		97.62	-4.39E-03		6.71E-02
		795.86		85.46	2.71E-02		5.03E-02
		801.95		8.69	1.76E-01		5.39E-01
		1038.61		0.99	-4.13E-01		4.16E+00
		1167.97		1.79	-4.30E-01		3.27E+00
		1365.19		3.02	-2.10E-01		1.38E+00
+	Cs-137	661.66	*	85.10	6.30E-02	4.65E-02	4.65E-02
	Eu-152	121.78		28.67	1.78E-02	1.19E-01	1.24E-01
		244.70		7.61	3.20E-01		5.20E-01
		295.94		0.45	1.16E+00		9.57E+00
		344.28		26.60	5.10E-02		1.19E-01
		367.79		0.86	7.41E-01		4.10E+00
		411.12		2.24	1.35E-01		1.57E+00
		443.96		2.83	8.68E-01		1.32E+00
		488.68		0.42	-7.10E-01		8.51E+00
		563.99		0.49	-1.30E+01		6.92E+00
		586.26		0.46	-8.60E+00		1.18E+01
		678.62		0.47	3.59E-01		8.17E+00
		688.67		0.86	1.92E+00		4.77E+00
		719.35		0.28	-6.08E+00		1.56E+01
		778.90		12.96	-3.43E-01		3.15E-01
		810.45		0.32	-9.07E+00		1.30E+01
		867.37		4.26	-3.40E-01		1.03E+00
		919.33		0.43	5.26E+00		1.09E+01
		964.08		14.65	1.74E-01		4.78E-01
		1085.87		10.24	4.64E-02		5.17E-01
		1089.74		1.73	1.05E+00		3.23E+00
		1112.07		13.69	6.06E-02		4.51E-01
		1212.95		1.43	3.83E+00		4.83E+00
		1249.94		0.19	-2.98E+01		2.96E+01
		1299.14		1.63	-1.81E+00		3.17E+00
		1408.01		21.07	7.55E-02		2.33E-01
		1457.64		0.50	1.33E+02		4.06E+01
		1528.10		0.28	1.36E+00		1.61E+01
	Eu-154	123.07		40.40	3.26E-02	8.72E-02	8.72E-02
		247.93		6.89	1.17E-01		5.04E-01
		591.76		4.95	7.92E-02		7.21E-01
		692.42		1.78	-1.88E+00		2.20E+00
		723.30		20.06	1.23E-01		2.56E-01
		756.80		4.52	-5.94E-02		8.85E-01

Analysis Report for 21-Nov-19-10014

L1-10203B-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	7.04E-03	8.72E-02	3.64E-01
	996.29	10.48	-1.88E-01		4.86E-01
	1004.76	18.01	1.47E-01		3.03E-01
	1274.43	34.80	-5.29E-02		1.75E-01
	1596.48	1.80	9.48E-01		2.82E+00
Eu-155	45.30	1.31	2.68E+00	1.91E-01	1.15E+01
	60.01	1.22	8.71E+00		1.28E+01
	86.55	30.70	6.13E-02		1.92E-01
	105.31	21.10	5.63E-02		1.91E-01
Ra-226	186.21	3.64	7.01E-01	9.97E-01	9.97E-01
Pa-231	27.36	10.30	1.01E+00	1.40E+00	1.45E+00
	283.69	1.70	-1.70E+00		1.78E+00
	300.07	2.47	4.92E-01		1.40E+00
	302.65	2.20	7.58E-01		1.65E+00
	330.06	1.40	-6.33E-01		2.56E+00
U-235	143.76	10.96	-1.73E-01	6.33E-02	3.02E-01
	163.33	5.08	-1.25E-01		6.26E-01
	185.71	57.20	4.41E-02		6.33E-02
	202.11	1.08	-1.03E+00		3.01E+00
	205.31	5.01	-8.91E-01		6.10E-01
Am-241	59.54	35.90	6.63E-02	4.41E-01	4.41E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10015

L1-10203B-FSGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10015
Sample Description	: L1-10203B-FSGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.317E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:08:00AM
Acquisition Started	: 11/21/2019 9:46:40AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81488
Fill Height	: 1316.58 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 10:02:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10015

L1-10203B-FSGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.61	946 -	960	954.89	1.31E+02	18.12	6.86E+01	1.22
2	295.23	1174 -	1185	1181.15	4.40E+01	12.22	4.20E+01	0.63
3	338.42	1349 -	1359	1353.74	2.87E+01	8.12	1.53E+01	0.72
4	351.96	1401 -	1414	1407.84	8.64E+01	13.48	3.46E+01	1.12
5	583.07	2326 -	2337	2331.58	4.83E+01	7.90	5.72E+00	0.85
6	609.19	2429 -	2443	2436.03	6.34E+01	11.19	2.16E+01	1.04
7	661.61	2637 -	2653	2645.62	8.98E+01	12.25	1.92E+01	1.02
8	911.13	3637 -	3649	3643.55	3.62E+01	7.89	9.80E+00	0.50
9	969.17	3869 -	3882	3875.76	2.91E+01	7.03	6.89E+00	0.36
10	1460.69	5830 -	5854	5843.13	2.90E+02	17.76	6.25E+00	1.71

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.36E+00	4.77E-01
Cs-137	1.00	661.66	*	85.10	1.45E-01	2.16E-02
Tl-208	0.99	583.19	*	85.00	7.18E-02	1.25E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.12E-01	3.39E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.81E-01	3.38E-02

Analysis Report for 21-Nov-19-10015

L1-10203B-FSGS-005SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.89E-01	5.47E-02
		351.93	*	35.60	2.18E-01	3.82E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.22E-01	6.54E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.39E-01	5.31E-02
		964.77		4.99		
		968.97	*	15.80	3.27E-01	8.02E-02
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 21-Nov-19-10015

L1-10203B-FSGS-005SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	6.36E+00	4.77E-01	
	Cs-137	1.000	1.45E-01	2.16E-02	
	Tl-208	0.998	7.18E-02	1.25E-02	
X	Bi-211	0.881			
	Pb-212	1.000	2.12E-01	3.39E-02	
	Bi-214	0.999	1.81E-01	3.38E-02	
	Pb-214	1.000	2.08E-01	3.13E-02	
	Ac-228	0.998	2.52E-01	3.67E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10015

L1-10203B-FSGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 10:02:00AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	9.19E-02	6.07E-02	6.07E-02
	BE-7	477.60		10.44	1.14E-01	4.71E-01	4.71E-01
+	K-40	1460.82	*	10.66	6.36E+00	4.41E-01	4.41E-01
	Mn-54	834.85		99.98	-1.43E-02	4.82E-02	4.82E-02
	Co-60	1173.23		99.85	6.13E-02	5.97E-02	7.92E-02
		1332.49		99.98	2.48E-02		5.97E-02
	Nb-94	702.65		99.81	-1.36E-02	4.59E-02	4.59E-02
		871.09		99.89	-3.30E-02		4.74E-02
	Ag-108m	79.13		6.60	7.52E-01	4.17E-02	1.63E+00
		433.94		90.50	-1.66E-02		4.17E-02
		614.28		89.80	-1.57E-02		7.41E-02
		722.94		90.80	2.12E-03		5.57E-02
	Sb-125	176.31		6.84	-1.86E-01	1.37E-01	4.96E-01
		380.45		1.52	1.76E-01		2.40E+00
		427.87		29.60	2.82E-02		1.37E-01
		463.36		10.49	-1.62E-01		3.94E-01
		600.60		17.65	-7.31E-03		2.43E-01
		606.71		4.98	2.41E+00		1.39E+00
		635.95		11.22	-1.41E-01		3.92E-01

Analysis Report for 21-Nov-19-10015

L1-10203B-FSGS-005SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	2.52E-01	1.37E-01	2.49E+00
	Ba-133	79.61		2.65	-1.21E+00	8.39E-02	3.80E+00
		81.00		32.90	-4.63E-01		2.58E-01
		276.40		7.16	3.27E-01		5.32E-01
		302.85		18.34	2.16E-02		2.12E-01
		356.01		62.05	4.52E-03		8.39E-02
		383.85		8.94	-1.75E-01		4.07E-01
	Cs-134	475.36		1.48	4.29E-01	6.04E-02	3.21E+00
		563.25		8.34	-2.14E-01		4.87E-01
		569.33		15.37	-9.50E-02		2.72E-01
		604.72		97.62	-4.31E-02		6.78E-02
		795.86		85.46	3.24E-02		6.04E-02
		801.95		8.69	-2.25E-02		5.55E-01
		1038.61		0.99	1.22E+00		5.63E+00
		1167.97		1.79	2.27E+00		4.19E+00
		1365.19		3.02	8.11E-01		1.39E+00
+	Cs-137	661.66	*	85.10	1.45E-01	4.72E-02	4.72E-02
	Eu-152	121.78		28.67	7.23E-03	1.38E-01	1.48E-01
		244.70		7.61	2.46E-01		5.84E-01
		295.94		0.45	1.28E+01		1.09E+01
		344.28		26.60	2.61E-02		1.38E-01
		367.79		0.86	-1.18E+00		4.39E+00
		411.12		2.24	2.90E-01		1.86E+00
		443.96		2.83	-6.13E-01		1.26E+00
		488.68		0.42	-3.08E+00		9.92E+00
		563.99		0.49	-1.30E-01		8.46E+00
		586.26		0.46	1.25E+01		1.23E+01
		678.62		0.47	2.89E+00		8.37E+00
		688.67		0.86	-5.75E-02		4.79E+00
		719.35		0.28	-9.57E+00		1.56E+01
		778.90		12.96	-5.77E-01		2.94E-01
		810.45		0.32	3.95E+00		1.45E+01
		867.37		4.26	-1.35E+00		1.24E+00
		919.33		0.43	-5.86E+00		1.04E+01
		964.08		14.65	2.77E-01		5.05E-01
		1085.87		10.24	1.53E-01		5.27E-01
		1089.74		1.73	-1.97E+00		3.27E+00
		1112.07		13.69	-2.39E-01		4.48E-01
		1212.95		1.43	6.27E-01		4.67E+00
		1249.94		0.19	-2.03E+01		2.75E+01
		1299.14		1.63	-1.52E+00		2.99E+00
		1408.01		21.07	8.64E-02		1.78E-01
		1457.64		0.50	1.37E+02		4.01E+01
		1528.10		0.28	-1.16E+00		1.34E+01
	Eu-154	123.07		40.40	2.39E-02	1.04E-01	1.04E-01
		247.93		6.89	-4.92E-01		5.08E-01
		591.76		4.95	-2.74E-01		8.57E-01
		692.42		1.78	7.58E-01		2.59E+00
		723.30		20.06	3.17E-02		2.60E-01
		756.80		4.52	7.65E-03		8.93E-01
		873.18		12.08	7.39E-02		3.92E-01

Analysis Report for 21-Nov-19-10015

L1-10203B-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.43E-01	1.04E-01	4.87E-01
	1004.76	18.01	3.81E-02		2.61E-01
	1274.43	34.80	5.63E-02		1.58E-01
	1596.48	1.80	1.32E+00		2.99E+00
Eu-155	45.30	1.31	2.01E+00	2.16E-01	1.96E+01
	60.01	1.22	2.14E+00		2.34E+01
	86.55	30.70	1.05E-01		2.41E-01
	105.31	21.10	4.24E-02		2.16E-01
Ra-226	186.21	3.64	9.29E-01	1.10E+00	1.10E+00
Pa-231	27.36	10.30	1.51E+00	1.73E+00	2.42E+00
	283.69	1.70	-3.48E-01		2.21E+00
	300.07	2.47	-2.68E+00		1.73E+00
	302.65	2.20	-4.20E-01		1.76E+00
	330.06	1.40	-5.95E-01		2.67E+00
U-235	143.76	10.96	-2.71E-01	7.08E-02	3.51E-01
	163.33	5.08	8.16E-02		7.19E-01
	185.71	57.20	6.20E-02		7.08E-02
	202.11	1.08	4.53E-01		3.30E+00
	205.31	5.01	-4.65E-01		6.92E-01
Am-241	59.54	35.90	-3.04E-01	8.12E-01	8.12E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10016

L1-10203B-FQGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10016
Sample Description	: L1-10203B-FQGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.393E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:08:00AM
Acquisition Started	: 11/21/2019 10:06:46AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81489
Fill Height	: 1393.02 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 10:21:49AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10016

L1-10203B-FQGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.68	948 -	960	955.17	1.22E+02	15.92	4.99E+01	0.80
2	295.09	1175 -	1187	1180.56	4.38E+01	10.74	2.72E+01	0.48
3	351.85	1397 -	1413	1407.40	8.38E+01	12.50	2.32E+01	1.09
4	510.36	2036 -	2045	2040.93	1.51E+01	9.73	3.39E+01	0.36
5	583.21	2325 -	2338	2332.15	4.63E+01	8.75	1.07E+01	1.11
6	609.21	2427 -	2444	2436.10	8.45E+01	9.97	4.52E+00	1.22
7	661.53	2639 -	2651	2645.30	4.20E+01	8.73	1.30E+01	0.88
8	911.01	3636 -	3649	3643.07	3.40E+01	7.30	7.00E+00	0.70
9	1460.70	5830 -	5854	5843.18	2.88E+02	18.46	1.26E+01	1.22

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.93	511.00	*	100.00	1.75E-02	1.13E-02
K-40	0.99	1460.82	*	10.66	6.21E+00	4.80E-01
Cs-137	0.99	661.66	*	85.10	6.68E-02	1.44E-02
Tl-208	1.00	583.19	*	85.00	6.77E-02	1.34E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.95E-01	2.99E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.38E-01	3.15E-02

Analysis Report for 21-Nov-19-10016

L1-10203B-FQGS-005SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.86E-01	4.79E-02
		351.93	*	35.60	2.08E-01	3.52E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.20E-01	4.82E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 21-Nov-19-10016

L1-10203B-FQGS-005SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.937	1.75E-02	1.13E-02	
	K-40	0.998	6.21E+00	4.80E-01	
	Cs-137	0.997	6.68E-02	1.44E-02	
	Tl-208	1.000	6.77E-02	1.34E-02	
X	Bi-211	0.907			
	Pb-212	1.000	1.95E-01	2.99E-02	
	Bi-214	0.999	2.38E-01	3.15E-02	
	Pb-214	0.999	2.00E-01	2.84E-02	
	Ac-228	0.998	2.20E-01	4.82E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10016

L1-10203B-FQGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 10:21:49AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	1.75E-02	3.83E-02	3.83E-02
	BE-7	477.60		10.44	8.50E-02	4.17E-01	4.17E-01
+	K-40	1460.82	*	10.66	6.21E+00	5.89E-01	5.89E-01
	Mn-54	834.85		99.98	4.62E-02	5.31E-02	5.31E-02
	Co-60	1173.23		99.85	2.87E-02	5.44E-02	6.17E-02
		1332.49		99.98	3.21E-02		5.44E-02
	Nb-94	702.65		99.81	2.29E-02	4.73E-02	5.19E-02
		871.09		99.89	1.71E-02		4.73E-02
	Ag-108m	79.13		6.60	-2.77E-01	4.00E-02	1.49E+00
		433.94		90.50	-4.71E-02		4.00E-02
		614.28		89.80	-1.12E-02		7.22E-02
		722.94		90.80	2.68E-02		5.76E-02
	Sb-125	176.31		6.84	2.10E-02	1.32E-01	4.82E-01
		380.45		1.52	1.09E-01		2.11E+00
		427.87		29.60	3.33E-02		1.32E-01
		463.36		10.49	-2.18E-01		3.57E-01
		600.60		17.65	2.24E-01		2.62E-01
		606.71		4.98	1.93E+00		1.36E+00
		635.95		11.22	-1.97E-01		3.62E-01

Analysis Report for 21-Nov-19-10016

L1-10203B-FQGS-005SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	1.97E+00	1.32E-01	2.45E+00
	Ba-133	79.61		2.65	4.45E-01	6.77E-02	3.58E+00
		81.00		32.90	-3.53E-01		2.41E-01
		276.40		7.16	-7.01E-02		5.30E-01
		302.85		18.34	1.24E-02		1.85E-01
		356.01		62.05	-3.12E-02		6.77E-02
		383.85		8.94	-1.76E-01		3.80E-01
	Cs-134	475.36		1.48	2.34E+00	4.80E-02	3.08E+00
		563.25		8.34	1.95E-02		4.32E-01
		569.33		15.37	-6.38E-02		2.43E-01
		604.72		97.62	-1.83E-02		6.55E-02
		795.86		85.46	-3.08E-02		4.80E-02
		801.95		8.69	-4.43E-01		4.40E-01
		1038.61		0.99	1.07E+00		4.95E+00
		1167.97		1.79	1.94E-01		3.48E+00
		1365.19		3.02	2.71E-01		1.68E+00
+	Cs-137	661.66	*	85.10	6.68E-02	3.61E-02	3.61E-02
	Eu-152	121.78		28.67	-7.79E-02	1.26E-01	1.26E-01
		244.70		7.61	-2.56E-02		5.15E-01
		295.94		0.45	5.10E+00		9.45E+00
		344.28		26.60	-2.87E-02		1.42E-01
		367.79		0.86	-1.84E-01		3.67E+00
		411.12		2.24	2.94E-01		1.76E+00
		443.96		2.83	-6.60E-01		1.32E+00
		488.68		0.42	3.49E+00		9.15E+00
		563.99		0.49	2.85E+00		7.44E+00
		586.26		0.46	1.44E+01		1.27E+01
		678.62		0.47	-2.21E-03		8.87E+00
		688.67		0.86	-1.84E+00		4.57E+00
		719.35		0.28	7.94E+00		1.66E+01
		778.90		12.96	-1.50E-01		3.23E-01
		810.45		0.32	1.25E+01		1.32E+01
		867.37		4.26	-2.18E-01		1.12E+00
		919.33		0.43	-6.73E+00		1.02E+01
		964.08		14.65	4.32E-01		4.67E-01
		1085.87		10.24	2.95E-02		5.57E-01
		1089.74		1.73	9.78E-01		3.35E+00
		1112.07		13.69	-2.92E-01		4.05E-01
		1212.95		1.43	-3.76E+00		4.47E+00
		1249.94		0.19	8.20E+00		3.07E+01
		1299.14		1.63	2.02E+00		3.67E+00
		1408.01		21.07	1.32E-03		1.74E-01
		1457.64		0.50	1.38E+02		3.99E+01
		1528.10		0.28	-3.21E+00		1.05E+01
	Eu-154	123.07		40.40	-2.62E-03	9.09E-02	9.09E-02
		247.93		6.89	2.50E-05		5.31E-01
		591.76		4.95	-3.12E-01		8.81E-01
		692.42		1.78	-4.01E-01		2.42E+00
		723.30		20.06	-3.37E-02		2.56E-01
		756.80		4.52	-1.96E-02		9.24E-01
		873.18		12.08	8.73E-02		3.97E-01

Analysis Report for 21-Nov-19-10016

L1-10203B-FQGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.81E-02	9.09E-02	5.29E-01
	1004.76	18.01	1.24E-01		3.21E-01
	1274.43	34.80	-1.06E-01		1.58E-01
	1596.48	1.80	1.09E+00		2.25E+00
Eu-155	45.30	1.31	-7.17E+00	2.19E-01	1.97E+01
	60.01	1.22	-1.42E+01		2.17E+01
	86.55	30.70	-6.60E-02		2.28E-01
	105.31	21.10	8.56E-02		2.19E-01
Ra-226	186.21	3.64	1.56E+00	1.15E+00	1.15E+00
Pa-231	27.36	10.30	2.47E+00	1.42E+00	2.52E+00
	283.69	1.70	-4.56E-01		2.01E+00
	300.07	2.47	2.79E-01		1.42E+00
	302.65	2.20	-1.05E-01		1.53E+00
	330.06	1.40	3.47E-01		2.54E+00
U-235	143.76	10.96	-1.54E-01	7.32E-02	3.43E-01
	163.33	5.08	-3.09E-01		6.63E-01
	185.71	57.20	1.12E-01		7.32E-02
	202.11	1.08	8.80E-01		3.24E+00
	205.31	5.01	-1.33E-01		7.35E-01
Am-241	59.54	35.90	-1.18E-01	7.59E-01	7.59E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10017

L1-10203B-FSGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10017
Sample Description	: L1-10203B-FSGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.405E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:10:00AM
Acquisition Started	: 11/21/2019 10:06:52AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81490
Fill Height	: 1404.57 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 10:21:54AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10017

L1-10203B-FSGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.16	151 -	158	154.91	5.99E+01	17.60	1.24E+02	0.76
2	238.57	474 -	481	477.31	1.15E+02	19.02	1.14E+02	1.17
3	295.20	585 -	594	590.45	6.02E+01	13.67	5.58E+01	1.44
4	351.78	699 -	708	703.50	1.02E+02	15.03	5.44E+01	1.53
5	583.18	1160 -	1171	1165.96	7.94E+01	11.34	1.96E+01	0.94
6	609.14	1212 -	1223	1217.86	7.98E+01	11.32	1.92E+01	1.67
7	661.54	1317 -	1326	1322.61	3.33E+01	9.34	2.37E+01	0.99
8	910.89	1815 -	1826	1821.23	3.46E+01	9.91	2.54E+01	1.06
9	1460.54	2913 -	2928	2921.14	3.56E+02	19.18	4.00E+00	2.00

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	6.86E+00	4.75E-01
Cs-137	0.99	661.66	*	85.10	4.77E-02	1.37E-02
Tl-208	1.00	583.19	*	85.00	1.05E-01	1.62E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.63E-01	3.02E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	3.95E-01	1.23E-01

Analysis Report for 21-Nov-19-10017

L1-10203B-FSGS-006SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	1.00	87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.02E-01	3.11E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.30E-01	5.52E-02
		351.93	*	35.60	2.27E-01	3.81E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	6.96E-01	2.19E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.01E-01	5.84E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10017

L1-10203B-FSGS-006SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.987	6.86E+00	4.75E-01	
	Cs-137	0.998	4.77E-02	1.37E-02	
	Tl-208	1.000	1.05E-01	1.62E-02	
X	Bi-211	0.923			
	Pb-212	0.999	1.63E-01	3.02E-02	
?	Pb212-XR	1.000	3.95E-01	1.23E-01	
	Bi-214	0.998	2.02E-01	3.11E-02	
	Pb-214	0.998	2.28E-01	3.14E-02	
?	Pb214-XR	1.000	6.96E-01	2.19E-01	
	Ac-228	0.995	2.01E-01	5.84E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10017

L1-10203B-FSGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 10:21:54AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.49E-02	5.40E-02	5.40E-02
	BE-7	477.60		10.44	1.59E-01	3.26E-01	3.26E-01
+	K-40	1460.82	*	10.66	6.86E+00	2.82E-01	2.82E-01
	Mn-54	834.85		99.98	6.01E-03	3.81E-02	3.81E-02
	Co-60	1173.23		99.85	3.74E-02	5.34E-02	6.33E-02
		1332.49		99.98	3.41E-02		5.34E-02
	Nb-94	702.65		99.81	9.79E-03	3.77E-02	4.21E-02
		871.09		99.89	1.63E-02		3.77E-02
	Ag-108m	79.13		6.60	-1.76E-01	3.77E-02	1.12E+00
		433.94		90.50	1.75E-02		3.77E-02
		614.28		89.80	-1.74E-02		5.12E-02
		722.94		90.80	9.08E-03		4.98E-02
	Sb-125	176.31		6.84	-2.78E-01	1.10E-01	4.77E-01
		380.45		1.52	-4.66E-01		2.09E+00
		427.87		29.60	-1.53E-02		1.10E-01
		463.36		10.49	1.88E-01		3.61E-01
		600.60		17.65	5.06E-02		2.40E-01
		606.71		4.98	1.26E-01		1.27E+00
		635.95		11.22	2.75E-02		3.03E-01

Analysis Report for 21-Nov-19-10017

L1-10203B-FSGS-006SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-2.14E+00	1.10E-01	2.23E+00
	Ba-133	79.61		2.65	-5.96E-01	7.52E-02	2.61E+00
		81.00		32.90	-1.87E-01		1.74E-01
		276.40		7.16	1.94E-01		4.73E-01
		302.85		18.34	3.79E-02		1.95E-01
		356.01		62.05	-1.54E-02		7.52E-02
		383.85		8.94	-1.11E-01		3.60E-01
	Cs-134	475.36		1.48	-1.09E+00	4.54E-02	2.09E+00
		563.25		8.34	2.30E-01		4.87E-01
		569.33		15.37	-1.45E-01		2.35E-01
		604.72		97.62	2.79E-03		5.98E-02
		795.86		85.46	8.73E-03		4.54E-02
		801.95		8.69	1.43E-01		4.49E-01
		1038.61		0.99	1.33E+00		4.67E+00
		1167.97		1.79	-5.57E-02		3.20E+00
		1365.19		3.02	-3.24E-02		1.35E+00
+	Cs-137	661.66	*	85.10	4.77E-02	3.97E-02	3.97E-02
	Eu-152	121.78		28.67	-2.80E-02	1.14E-01	1.14E-01
		244.70		7.61	-2.40E-01		4.66E-01
		295.94		0.45	-2.23E+00		9.20E+00
		344.28		26.60	-6.16E-02		1.22E-01
		367.79		0.86	-7.13E-01		3.69E+00
		411.12		2.24	6.68E-01		1.58E+00
		443.96		2.83	2.39E-01		1.17E+00
		488.68		0.42	3.13E+00		8.79E+00
		563.99		0.49	3.52E+00		8.13E+00
		586.26		0.46	-2.69E+00		1.30E+01
		678.62		0.47	4.76E+00		8.81E+00
		688.67		0.86	-7.36E-01		4.24E+00
		719.35		0.28	-1.54E+00		1.34E+01
		778.90		12.96	7.86E-02		2.81E-01
		810.45		0.32	-2.28E+00		1.28E+01
		867.37		4.26	-3.34E-01		8.82E-01
		919.33		0.43	-7.34E+00		1.03E+01
		964.08		14.65	1.62E-01		3.81E-01
		1085.87		10.24	-1.43E-01		4.72E-01
		1089.74		1.73	-8.98E-01		2.75E+00
		1112.07		13.69	-1.12E-01		4.10E-01
		1212.95		1.43	-6.16E-01		3.75E+00
		1249.94		0.19	6.22E-01		2.71E+01
		1299.14		1.63	6.54E-01		3.07E+00
		1408.01		21.07	-3.56E-02		1.98E-01
		1457.64		0.50	-1.63E+00		3.85E+01
		1528.10		0.28	7.35E-01		1.36E+01
	Eu-154	123.07		40.40	2.81E-03	8.10E-02	8.10E-02
		247.93		6.89	5.39E-02		4.71E-01
		591.76		4.95	-1.36E-01		6.66E-01
		692.42		1.78	3.42E-01		2.37E+00
		723.30		20.06	8.23E-02		2.30E-01
		756.80		4.52	-3.23E-01		7.31E-01
		873.18		12.08	-1.24E-02		2.94E-01

Analysis Report for 21-Nov-19-10017

L1-10203B-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.18E-02	8.10E-02	4.08E-01
	1004.76	18.01	5.56E-02		2.26E-01
	1274.43	34.80	6.18E-02		1.49E-01
	1596.48	1.80	9.27E-01		2.47E+00
Eu-155	45.30	1.31	-5.33E-01	1.78E-01	1.15E+01
	60.01	1.22	-2.02E+00		1.28E+01
	86.55	30.70	2.76E-02		1.78E-01
	105.31	21.10	-3.21E-03		1.79E-01
Ra-226	186.21	3.64	4.91E-01	9.98E-01	9.98E-01
Pa-231	27.36	10.30	6.30E-01	1.18E+00	1.18E+00
	283.69	1.70	-5.54E-01		1.70E+00
	300.07	2.47	-9.10E-01		1.41E+00
	302.65	2.20	3.15E-01		1.63E+00
	330.06	1.40	2.38E-01		2.50E+00
U-235	143.76	10.96	1.16E-01	6.47E-02	2.90E-01
	163.33	5.08	-1.35E-01		6.75E-01
	185.71	57.20	4.53E-02		6.47E-02
	202.11	1.08	-6.21E-01		3.15E+00
	205.31	5.01	-1.53E-01		6.90E-01
Am-241	59.54	35.90	-1.06E-01	4.46E-01	4.46E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
\> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10018

L1-10203B-FSGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10018
Sample Description	: L1-10203B-FSGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.467E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:12:00AM
Acquisition Started	: 11/21/2019 10:06:58AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81491
Fill Height	: 1467.02 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 10:22:23AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10018

L1-10203B-FSGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.60	949 -	960	954.50	1.30E+02	17.75	7.17E+01	0.95
2	295.22	1175 -	1187	1180.77	4.55E+01	12.34	4.05E+01	1.24
3	351.94	1401 -	1416	1407.51	9.80E+01	12.11	1.60E+01	1.12
4	609.35	2429 -	2445	2436.59	6.99E+01	10.58	1.31E+01	1.31
5	1460.87	5831 -	5854	5843.33	3.50E+02	19.03	3.02E+00	1.45

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	8.84E+00	6.15E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.35E-01	3.72E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.27E-01	3.70E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		

Analysis Report for 21-Nov-19-10018

L1-10203B-FSGS-007SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.19E-01	6.19E-02
		351.93	*	35.60	2.77E-01	4.08E-02
		785.96		1.06		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	8.84E+00	6.15E-01	
X	Bi-211	0.885			
	Pb-212	1.000	2.35E-01	3.72E-02	
	Bi-214	1.000	2.27E-01	3.70E-02	
	Pb-214	1.000	2.59E-01	3.40E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10018

L1-10203B-FSGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 10:22:23AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.62E-02	6.25E-02	6.25E-02
	BE-7	477.60		10.44	3.81E-01	4.25E-01	4.25E-01
+	K-40	1460.82	*	10.66	8.84E+00	3.71E-01	3.71E-01
	Mn-54	834.85		99.98	-2.47E-03	5.27E-02	5.27E-02
	Co-60	1173.23		99.85	-3.29E-02	5.83E-02	5.86E-02
		1332.49		99.98	1.32E-02		5.83E-02
	Nb-94	702.65		99.81	-5.36E-03	4.97E-02	4.97E-02
		871.09		99.89	2.07E-02		5.41E-02
	Ag-108m	79.13		6.60	6.82E-01	4.24E-02	2.03E+00
		433.94		90.50	-1.27E-02		4.24E-02
		614.28		89.80	-1.16E-02		7.40E-02
		722.94		90.80	1.87E-02		6.54E-02
	Sb-125	176.31		6.84	3.37E-01	1.46E-01	6.03E-01
		380.45		1.52	-7.31E-01		2.54E+00
		427.87		29.60	6.46E-02		1.46E-01
		463.36		10.49	2.50E-01		4.37E-01
		600.60		17.65	-5.59E-02		2.45E-01
		606.71		4.98	-5.55E-02		1.55E+00
		635.95		11.22	-3.41E-02		4.61E-01

Analysis Report for 21-Nov-19-10018

L1-10203B-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.10E+00	1.46E-01	2.61E+00
Ba-133	79.61	2.65	-3.09E+00	8.04E-02	4.63E+00
	81.00	32.90	-2.60E-01		3.25E-01
	276.40	7.16	5.54E-01		5.77E-01
	302.85	18.34	-1.42E-02		2.30E-01
	356.01	62.05	-2.29E-02		8.04E-02
	383.85	8.94	-1.40E-01		4.41E-01
Cs-134	475.36	1.48	1.71E+00	6.57E-02	2.89E+00
	563.25	8.34	3.20E-02		5.18E-01
	569.33	15.37	1.80E-02		2.64E-01
	604.72	97.62	3.44E-03		6.82E-02
	795.86	85.46	3.21E-02		6.57E-02
	801.95	8.69	-2.43E-01		4.88E-01
	1038.61	0.99	2.28E+00		4.87E+00
	1167.97	1.79	-6.42E-02		3.39E+00
	1365.19	3.02	2.76E-01		1.87E+00
Cs-137	661.66	85.10	-1.62E-04	5.67E-02	5.67E-02
Eu-152	121.78	28.67	-5.97E-02	1.50E-01	1.69E-01
	244.70	7.61	5.30E-02		5.96E-01
	295.94	0.45	3.57E+00		1.12E+01
	344.28	26.60	-7.59E-02		1.50E-01
	367.79	0.86	1.72E+00		4.56E+00
	411.12	2.24	3.64E-01		2.09E+00
	443.96	2.83	5.75E-01		1.53E+00
	488.68	0.42	-3.02E-01		9.31E+00
	563.99	0.49	-2.89E+00		8.57E+00
	586.26	0.46	1.03E+01		1.32E+01
	678.62	0.47	-4.21E-01		9.53E+00
	688.67	0.86	-3.42E+00		5.85E+00
	719.35	0.28	3.98E+00		1.85E+01
	778.90	12.96	1.42E-01		3.93E-01
	810.45	0.32	1.54E+00		1.30E+01
	867.37	4.26	2.20E-02		1.14E+00
	919.33	0.43	-7.06E+00		1.14E+01
	964.08	14.65	-2.70E-01		4.84E-01
	1085.87	10.24	-6.31E-02		6.42E-01
	1089.74	1.73	2.81E+00		4.16E+00
	1112.07	13.69	4.21E-01		4.81E-01
	1212.95	1.43	3.57E+00		5.55E+00
	1249.94	0.19	1.14E+01		3.59E+01
	1299.14	1.63	1.25E+00		3.77E+00
	1408.01	21.07	-1.68E-01		2.04E-01
	1457.64	0.50	1.84E+02		5.00E+01
	1528.10	0.28	-4.29E+00		1.11E+01
Eu-154	123.07	40.40	6.31E-02	1.23E-01	1.23E-01
	247.93	6.89	3.50E-02		5.64E-01
	591.76	4.95	3.95E-01		8.91E-01
	692.42	1.78	1.68E+00		2.98E+00
	723.30	20.06	-4.51E-03		2.90E-01
	756.80	4.52	1.70E-01		1.10E+00
	873.18	12.08	-2.46E-01		4.34E-01

Analysis Report for 21-Nov-19-10018

L1-10203B-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.95E-01	1.23E-01	4.58E-01
	1004.76	18.01	1.09E-01		3.21E-01
	1274.43	34.80	3.01E-02		1.85E-01
	1596.48	1.80	8.80E-01		3.24E+00
Eu-155	45.30	1.31	1.29E+01	2.73E-01	3.38E+01
	60.01	1.22	-7.15E+00		3.47E+01
	86.55	30.70	3.38E-02		2.83E-01
	105.31	21.10	-1.82E-01		2.73E-01
Ra-226	186.21	3.64	6.20E-01	1.27E+00	1.27E+00
Pa-231	27.36	10.30	2.83E+00	1.63E+00	3.63E+00
	283.69	1.70	1.14E+00		2.39E+00
	300.07	2.47	4.22E-01		1.63E+00
	302.65	2.20	4.73E-01		1.91E+00
	330.06	1.40	1.98E+00		3.27E+00
U-235	143.76	10.96	-1.88E-01	8.32E-02	4.15E-01
	163.33	5.08	4.17E-01		8.59E-01
	185.71	57.20	7.78E-02		8.32E-02
	202.11	1.08	-2.89E+00		3.56E+00
	205.31	5.01	5.10E-01		8.46E-01
Am-241	59.54	35.90	-2.30E-01	1.22E+00	1.22E+00

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10019

L1-10203B-FSGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10019
Sample Description	: L1-10203B-FSGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.656E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:14:00AM
Acquisition Started	: 11/21/2019 10:07:06AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81492
Fill Height	: 1656.20 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 10:22:10AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10019

L1-10203B-FSGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.68	949 -	961	954.28	1.23E+02	17.16	6.42E+01	1.14
2	295.31	1174 -	1186	1180.54	5.98E+01	12.82	3.92E+01	1.46
3	338.36	1347 -	1357	1352.52	3.67E+01	9.10	1.93E+01	1.04
4	351.97	1399 -	1413	1406.90	8.51E+01	13.08	2.99E+01	1.24
5	582.95	2325 -	2336	2329.90	5.50E+01	8.81	9.00E+00	0.43
6	609.27	2426 -	2443	2435.12	7.00E+01	11.34	1.80E+01	1.28
7	910.54	3633 -	3647	3639.63	4.72E+01	8.40	7.80E+00	0.83
8	1460.05	5826 -	5849	5838.12	3.01E+02	17.69	2.98E+00	1.68

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.90	1460.82	*	10.66	6.61E+00	4.83E-01
Tl-208	0.99	583.19	*	85.00	8.13E-02	1.39E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.92E-01	3.10E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.99E-01	3.44E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 21-Nov-19-10019

L1-10203B-FSGS-008SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.52E-01	5.76E-02
		351.93	*	35.60	2.11E-01	3.66E-02
		785.96		1.06		
Ac-228	0.97	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.79E-01	7.29E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.11E-01	5.70E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 21-Nov-19-10019

L1-10203B-FSGS-008SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.908	6.61E+00	4.83E-01	
	Tl-208	0.991	8.13E-02	1.39E-02	
X	Bi-211	0.878			
	Pb-212	1.000	1.92E-01	3.10E-02	
	Bi-214	1.000	1.99E-01	3.44E-02	
	Pb-214	0.999	2.23E-01	3.09E-02	
	Ac-228	0.979	2.99E-01	4.49E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10019

L1-10203B-FSGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 10:22:10AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.44E-02	5.10E-02	5.10E-02
	BE-7	477.60		10.44	-1.90E-01	3.53E-01	3.53E-01
+	K-40	1460.82	*	10.66	6.61E+00	3.20E-01	3.20E-01
	Mn-54	834.85		99.98	-1.76E-02	4.68E-02	4.68E-02
	Co-60	1173.23		99.85	-5.89E-02	4.82E-02	6.04E-02
		1332.49		99.98	1.06E-02		4.82E-02
	Nb-94	702.65		99.81	-1.96E-02	3.84E-02	3.84E-02
		871.09		99.89	-2.08E-02		4.27E-02
	Ag-108m	79.13		6.60	2.00E-01	4.01E-02	1.22E+00
		433.94		90.50	1.24E-02		4.01E-02
		614.28		89.80	-5.20E-04		5.76E-02
		722.94		90.80	3.80E-02		4.94E-02
	Sb-125	176.31		6.84	2.08E-01	1.07E-01	4.59E-01
		380.45		1.52	-1.42E+00		2.20E+00
		427.87		29.60	-6.08E-02		1.07E-01
		463.36		10.49	2.27E-01		3.86E-01
		600.60		17.65	-8.26E-04		2.21E-01
		606.71		4.98	-5.12E-03		1.36E+00
		635.95		11.22	1.75E-02		3.99E-01

Analysis Report for 21-Nov-19-10019

L1-10203B-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.71E-01	1.07E-01	2.00E+00
Ba-133	79.61	2.65	6.09E-01	6.79E-02	2.94E+00
	81.00	32.90	-2.66E-01		1.97E-01
	276.40	7.16	1.63E-01		4.60E-01
	302.85	18.34	-8.59E-02		1.93E-01
	356.01	62.05	-2.66E-02		6.79E-02
	383.85	8.94	2.39E-01		3.76E-01
Cs-134	475.36	1.48	2.22E-01	5.37E-02	2.40E+00
	563.25	8.34	-4.79E-01		5.06E-01
	569.33	15.37	1.44E-01		2.24E-01
	604.72	97.62	-4.38E-03		6.01E-02
	795.86	85.46	1.91E-02		5.37E-02
	801.95	8.69	1.78E-01		4.65E-01
	1038.61	0.99	4.09E+00		5.71E+00
	1167.97	1.79	-1.76E+00		3.01E+00
	1365.19	3.02	3.81E-01		1.39E+00
Cs-137	661.66	85.10	3.41E-02	5.10E-02	5.10E-02
Eu-152	121.78	28.67	1.02E-01	1.22E-01	1.22E-01
	244.70	7.61	-6.63E-02		4.56E-01
	295.94	0.45	4.73E+00		1.05E+01
	344.28	26.60	3.34E-02		1.28E-01
	367.79	0.86	-8.36E-01		3.13E+00
	411.12	2.24	1.40E+00		1.72E+00
	443.96	2.83	-7.08E-01		1.25E+00
	488.68	0.42	-2.91E+00		6.98E+00
	563.99	0.49	-1.33E+01		7.40E+00
	586.26	0.46	-2.07E+00		1.32E+01
	678.62	0.47	4.22E+00		9.11E+00
	688.67	0.86	-1.82E+00		4.99E+00
	719.35	0.28	-9.30E-01		1.37E+01
	778.90	12.96	-1.65E-01		3.05E-01
	810.45	0.32	-3.95E+00		1.22E+01
	867.37	4.26	-8.28E-01		9.17E-01
	919.33	0.43	-5.10E+00		9.94E+00
	964.08	14.65	-1.36E-01		4.23E-01
	1085.87	10.24	-2.02E-01		4.73E-01
	1089.74	1.73	-4.59E-01		2.97E+00
	1112.07	13.69	-4.41E-02		3.94E-01
	1212.95	1.43	7.66E-01		5.15E+00
	1249.94	0.19	-2.11E+01		2.51E+01
	1299.14	1.63	-5.94E-01		3.28E+00
	1408.01	21.07	6.96E-02		2.57E-01
	1457.64	0.50	1.39E+02		4.04E+01
	1528.10	0.28	-6.02E+00		1.48E+01
Eu-154	123.07	40.40	1.51E-02	8.47E-02	8.47E-02
	247.93	6.89	-1.75E-01		4.56E-01
	591.76	4.95	-5.22E-01		6.89E-01
	692.42	1.78	0.00E+00		2.61E+00
	723.30	20.06	1.72E-01		2.24E-01
	756.80	4.52	2.16E-01		9.22E-01
	873.18	12.08	-9.22E-02		3.80E-01

Analysis Report for 21-Nov-19-10019

L1-10203B-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.61E-01	8.47E-02	4.00E-01
	1004.76	18.01	1.51E-01		2.40E-01
	1274.43	34.80	-1.08E-01		1.41E-01
	1596.48	1.80	1.26E+00		2.41E+00
Eu-155	45.30	1.31	-1.83E+00	1.85E-01	1.16E+01
	60.01	1.22	6.29E+00		1.20E+01
	86.55	30.70	5.22E-02		1.85E-01
	105.31	21.10	1.65E-02		1.86E-01
Ra-226	186.21	3.64	6.56E-01	8.84E-01	8.84E-01
Pa-231	27.36	10.30	8.80E-01	1.27E+00	1.27E+00
	283.69	1.70	-1.46E+00		1.70E+00
	300.07	2.47	-1.23E-01		1.56E+00
	302.65	2.20	-4.08E-02		1.63E+00
	330.06	1.40	-5.17E-01		2.37E+00
U-235	143.76	10.96	-1.41E-01	5.67E-02	3.06E-01
	163.33	5.08	-2.15E-02		6.06E-01
	185.71	57.20	3.29E-02		5.67E-02
	202.11	1.08	-1.57E+00		2.73E+00
	205.31	5.01	-8.71E-02		6.41E-01
Am-241	59.54	35.90	-2.98E-02	4.08E-01	4.08E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10020

L1-10203B-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10020
Sample Description	: L1-10203B-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.629E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:16:00AM
Acquisition Started	: 11/21/2019 10:37:26AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81493
Fill Height	: 1628.57 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 10:52:29AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10020

L1-10203B-FSGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.54	472 -	481	477.26	1.34E+02	21.16	1.38E+02	0.92
2	295.16	585 -	595	590.37	8.35E+01	15.92	7.05E+01	1.28
3	351.77	698 -	708	703.48	1.17E+02	14.22	3.56E+01	1.22
4	582.88	1159 -	1171	1165.37	7.63E+01	11.66	2.28E+01	1.41
5	609.31	1212 -	1223	1218.20	1.00E+02	11.59	1.35E+01	1.48
6	911.32	1818 -	1826	1822.09	4.00E+01	8.62	1.60E+01	1.40
7	968.73	1932 -	1942	1936.92	3.57E+01	9.17	2.03E+01	1.14
8	1120.51	2237 -	2245	2240.57	2.28E+01	7.54	1.52E+01	0.84
9	1460.66	2913 -	2928	2921.37	3.98E+02	20.54	8.00E+00	1.87

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.36E+00	4.96E-01
Tl-208	0.98	583.19	*	85.00	9.70E-02	1.59E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.86E-01	3.30E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.46E-01	3.20E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 21-Nov-19-10020

L1-10203B-FSGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29	*	14.92	2.52E-01	8.40E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	3.09E-01	6.39E-02
		351.93	*	35.60	2.54E-01	3.69E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.25E-01	4.93E-02
		964.77		4.99		
		968.97	*	15.80	3.40E-01	8.86E-02
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 21-Nov-19-10020

L1-10203B-FSGS-009SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.996	7.36E+00	4.96E-01	
	Tl-208	0.985	9.70E-02	1.59E-02	
X	Bi-211	0.925			
	Pb-212	0.999	1.86E-01	3.30E-02	
	Bi-214	0.999	2.46E-01	2.99E-02	
	Pb-214	0.997	2.68E-01	3.20E-02	
	Ac-228	0.998	2.52E-01	4.31E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10020

L1-10203B-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 10:52:29AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.34E-02	5.13E-02	5.13E-02
	BE-7	477.60		10.44	3.11E-02	3.57E-01	3.57E-01
+	K-40	1460.82	*	10.66	7.36E+00	3.60E-01	3.60E-01
	Mn-54	834.85		99.98	-5.95E-03	4.16E-02	4.16E-02
	Co-60	1173.23		99.85	2.38E-02	4.28E-02	5.24E-02
		1332.49		99.98	-2.14E-02		4.28E-02
	Nb-94	702.65		99.81	-8.03E-03	3.51E-02	3.51E-02
		871.09		99.89	7.93E-03		3.70E-02
	Ag-108m	79.13		6.60	5.21E-01	3.71E-02	1.24E+00
		433.94		90.50	-2.84E-02		3.71E-02
		614.28		89.80	-2.71E-02		5.32E-02
		722.94		90.80	1.62E-02		5.22E-02
	Sb-125	176.31		6.84	9.28E-02	1.12E-01	5.15E-01
		380.45		1.52	-6.02E-01		2.10E+00
		427.87		29.60	-1.83E-02		1.12E-01
		463.36		10.49	6.28E-02		3.43E-01
		600.60		17.65	2.64E-02		2.10E-01
		606.71		4.98	-1.10E-01		1.26E+00
		635.95		11.22	-2.01E-02		3.06E-01

Analysis Report for 21-Nov-19-10020

L1-10203B-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	4.84E-01	1.12E-01	2.20E+00
Ba-133	79.61	2.65	-4.90E-01	6.80E-02	2.84E+00
	81.00	32.90	-1.55E-01		1.98E-01
	276.40	7.16	1.07E-01		4.69E-01
	302.85	18.34	8.52E-02		1.77E-01
	356.01	62.05	-1.18E-02		6.80E-02
	383.85	8.94	-1.16E-01		3.40E-01
Cs-134	475.36	1.48	9.75E-01	5.15E-02	2.52E+00
	563.25	8.34	-1.94E-01		3.53E-01
	569.33	15.37	1.46E-01		2.25E-01
	604.72	97.62	-1.68E-02		5.32E-02
	795.86	85.46	9.83E-03		5.15E-02
	801.95	8.69	3.42E-02		4.33E-01
	1038.61	0.99	8.51E-01		4.91E+00
	1167.97	1.79	-4.26E-01		2.76E+00
	1365.19	3.02	1.73E-01		1.48E+00
Cs-137	661.66	85.10	1.69E-02	5.31E-02	5.31E-02
Eu-152	121.78	28.67	-2.45E-03	1.15E-01	1.15E-01
	244.70	7.61	-2.11E-01		4.78E-01
	295.94	0.45	-8.93E-01		9.92E+00
	344.28	26.60	-1.31E-01		1.15E-01
	367.79	0.86	-4.10E-01		3.63E+00
	411.12	2.24	-1.28E-01		1.34E+00
	443.96	2.83	-9.20E-01		1.09E+00
	488.68	0.42	5.42E+00		8.66E+00
	563.99	0.49	-2.91E+00		6.18E+00
	586.26	0.46	-1.78E+00		1.24E+01
	678.62	0.47	4.07E+00		7.91E+00
	688.67	0.86	8.79E-01		4.09E+00
	719.35	0.28	2.98E-01		1.49E+01
	778.90	12.96	-1.03E-01		2.66E-01
	810.45	0.32	1.67E+00		1.08E+01
	867.37	4.26	2.66E-01		9.43E-01
	919.33	0.43	-9.81E-01		9.30E+00
	964.08	14.65	-7.15E-02		4.00E-01
	1085.87	10.24	2.32E-01		4.94E-01
	1089.74	1.73	2.11E-01		2.77E+00
	1112.07	13.69	-2.55E-02		3.50E-01
	1212.95	1.43	1.71E+00		4.17E+00
	1249.94	0.19	-4.30E-01		2.77E+01
	1299.14	1.63	-7.26E-01		3.15E+00
	1408.01	21.07	-1.19E-01		1.57E-01
	1457.64	0.50	-3.91E+00		3.91E+01
	1528.10	0.28	-2.35E+00		9.83E+00
Eu-154	123.07	40.40	2.05E-02	8.30E-02	8.30E-02
	247.93	6.89	1.61E-01		5.07E-01
	591.76	4.95	-9.68E-02		7.24E-01
	692.42	1.78	7.33E-01		2.04E+00
	723.30	20.06	1.19E-01		2.38E-01
	756.80	4.52	2.83E-01		9.09E-01
	873.18	12.08	-2.48E-01		2.89E-01

Analysis Report for 21-Nov-19-10020

L1-10203B-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.68E-02	8.30E-02	4.45E-01
	1004.76	18.01	-1.31E-01		2.26E-01
	1274.43	34.80	9.20E-02		1.71E-01
	1596.48	1.80	-1.69E+00		1.71E+00
Eu-155	45.30	1.31	6.02E-01	1.81E-01	1.15E+01
	60.01	1.22	-6.21E+00		1.20E+01
	86.55	30.70	-4.40E-02		1.81E-01
	105.31	21.10	1.24E-01		2.02E-01
Ra-226	186.21	3.64	9.36E-01	1.09E+00	1.09E+00
Pa-231	27.36	10.30	5.07E-01	1.15E+00	1.15E+00
	283.69	1.70	-4.87E-01		1.80E+00
	300.07	2.47	-7.36E-02		1.39E+00
	302.65	2.20	7.10E-01		1.48E+00
	330.06	1.40	7.93E-01		2.31E+00
U-235	143.76	10.96	1.20E-01	6.94E-02	3.08E-01
	163.33	5.08	1.91E-02		6.86E-01
	185.71	57.20	6.78E-02		6.94E-02
	202.11	1.08	-6.26E-01		3.20E+00
	205.31	5.01	-2.34E-01		7.10E-01
Am-241	59.54	35.90	-9.28E-02	4.31E-01	4.31E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10021

L1-10203B-FSGS-010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10021
Sample Description	: L1-10203B-FSGS-010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.452E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:18:00AM
Acquisition Started	: 11/21/2019 10:37:32AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81494
Fill Height	: 1452.49 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 10:52:36AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10021

L1-10203B-FSGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.72	947 -	960	954.97	1.47E+02	18.07	6.47E+01	0.99
2	295.19	1176 -	1187	1180.68	6.24E+01	12.33	3.56E+01	0.92
3	338.31	1345 -	1357	1353.02	3.41E+01	10.37	2.79E+01	0.86
4	351.91	1402 -	1415	1407.39	8.99E+01	12.15	2.01E+01	1.23
5	583.15	2327 -	2339	2331.82	5.23E+01	8.86	9.75E+00	0.65
6	609.40	2429 -	2443	2436.75	5.87E+01	9.58	1.14E+01	0.88
7	661.68	2638 -	2654	2645.84	1.19E+02	12.29	1.05E+01	1.50
8	911.45	3639 -	3652	3644.75	3.20E+01	8.07	1.20E+01	1.15
9	1460.65	5832 -	5854	5842.42	2.96E+02	17.85	5.75E+00	1.75

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.50E+00	5.57E-01
Cs-137	1.00	661.66	*	85.10	2.18E-01	2.62E-02
Tl-208	1.00	583.19	*	85.00	8.84E-02	1.59E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.66E-01	3.91E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.91E-01	3.32E-02
		768.36		4.89		

Analysis Report for 21-Nov-19-10021

L1-10203B-FSGS-010SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	3.01E-01	6.41E-02
		351.93	*	35.60	2.55E-01	4.00E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.96E-01	9.33E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.42E-01	6.19E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 21-Nov-19-10021

L1-10203B-FSGS-010SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.995	7.50E+00	5.57E-01	
	Cs-137	1.000	2.18E-01	2.62E-02	
	Tl-208	1.000	8.84E-02	1.59E-02	
X	Bi-211	0.892			
	Pb-212	0.999	2.66E-01	3.91E-02	
	Bi-214	1.000	1.91E-01	3.32E-02	
	Pb-214	1.000	2.68E-01	3.39E-02	
	Ac-228	0.997	2.58E-01	5.16E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10021

L1-10203B-FSGS-010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 10:52:36AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	8.79E-02	6.63E-02	6.63E-02
	BE-7	477.60		10.44	-2.74E-02	4.83E-01	4.83E-01
+	K-40	1460.82	*	10.66	7.50E+00	4.79E-01	4.79E-01
	Mn-54	834.85		99.98	1.62E-02	4.85E-02	4.85E-02
	Co-60	1173.23		99.85	3.75E-02	6.12E-02	7.24E-02
		1332.49		99.98	3.37E-02		6.12E-02
	Nb-94	702.65		99.81	-4.73E-02	3.71E-02	3.71E-02
		871.09		99.89	7.30E-04		4.80E-02
	Ag-108m	79.13		6.60	-1.45E-01	4.89E-02	2.06E+00
		433.94		90.50	-1.66E-02		4.89E-02
		614.28		89.80	-1.66E-02		6.49E-02
		722.94		90.80	2.70E-02		5.80E-02
	Sb-125	176.31		6.84	2.65E-01	1.58E-01	5.80E-01
		380.45		1.52	-4.57E-01		2.84E+00
		427.87		29.60	5.00E-02		1.58E-01
		463.36		10.49	3.64E-01		4.75E-01
		600.60		17.65	3.94E-02		2.86E-01
		606.71		4.98	1.18E+00		1.44E+00
		635.95		11.22	-2.01E-01		3.52E-01

Analysis Report for 21-Nov-19-10021

L1-10203B-FSGS-010SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-7.12E-01	1.58E-01	2.58E+00
	Ba-133	79.61		2.65	-9.02E-01	8.72E-02	4.91E+00
		81.00		32.90	-2.69E-01		3.40E-01
		276.40		7.16	2.72E-01		5.96E-01
		302.85		18.34	4.34E-02		2.36E-01
		356.01		62.05	-3.97E-03		8.72E-02
		383.85		8.94	-1.64E-01		4.54E-01
	Cs-134	475.36		1.48	3.17E-01	6.42E-02	3.51E+00
		563.25		8.34	8.37E-02		5.40E-01
		569.33		15.37	5.44E-02		2.84E-01
		604.72		97.62	-7.10E-03		6.84E-02
		795.86		85.46	2.52E-02		6.42E-02
		801.95		8.69	-8.96E-01		5.11E-01
		1038.61		0.99	-3.98E+00		5.47E+00
		1167.97		1.79	2.52E+00		4.18E+00
		1365.19		3.02	2.13E-02		1.72E+00
+	Cs-137	661.66	*	85.10	2.18E-01	4.10E-02	4.10E-02
	Eu-152	121.78		28.67	-6.20E-02	1.54E-01	1.59E-01
		244.70		7.61	2.31E-01		6.04E-01
		295.94		0.45	1.02E+01		1.20E+01
		344.28		26.60	-3.98E-02		1.54E-01
		367.79		0.86	-9.45E-01		4.68E+00
		411.12		2.24	9.32E-01		2.00E+00
		443.96		2.83	1.28E-01		1.56E+00
		488.68		0.42	1.68E-02		9.58E+00
		563.99		0.49	1.23E+00		9.06E+00
		586.26		0.46	1.48E+01		1.49E+01
		678.62		0.47	5.82E+00		1.14E+01
		688.67		0.86	2.09E+00		5.13E+00
		719.35		0.28	-6.78E+00		1.57E+01
		778.90		12.96	8.34E-02		4.38E-01
		810.45		0.32	1.96E+00		1.48E+01
		867.37		4.26	1.31E-02		1.12E+00
		919.33		0.43	-5.82E+00		1.07E+01
		964.08		14.65	1.40E-01		5.23E-01
		1085.87		10.24	5.35E-01		6.25E-01
		1089.74		1.73	-6.68E-01		3.29E+00
		1112.07		13.69	-2.45E-01		4.13E-01
		1212.95		1.43	1.78E+00		5.18E+00
		1249.94		0.19	-1.56E+01		3.36E+01
		1299.14		1.63	1.02E+00		4.50E+00
		1408.01		21.07	-3.02E-01		2.60E-01
		1457.64		0.50	1.63E+02		4.67E+01
		1528.10		0.28	-1.38E+01		1.24E+01
	Eu-154	123.07		40.40	-3.42E-03	1.13E-01	1.13E-01
		247.93		6.89	-2.69E-01		5.77E-01
		591.76		4.95	-9.17E-01		9.41E-01
		692.42		1.78	1.15E+00		2.57E+00
		723.30		20.06	1.84E-01		2.73E-01
		756.80		4.52	-9.14E-01		1.04E+00
		873.18		12.08	-8.95E-02		3.97E-01

Analysis Report for 21-Nov-19-10021

L1-10203B-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.05E-02	1.13E-01	5.41E-01
	1004.76	18.01	2.68E-01		3.38E-01
	1274.43	34.80	-4.44E-02		1.74E-01
	1596.48	1.80	4.83E-01		1.80E+00
Eu-155	45.30	1.31	3.20E+00	2.97E-01	3.24E+01
	60.01	1.22	-2.77E+01		3.27E+01
	86.55	30.70	4.36E-02		2.97E-01
	105.31	21.10	7.46E-02		3.02E-01
Ra-226	186.21	3.64	5.99E-01	1.22E+00	1.22E+00
Pa-231	27.36	10.30	5.96E+00	1.72E+00	4.28E+00
	283.69	1.70	-1.54E+00		2.30E+00
	300.07	2.47	-1.56E-01		1.72E+00
	302.65	2.20	4.08E-01		1.98E+00
	330.06	1.40	1.03E+00		3.03E+00
U-235	143.76	10.96	1.12E-01	7.63E-02	4.24E-01
	163.33	5.08	-4.58E-01		7.99E-01
	185.71	57.20	1.57E-02		7.63E-02
	202.11	1.08	-1.06E+00		3.47E+00
	205.31	5.01	-7.73E-01		7.63E-01
Am-241	59.54	35.90	-2.96E-01	1.20E+00	1.20E+00

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10022

L1-10203B-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10022
Sample Description	: L1-10203B-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.431E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:20:00AM
Acquisition Started	: 11/21/2019 10:37:39AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81495
Fill Height	: 1430.83 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 10:52:50AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10022

L1-10203B-FSGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.30	307 -	313	309.74	2.48E+01	10.92	4.92E+01	0.71
2	238.73	947 -	960	954.50	1.80E+02	19.36	7.10E+01	0.55
3	295.49	1174 -	1188	1181.24	4.61E+01	12.83	3.89E+01	1.02
4	328.08	1306 -	1316	1311.45	2.10E+01	7.53	1.50E+01	0.84
5	352.01	1399 -	1415	1407.05	1.14E+02	14.09	2.72E+01	1.23
6	582.93	2322 -	2339	2329.84	6.64E+01	9.37	6.63E+00	0.39
7	609.12	2426 -	2443	2434.53	8.31E+01	11.65	1.59E+01	1.59
8	1459.99	5826 -	5850	5837.90	3.16E+02	18.81	9.28E+00	1.86

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.89	1460.82	*	10.66	7.23E+00	5.33E-01
Tl-208	0.99	583.19	*	85.00	1.02E-01	1.56E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.90E-01	3.90E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	1.75E-01	7.93E-02
		87.35		3.97		
		89.78		1.46		

Analysis Report for 21-Nov-19-10022

L1-10203B-FSGS-011SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	609.32	*	45.49	2.45E-01	3.73E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.00E-01	5.79E-02
		351.93	*	35.60	2.91E-01	4.29E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	3.09E-01	1.40E-01
		87.35		2.24		
		89.78		0.82		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.895	7.23E+00	5.33E-01	

Analysis Report for 21-Nov-19-10022

L1-10203B-FSGS-011SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	Tl-208	0.990	1.02E-01	1.56E-02	
X	Bi-211	0.868			
	Pb-212	0.999	2.90E-01	3.90E-02	
?	Pb212-XR	0.997	1.75E-01	7.93E-02	
	Bi-214	0.997	2.45E-01	3.73E-02	
	Pb-214	0.996	2.59E-01	3.45E-02	
?	Pb214-XR	0.997	3.09E-01	1.40E-01	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10022

L1-10203B-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 10:52:50AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
4	328.08	2.33411E-02	35.84	Tol.	Ac-228

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.66E-02	5.73E-02	5.73E-02
	BE-7	477.60		10.44	3.12E-01	4.50E-01	4.50E-01
+	K-40	1460.82	*	10.66	7.23E+00	5.45E-01	5.45E-01
	Mn-54	834.85		99.98	1.08E-02	4.71E-02	4.71E-02
	Co-60	1173.23		99.85	1.68E-02	5.89E-02	6.29E-02
		1332.49		99.98	5.24E-02		5.89E-02
	Nb-94	702.65		99.81	-4.38E-02	3.88E-02	3.91E-02
		871.09		99.89	-6.70E-03		3.88E-02
	Ag-108m	79.13		6.60	-3.48E-01	4.53E-02	1.09E+00
		433.94		90.50	3.07E-03		4.53E-02
		614.28		89.80	-1.41E-02		6.01E-02
		722.94		90.80	3.12E-02		5.94E-02
	Sb-125	176.31		6.84	1.19E-01	1.30E-01	5.02E-01
		380.45		1.52	2.86E-01		2.53E+00
		427.87		29.60	1.12E-02		1.30E-01
		463.36		10.49	1.70E-01		4.23E-01
		600.60		17.65	9.78E-02		2.64E-01
		606.71		4.98	-1.64E-01		1.52E+00

Analysis Report for 21-Nov-19-10022

L1-10203B-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	635.95	11.22	1.08E-01	1.30E-01	4.00E-01
	671.44	1.79	-3.96E-01		1.91E+00
Ba-133	79.61	2.65	-1.02E+00	6.89E-02	2.64E+00
	81.00	32.90	-2.90E-01		1.78E-01
	276.40	7.16	4.53E-01		5.24E-01
	302.85	18.34	-2.95E-02		1.96E-01
	356.01	62.05	-1.87E-02		6.89E-02
	383.85	8.94	-1.35E-01		3.96E-01
Cs-134	475.36	1.48	7.59E-01	5.24E-02	3.11E+00
	563.25	8.34	-7.17E-01		4.83E-01
	569.33	15.37	7.43E-03		2.89E-01
	604.72	97.62	-2.48E-02		7.02E-02
	795.86	85.46	-7.07E-03		5.24E-02
	801.95	8.69	5.12E-02		5.75E-01
	1038.61	0.99	-5.90E+00		4.42E+00
	1167.97	1.79	-2.79E+00		3.40E+00
	1365.19	3.02	4.70E-01		1.60E+00
Cs-137	661.66	85.10	3.91E-02	6.58E-02	6.58E-02
Eu-152	121.78	28.67	2.89E-02	1.16E-01	1.16E-01
	244.70	7.61	1.07E-02		5.15E-01
	295.94	0.45	1.03E+00		9.62E+00
	344.28	26.60	-4.57E-03		1.40E-01
	367.79	0.86	-3.02E+00		3.54E+00
	411.12	2.24	-3.29E-01		1.46E+00
	443.96	2.83	6.46E-01		1.42E+00
	488.68	0.42	3.42E+00		8.56E+00
	563.99	0.49	-4.53E+00		8.40E+00
	586.26	0.46	-2.99E+00		1.37E+01
	678.62	0.47	-1.62E+00		8.51E+00
	688.67	0.86	-1.20E-01		5.24E+00
	719.35	0.28	-1.80E+00		1.64E+01
	778.90	12.96	8.07E-02		3.35E-01
	810.45	0.32	3.14E+00		1.26E+01
	867.37	4.26	4.12E-01		9.95E-01
	919.33	0.43	3.03E-01		1.12E+01
	964.08	14.65	4.19E-01		5.13E-01
	1085.87	10.24	-3.40E-02		4.72E-01
	1089.74	1.73	-1.92E+00		2.74E+00
	1112.07	13.69	-1.97E-02		4.10E-01
	1212.95	1.43	2.93E+00		4.81E+00
	1249.94	0.19	1.11E+01		3.31E+01
	1299.14	1.63	1.28E+00		3.83E+00
	1408.01	21.07	8.48E-02		2.62E-01
	1457.64	0.50	1.60E+02		4.37E+01
	1528.10	0.28	5.38E+00		1.31E+01
Eu-154	123.07	40.40	-1.97E-02	8.20E-02	8.20E-02
	247.93	6.89	-3.79E-01		4.77E-01
	591.76	4.95	2.46E-01		8.52E-01
	692.42	1.78	1.38E+00		2.64E+00
	723.30	20.06	2.70E-01		2.72E-01
	756.80	4.52	-6.10E-02		1.06E+00

Analysis Report for 21-Nov-19-10022

L1-10203B-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	-1.97E-01	8.20E-02	3.37E-01
	996.29	10.48	-1.75E-01		5.06E-01
	1004.76	18.01	1.88E-01		2.71E-01
	1274.43	34.80	-3.81E-02		1.85E-01
	1596.48	1.80	5.83E-01		1.82E+00
Eu-155	45.30	1.31	-9.34E-01	1.94E-01	1.16E+01
	60.01	1.22	-4.76E+00		1.33E+01
	86.55	30.70	2.01E-01		1.98E-01
	105.31	21.10	3.72E-02		1.94E-01
Ra-226	186.21	3.64	6.73E-01	1.01E+00	1.01E+00
Pa-231	27.36	10.30	9.48E-01	1.27E+00	1.27E+00
	283.69	1.70	-1.45E+00		1.81E+00
	300.07	2.47	9.53E-01		1.42E+00
	302.65	2.20	1.11E-01		1.64E+00
	330.06	1.40	1.40E+00		2.56E+00
U-235	143.76	10.96	-9.95E-03	6.32E-02	3.31E-01
	163.33	5.08	-1.03E-01		6.04E-01
	185.71	57.20	-1.16E-02		6.32E-02
	202.11	1.08	2.54E+00		2.97E+00
	205.31	5.01	-2.57E-01		5.96E-01
Am-241	59.54	35.90	6.23E-03	4.76E-01	4.76E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10023

L1-10203B-FSGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10023
Sample Description	: L1-10203B-FSGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.671E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:22:00AM
Acquisition Started	: 11/21/2019 10:37:47AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81496
Fill Height	: 1670.64 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 10:52:50AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10023

L1-10203B-FSGS-012SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.69	739 -	749	743.48	3.65E+01	11.74	4.25E+01	0.56
2	238.56	948 -	959	954.70	1.41E+02	17.21	6.21E+01	0.90
3	295.18	1173 -	1186	1180.95	5.70E+01	12.49	3.60E+01	0.40
4	351.81	1401 -	1415	1407.25	1.14E+02	12.38	1.34E+01	0.87
5	583.07	2324 -	2339	2331.60	6.81E+01	9.89	9.92E+00	0.86
6	609.20	2429 -	2444	2436.07	7.31E+01	11.26	1.79E+01	0.68
7	911.10	3637 -	3649	3643.45	3.85E+01	7.46	6.50E+00	0.40
8	968.76	3869 -	3880	3874.11	2.96E+01	6.56	5.44E+00	0.50
9	1460.52	5831 -	5854	5842.46	3.33E+02	19.17	8.69E+00	2.16

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	6.82E+00	4.91E-01
Tl-208	0.99	583.19	*	85.00	9.56E-02	1.50E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.18E-01	3.19E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.97E-01	3.26E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 21-Nov-19-10023

L1-10203B-FSGS-012SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.34E-01	5.45E-02
		351.93	*	35.60	2.72E-01	3.68E-02
		785.96		1.06		
Ra-226	0.95	186.21	*	3.64	6.04E-01	2.00E-01
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.38E-01	4.73E-02
		964.77		4.99		
		968.97	*	15.80	3.11E-01	7.04E-02
		1588.20		3.22		
U-235	1.00	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.85E-02	1.28E-02
		202.11		1.08		
		205.31		5.01		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10023

L1-10203B-FSGS-012SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.986	6.82E+00	4.91E-01	
	Tl-208	0.998	9.56E-02	1.50E-02	
X	Bi-211	0.915			
	Pb-212	0.999	2.18E-01	3.19E-02	
	Bi-214	0.999	1.97E-01	3.26E-02	
	Pb-214	0.999	2.60E-01	3.05E-02	
?	Ra-226	0.957	6.04E-01	2.00E-01	
	Ac-228	0.998	2.61E-01	3.93E-02	
?	U-235	1.000	3.85E-02	1.28E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10023

L1-10203B-FSGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 10:52:50AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.28E-02	5.72E-02	5.72E-02
	BE-7	477.60		10.44	-7.63E-02	3.88E-01	3.88E-01
+	K-40	1460.82	*	10.66	6.82E+00	4.64E-01	4.64E-01
	Mn-54	834.85		99.98	3.46E-03	4.78E-02	4.78E-02
	Co-60	1173.23		99.85	-5.51E-03	4.85E-02	5.56E-02
		1332.49		99.98	-6.82E-03		4.85E-02
	Nb-94	702.65		99.81	2.55E-02	4.59E-02	4.59E-02
		871.09		99.89	2.40E-02		4.59E-02
	Ag-108m	79.13		6.60	4.50E-01	3.88E-02	1.59E+00
		433.94		90.50	-3.37E-02		3.88E-02
		614.28		89.80	-6.22E-02		6.96E-02
		722.94		90.80	-1.13E-03		4.60E-02
	Sb-125	176.31		6.84	1.35E-01	1.20E-01	5.58E-01
		380.45		1.52	-6.14E-01		2.47E+00
		427.87		29.60	-9.07E-02		1.20E-01
		463.36		10.49	-3.31E-02		3.60E-01
		600.60		17.65	7.50E-02		2.47E-01
		606.71		4.98	1.91E+00		1.39E+00
		635.95		11.22	-3.10E-01		3.74E-01

Analysis Report for 21-Nov-19-10023

L1-10203B-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	5.80E-02	1.20E-01	2.46E+00
Ba-133	79.61	2.65	1.47E+00	8.04E-02	3.84E+00
	81.00	32.90	-3.29E-01		2.61E-01
	276.40	7.16	-2.29E-01		5.15E-01
	302.85	18.34	-1.22E-02		1.94E-01
	356.01	62.05	1.99E-02		8.04E-02
	383.85	8.94	2.28E-02		4.27E-01
Cs-134	475.36	1.48	9.05E-01	4.76E-02	2.60E+00
	563.25	8.34	1.85E-01		4.65E-01
	569.33	15.37	-3.75E-03		2.06E-01
	604.72	97.62	-3.01E-02		6.49E-02
	795.86	85.46	-7.37E-03		4.76E-02
	801.95	8.69	-2.20E-01		4.62E-01
	1038.61	0.99	-4.93E-01		5.05E+00
	1167.97	1.79	1.23E+00		3.19E+00
	1365.19	3.02	-1.72E-02		1.43E+00
Cs-137	661.66	85.10	1.56E-02	5.29E-02	5.29E-02
Eu-152	121.78	28.67	-1.63E-02	1.20E-01	1.38E-01
	244.70	7.61	-2.22E-02		5.24E-01
	295.94	0.45	7.37E+00		1.02E+01
	344.28	26.60	-8.51E-02		1.20E-01
	367.79	0.86	1.11E+00		3.92E+00
	411.12	2.24	5.64E-01		1.77E+00
	443.96	2.83	-1.30E+00		1.18E+00
	488.68	0.42	-7.41E+00		8.21E+00
	563.99	0.49	4.88E+00		7.99E+00
	586.26	0.46	1.60E+00		1.36E+01
	678.62	0.47	3.48E+00		8.02E+00
	688.67	0.86	2.03E+00		4.97E+00
	719.35	0.28	-1.19E+00		1.41E+01
	778.90	12.96	-2.83E-01		3.19E-01
	810.45	0.32	3.03E+00		1.38E+01
	867.37	4.26	-2.33E-01		1.15E+00
	919.33	0.43	-1.45E+01		1.01E+01
	964.08	14.65	9.19E-02		5.03E-01
	1085.87	10.24	-2.85E-01		3.96E-01
	1089.74	1.73	-1.27E+00		2.52E+00
	1112.07	13.69	9.85E-03		4.09E-01
	1212.95	1.43	2.57E+00		4.42E+00
	1249.94	0.19	-3.57E+00		3.06E+01
	1299.14	1.63	-1.76E+00		3.00E+00
	1408.01	21.07	5.68E-02		2.16E-01
	1457.64	0.50	1.48E+02		4.02E+01
	1528.10	0.28	7.20E+00		1.38E+01
Eu-154	123.07	40.40	1.15E-02	9.80E-02	9.80E-02
	247.93	6.89	1.52E-01		5.03E-01
	591.76	4.95	-2.21E-01		8.27E-01
	692.42	1.78	6.10E-01		2.58E+00
	723.30	20.06	1.21E-02		2.06E-01
	756.80	4.52	1.52E-01		1.06E+00
	873.18	12.08	-2.22E-01		3.57E-01

Analysis Report for 21-Nov-19-10023

L1-10203B-FSGS-012SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-1.07E-01	9.80E-02	4.42E-01
		1004.76		18.01	3.24E-03		2.63E-01
		1274.43		34.80	3.40E-02		1.58E-01
		1596.48		1.80	-2.17E+00		2.44E+00
	Eu-155	45.30		1.31	-1.01E+00	2.13E-01	1.85E+01
		60.01		1.22	1.21E+01		2.33E+01
		86.55		30.70	5.72E-02		2.43E-01
		105.31		21.10	5.90E-03		2.13E-01
+	Ra-226	186.21	*	3.64	6.04E-01	6.13E-01	6.13E-01
	Pa-231	27.36		10.30	2.34E+00	1.62E+00	2.42E+00
		283.69		1.70	-5.15E-01		2.05E+00
		300.07		2.47	-1.38E+00		1.64E+00
		302.65		2.20	2.49E-02		1.62E+00
		330.06		1.40	4.52E-01		2.70E+00
+	U-235	143.76		10.96	-6.92E-03	3.90E-02	3.35E-01
		163.33		5.08	-6.86E-01		7.20E-01
		185.71	*	57.20	3.85E-02		3.90E-02
		202.11		1.08	-9.20E-01		3.26E+00
		205.31		5.01	-5.17E-01		7.16E-01
	Am-241	59.54		35.90	3.65E-01	8.24E-01	8.24E-01

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10024

L1-10203B-FSGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10024
Sample Description	: L1-10203B-FSGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.419E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:24:00AM
Acquisition Started	: 11/21/2019 10:56:54AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81497
Fill Height	: 1418.94 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 11:11:57AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10024

L1-10203B-FSGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.63	472 -	481	477.44	1.41E+02	20.74	1.25E+02	0.97
2	295.18	587 -	594	590.42	6.77E+01	12.57	4.43E+01	1.17
3	338.24	673 -	681	676.44	3.93E+01	11.41	4.28E+01	1.09
4	351.93	698 -	708	703.81	1.13E+02	14.56	4.14E+01	1.39
5	583.15	1160 -	1171	1165.91	6.61E+01	11.55	2.69E+01	1.36
6	609.12	1215 -	1223	1217.82	9.54E+01	11.82	2.06E+01	1.21
7	661.70	1318 -	1328	1322.93	7.66E+01	10.87	1.74E+01	1.58
8	911.04	1816 -	1827	1821.54	4.80E+01	9.66	1.80E+01	1.61
9	1460.53	2913 -	2928	2921.11	3.25E+02	18.36	3.99E+00	1.79

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	6.25E+00	4.45E-01
Cs-137	1.00	661.66	*	85.10	1.09E-01	1.68E-02
Tl-208	1.00	583.19	*	85.00	8.68E-02	1.60E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.01E-01	3.37E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.41E-01	3.32E-02
		768.36		4.89		

Analysis Report for 21-Nov-19-10024

L1-10203B-FSGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.57E-01	5.20E-02
		351.93	*	35.60	2.51E-01	3.81E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.68E-01	8.10E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.79E-01	5.73E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 21-Nov-19-10024

L1-10203B-FSGS-013SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.986	6.25E+00	4.45E-01	
	Cs-137	1.000	1.09E-01	1.68E-02	
	Tl-208	1.000	8.68E-02	1.60E-02	
X	Bi-211	0.888			
	Pb-212	1.000	2.01E-01	3.37E-02	
	Bi-214	0.997	2.41E-01	3.32E-02	
	Pb-214	1.000	2.53E-01	3.08E-02	
	Ac-228	0.999	2.75E-01	4.68E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10024

L1-10203B-FSGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 11:11:57AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.53E-02	5.19E-02	5.19E-02
	BE-7	477.60		10.44	1.62E-01	3.49E-01	3.49E-01
+	K-40	1460.82	*	10.66	6.25E+00	2.81E-01	2.81E-01
	Mn-54	834.85		99.98	-8.14E-03	4.13E-02	4.13E-02
	Co-60	1173.23		99.85	6.48E-02	6.57E-02	7.01E-02
		1332.49		99.98	5.87E-02		6.57E-02
	Nb-94	702.65		99.81	-8.85E-04	3.40E-02	3.40E-02
		871.09		99.89	1.44E-02		4.11E-02
	Ag-108m	79.13		6.60	4.50E-02	3.58E-02	1.16E+00
		433.94		90.50	4.43E-03		3.58E-02
		614.28		89.80	-1.63E-02		5.64E-02
		722.94		90.80	-2.76E-02		4.13E-02
	Sb-125	176.31		6.84	1.65E-01	1.01E-01	5.29E-01
		380.45		1.52	5.22E-01		2.23E+00
		427.87		29.60	-6.96E-03		1.01E-01
		463.36		10.49	1.79E-01		3.68E-01
		600.60		17.65	-1.23E-01		2.09E-01
		606.71		4.98	-1.74E+00		1.38E+00
		635.95		11.22	2.13E-02		3.42E-01

Analysis Report for 21-Nov-19-10024

L1-10203B-FSGS-013SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	5.62E-01	1.01E-01	2.00E+00
	Ba-133	79.61		2.65	-1.25E-01	7.08E-02	2.77E+00
		81.00		32.90	-9.65E-02		2.00E-01
		276.40		7.16	-1.13E-01		4.39E-01
		302.85		18.34	6.13E-02		1.79E-01
		356.01		62.05	-3.42E-02		7.08E-02
		383.85		8.94	4.46E-02		3.74E-01
	Cs-134	475.36		1.48	9.12E-01	4.53E-02	2.43E+00
		563.25		8.34	3.78E-02		3.93E-01
		569.33		15.37	-1.34E-02		2.46E-01
		604.72		97.62	-1.18E-01		6.18E-02
		795.86		85.46	1.50E-02		4.53E-02
		801.95		8.69	-6.16E-02		4.41E-01
		1038.61		0.99	2.04E+00		4.95E+00
		1167.97		1.79	-2.72E-02		3.51E+00
		1365.19		3.02	3.72E-01		1.26E+00
+	Cs-137	661.66	*	85.10	1.09E-01	3.53E-02	3.53E-02
	Eu-152	121.78		28.67	1.69E-02	1.17E-01	1.17E-01
		244.70		7.61	-1.79E-01		4.81E-01
		295.94		0.45	8.19E+00		9.27E+00
		344.28		26.60	-4.55E-02		1.21E-01
		367.79		0.86	7.75E-01		3.65E+00
		411.12		2.24	6.96E-01		1.60E+00
		443.96		2.83	1.86E-01		1.05E+00
		488.68		0.42	9.42E-01		8.36E+00
		563.99		0.49	1.02E+00		6.86E+00
		586.26		0.46	-2.55E+00		1.31E+01
		678.62		0.47	3.05E+00		7.73E+00
		688.67		0.86	-3.81E-01		3.20E+00
		719.35		0.28	4.17E+00		1.30E+01
		778.90		12.96	-8.70E-02		2.94E-01
		810.45		0.32	2.62E+00		1.30E+01
		867.37		4.26	2.19E-02		9.61E-01
		919.33		0.43	7.85E-01		8.94E+00
		964.08		14.65	-2.52E-03		3.53E-01
		1085.87		10.24	6.25E-02		4.92E-01
		1089.74		1.73	-9.16E-01		2.79E+00
		1112.07		13.69	-2.02E-01		3.16E-01
		1212.95		1.43	-1.14E+00		4.00E+00
		1249.94		0.19	5.34E+00		2.74E+01
		1299.14		1.63	1.02E+00		3.43E+00
		1408.01		21.07	1.77E-01		2.54E-01
		1457.64		0.50	-1.58E+00		3.68E+01
		1528.10		0.28	-8.01E+00		1.02E+01
	Eu-154	123.07		40.40	3.20E-02	8.44E-02	8.44E-02
		247.93		6.89	1.37E-01		4.72E-01
		591.76		4.95	-1.43E-01		8.46E-01
		692.42		1.78	-5.65E-01		1.63E+00
		723.30		20.06	-6.73E-03		2.00E-01
		756.80		4.52	-2.93E-01		8.01E-01
		873.18		12.08	-1.92E-01		2.99E-01

Analysis Report for 21-Nov-19-10024

L1-10203B-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	8.70E-02	8.44E-02	4.35E-01
	1004.76	18.01	4.03E-02		2.34E-01
	1274.43	34.80	-1.83E-02		1.49E-01
	1596.48	1.80	2.67E-01		2.38E+00
Eu-155	45.30	1.31	-1.04E+00	1.85E-01	1.04E+01
	60.01	1.22	1.34E+00		1.28E+01
	86.55	30.70	6.14E-02		1.85E-01
	105.31	21.10	-2.49E-02		1.88E-01
Ra-226	186.21	3.64	8.99E-01	1.04E+00	1.04E+00
Pa-231	27.36	10.30	1.26E-01	1.03E+00	1.03E+00
	283.69	1.70	7.91E-02		1.91E+00
	300.07	2.47	-6.46E-01		1.32E+00
	302.65	2.20	5.11E-01		1.49E+00
	330.06	1.40	2.32E-01		2.31E+00
U-235	143.76	10.96	1.97E-02	6.64E-02	2.90E-01
	163.33	5.08	1.32E-01		6.98E-01
	185.71	57.20	5.39E-02		6.64E-02
	202.11	1.08	-8.15E-02		3.13E+00
	205.31	5.01	-7.82E-01		6.72E-01
Am-241	59.54	35.90	4.07E-02	4.38E-01	4.38E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
\> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10025

L1-10203B-FSGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10025
Sample Description	: L1-10203B-FSGS-014SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.702E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:26:00AM
Acquisition Started	: 11/21/2019 10:57:01AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.5 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81498
Fill Height	: 1701.79 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 11:12:05AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10025

L1-10203B-FSGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.22	305 -	314	309.61	2.57E+01	13.05	6.33E+01	0.48
2	238.70	946 -	960	954.90	1.24E+02	19.60	9.00E+01	0.74
3	295.49	1175 -	1187	1181.85	5.53E+01	12.21	3.58E+01	1.16
4	338.47	1348 -	1361	1353.64	4.09E+01	11.00	2.91E+01	0.54
5	352.02	1402 -	1416	1407.80	9.75E+01	14.35	3.75E+01	1.15
6	583.22	2324 -	2338	2332.08	4.90E+01	10.07	1.80E+01	1.25
7	609.27	2430 -	2444	2436.23	8.48E+01	11.10	1.32E+01	1.21
8	1460.85	5833 -	5853	5843.25	2.71E+02	18.15	1.59E+01	1.68

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	6.57E+00	5.24E-01
Tl-208	1.00	583.19	*	85.00	7.99E-02	1.71E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.18E-01	3.87E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.10E-01	1.61E-01
		87.35		3.97		
		89.78		1.46		

Analysis Report for 21-Nov-19-10025

L1-10203B-FSGS-014SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	609.32	*	45.49	2.66E-01	3.83E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.59E-01	6.08E-02
		351.93	*	35.60	2.68E-01	4.48E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	5.46E-01	2.84E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.57	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.45E-01	9.69E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10025

L1-10203B-FSGS-014SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	6.57E+00	5.24E-01	
	Tl-208	1.000	7.99E-02	1.71E-02	
X	Bi-211	0.866			
	Pb-212	0.999	2.18E-01	3.87E-02	
?	Pb212-XR	0.999	3.10E-01	1.61E-01	
	Bi-214	1.000	2.66E-01	3.83E-02	
	Pb-214	0.996	2.64E-01	3.61E-02	
?	Pb214-XR	0.999	5.46E-01	2.84E-01	
	Ac-228	0.573	3.45E-01	9.69E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10025

L1-10203B-FSGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 11:12:05AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	8.55E-02	6.56E-02	6.56E-02
	BE-7	477.60		10.44	1.41E-01	4.20E-01	4.20E-01
+	K-40	1460.82	*	10.66	6.57E+00	6.98E-01	6.98E-01
	Mn-54	834.85		99.98	-3.23E-02	5.38E-02	5.38E-02
	Co-60	1173.23		99.85	-1.66E-03	6.11E-02	7.02E-02
		1332.49		99.98	-6.57E-03		6.11E-02
	Nb-94	702.65		99.81	-2.64E-02	4.59E-02	4.59E-02
		871.09		99.89	7.85E-03		5.45E-02
	Ag-108m	79.13		6.60	-3.95E-02	4.52E-02	1.82E+00
		433.94		90.50	5.12E-03		4.52E-02
		614.28		89.80	-6.48E-02		7.19E-02
		722.94		90.80	-4.90E-03		5.66E-02
	Sb-125	176.31		6.84	1.20E-01	1.39E-01	6.35E-01
		380.45		1.52	1.55E+00		2.62E+00
		427.87		29.60	-2.70E-02		1.39E-01
		463.36		10.49	1.09E-01		4.19E-01
		600.60		17.65	4.21E-02		2.75E-01
		606.71		4.98	8.74E-01		1.55E+00
		635.95		11.22	-2.52E-02		3.99E-01

Analysis Report for 21-Nov-19-10025

L1-10203B-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	7.46E-01	1.39E-01	2.77E+00
Ba-133	79.61	2.65	-3.53E-01	8.70E-02	4.24E+00
	81.00	32.90	-1.27E-01		2.91E-01
	276.40	7.16	2.23E-01		5.87E-01
	302.85	18.34	-5.06E-02		2.29E-01
	356.01	62.05	-7.08E-03		8.70E-02
	383.85	8.94	4.60E-02		4.24E-01
Cs-134	475.36	1.48	-1.39E+00	5.18E-02	2.86E+00
	563.25	8.34	1.06E-01		4.37E-01
	569.33	15.37	1.11E-02		2.55E-01
	604.72	97.62	-1.93E-02		6.97E-02
	795.86	85.46	5.00E-03		5.18E-02
	801.95	8.69	2.96E-01		5.77E-01
	1038.61	0.99	1.65E+00		5.45E+00
	1167.97	1.79	1.88E+00		3.76E+00
	1365.19	3.02	-6.92E-01		1.84E+00
Cs-137	661.66	85.10	4.09E-02	5.40E-02	5.40E-02
Eu-152	121.78	28.67	1.04E-02	1.44E-01	1.75E-01
	244.70	7.61	4.19E-01		5.75E-01
	295.94	0.45	2.98E+00		1.12E+01
	344.28	26.60	-4.62E-02		1.44E-01
	367.79	0.86	1.10E+00		5.45E+00
	411.12	2.24	8.90E-01		1.67E+00
	443.96	2.83	-5.20E-01		1.27E+00
	488.68	0.42	5.12E-01		9.26E+00
	563.99	0.49	4.62E+00		7.55E+00
	586.26	0.46	-1.16E+00		1.52E+01
	678.62	0.47	-4.19E+00		9.91E+00
	688.67	0.86	-1.97E+00		5.50E+00
	719.35	0.28	3.79E+00		1.62E+01
	778.90	12.96	-3.31E-01		2.87E-01
	810.45	0.32	-4.38E+00		1.50E+01
	867.37	4.26	6.40E-01		1.27E+00
	919.33	0.43	3.00E-01		1.02E+01
	964.08	14.65	-1.61E-01		4.61E-01
	1085.87	10.24	-1.77E-01		6.08E-01
	1089.74	1.73	-4.48E+00		3.39E+00
	1112.07	13.69	-1.86E-01		4.55E-01
	1212.95	1.43	-1.74E+00		4.83E+00
	1249.94	0.19	-1.15E+01		3.40E+01
	1299.14	1.63	-3.84E-01		3.30E+00
	1408.01	21.07	7.90E-02		2.15E-01
	1457.64	0.50	1.44E+02		4.38E+01
	1528.10	0.28	6.64E+00		1.48E+01
Eu-154	123.07	40.40	-4.59E-02	1.22E-01	1.22E-01
	247.93	6.89	-2.45E-02		5.29E-01
	591.76	4.95	1.15E-01		9.81E-01
	692.42	1.78	5.22E-01		2.77E+00
	723.30	20.06	2.81E-02		2.56E-01
	756.80	4.52	3.84E-01		1.08E+00
	873.18	12.08	-7.08E-01		4.32E-01

Analysis Report for 21-Nov-19-10025

L1-10203B-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.39E-01	1.22E-01	6.01E-01
	1004.76	18.01	-4.03E-02		3.29E-01
	1274.43	34.80	-3.31E-02		1.87E-01
	1596.48	1.80	-3.08E+00		1.92E+00
Eu-155	45.30	1.31	1.81E+01	2.82E-01	3.57E+01
	60.01	1.22	-4.81E+00		3.41E+01
	86.55	30.70	8.46E-02		2.84E-01
	105.31	21.10	5.26E-02		2.82E-01
Ra-226	186.21	3.64	6.16E-01	1.21E+00	1.21E+00
Pa-231	27.36	10.30	3.11E+00	1.70E+00	3.81E+00
	283.69	1.70	2.13E-01		2.34E+00
	300.07	2.47	-9.64E-01		1.70E+00
	302.65	2.20	-1.59E-02		1.91E+00
	330.06	1.40	6.49E-01		2.94E+00
U-235	143.76	10.96	9.23E-02	7.74E-02	4.18E-01
	163.33	5.08	1.19E-01		7.96E-01
	185.71	57.20	5.65E-02		7.74E-02
	202.11	1.08	-1.83E-01		3.80E+00
	205.31	5.01	-3.00E-02		7.98E-01
Am-241	59.54	35.90	2.26E-01	1.29E+00	1.29E+00

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10026

L1-10203B-FSGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10026
Sample Description	: L1-10203B-FSGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.628E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:28:00AM
Acquisition Started	: 11/21/2019 10:57:08AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81499
Fill Height	: 1628.24 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 11:12:18AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10026

L1-10203B-FSGS-015SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.15	306 -	315	309.14	5.57E+01	15.22	7.33E+01	0.59
2	238.85	946 -	960	954.98	1.73E+02	17.99	5.19E+01	1.17
3	295.28	1175 -	1187	1180.39	7.75E+01	11.90	2.35E+01	0.91
4	338.54	1348 -	1358	1353.23	2.67E+01	8.99	2.23E+01	1.09
5	351.75	1398 -	1415	1406.03	1.27E+02	15.10	3.12E+01	1.34
6	510.72	2036 -	2046	2041.22	2.73E+01	8.77	2.07E+01	0.47
7	583.04	2324 -	2337	2330.26	5.18E+01	9.67	1.52E+01	0.85
8	609.20	2425 -	2444	2434.84	1.09E+02	11.57	7.22E+00	1.49
9	910.72	3635 -	3646	3640.33	2.53E+01	7.39	1.17E+01	0.40
10	968.76	3867 -	3879	3872.46	3.13E+01	6.79	5.66E+00	0.50
11	1119.93	4471 -	4483	4477.14	2.45E+01	6.46	6.50E+00	0.79
12	1460.08	5826 -	5849	5838.24	3.34E+02	19.23	8.99E+00	1.97

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.98	511.00	*	100.00	3.19E-02	1.05E-02
K-40	0.91	1460.82	*	10.66	7.36E+00	5.31E-01
Tl-208	0.99	583.19	*	85.00	7.69E-02	1.51E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.72E-01	3.58E-02

Analysis Report for 21-Nov-19-10026

L1-10203B-FSGS-015SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	3.91E-01	1.14E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	3.11E-01	3.80E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	3.22E-01	8.58E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	3.27E-01	5.67E-02
		351.93	*	35.60	3.15E-01	4.52E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	6.88E-01	2.04E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.04E-01	7.07E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.67E-01	4.95E-02
		964.77		4.99		
		968.97	*	15.80	3.53E-01	7.80E-02
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10026

L1-10203B-FSGS-015SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.987	3.19E-02	1.05E-02	
	K-40	0.915	7.36E+00	5.31E-01	
	Tl-208	0.996	7.69E-02	1.51E-02	
X	Bi-211	0.928			
	Pb-212	0.993	2.72E-01	3.58E-02	
?	Pb212-XR	1.000	3.91E-01	1.14E-01	
	Bi-214	0.996	3.13E-01	3.47E-02	
	Pb-214	0.997	3.20E-01	3.54E-02	
?	Pb214-XR	1.000	6.88E-01	2.04E-01	
	Ac-228	0.986	2.16E-01	3.60E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10026

L1-10203B-FSGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 11:12:18AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	3.19E-02	3.13E-02	3.13E-02
	BE-7	477.60		10.44	1.93E-01	4.04E-01	4.04E-01
+	K-40	1460.82	*	10.66	7.36E+00	5.12E-01	5.12E-01
	Mn-54	834.85		99.98	-1.87E-02	5.03E-02	5.03E-02
	Co-60	1173.23		99.85	-3.43E-02	5.22E-02	5.89E-02
		1332.49		99.98	-4.31E-02		5.22E-02
	Nb-94	702.65		99.81	1.70E-02	4.76E-02	4.76E-02
		871.09		99.89	1.90E-02		4.97E-02
	Ag-108m	79.13		6.60	-5.89E-01	4.14E-02	1.18E+00
		433.94		90.50	-1.90E-02		4.14E-02
		614.28		89.80	1.69E-02		6.58E-02
		722.94		90.80	4.03E-02		6.02E-02
	Sb-125	176.31		6.84	-1.87E-02	1.32E-01	4.78E-01
		380.45		1.52	5.15E-01		2.17E+00
		427.87		29.60	-4.88E-02		1.32E-01
		463.36		10.49	2.41E-01		4.15E-01
		600.60		17.65	-1.77E-02		2.03E-01
		606.71		4.98	-2.34E-01		1.48E+00
		635.95		11.22	-1.19E-01		3.43E-01

Analysis Report for 21-Nov-19-10026

L1-10203B-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.15E+00	1.32E-01	1.89E+00
Ba-133	79.61	2.65	-1.29E+00	6.93E-02	2.85E+00
	81.00	32.90	-1.35E-01		1.88E-01
	276.40	7.16	2.00E-01		5.00E-01
	302.85	18.34	-5.61E-02		1.80E-01
	356.01	62.05	-3.62E-02		6.93E-02
	383.85	8.94	1.31E-01		4.02E-01
Cs-134	475.36	1.48	-8.85E-01	5.70E-02	2.61E+00
	563.25	8.34	-6.90E-01		4.91E-01
	569.33	15.37	-1.86E-01		2.59E-01
	604.72	97.62	5.30E-04		6.38E-02
	795.86	85.46	5.33E-02		5.70E-02
	801.95	8.69	-9.70E-02		4.93E-01
	1038.61	0.99	-3.05E-01		5.24E+00
	1167.97	1.79	-1.67E+00		3.28E+00
	1365.19	3.02	1.65E-01		1.28E+00
Cs-137	661.66	85.10	3.51E-02	6.16E-02	6.16E-02
Eu-152	121.78	28.67	-4.62E-02	1.14E-01	1.14E-01
	244.70	7.61	-2.60E-02		5.12E-01
	295.94	0.45	3.63E+00		1.03E+01
	344.28	26.60	-4.92E-02		1.27E-01
	367.79	0.86	-1.16E+00		3.79E+00
	411.12	2.24	7.98E-01		1.64E+00
	443.96	2.83	-3.06E-01		1.33E+00
	488.68	0.42	-1.33E-02		8.85E+00
	563.99	0.49	-9.28E+00		8.05E+00
	586.26	0.46	-5.38E+00		1.28E+01
	678.62	0.47	3.11E+00		8.64E+00
	688.67	0.86	-3.95E+00		4.79E+00
	719.35	0.28	-1.21E+00		1.61E+01
	778.90	12.96	2.96E-02		3.06E-01
	810.45	0.32	-5.38E-01		1.34E+01
	867.37	4.26	-1.41E-01		1.14E+00
	919.33	0.43	4.59E+00		1.22E+01
	964.08	14.65	-2.95E-01		5.03E-01
	1085.87	10.24	2.11E-01		5.30E-01
	1089.74	1.73	-3.22E-01		3.04E+00
	1112.07	13.69	2.33E-01		4.45E-01
	1212.95	1.43	-2.89E-01		4.63E+00
	1249.94	0.19	-2.07E+01		2.88E+01
	1299.14	1.63	1.89E-01		3.63E+00
	1408.01	21.07	-2.98E-02		1.96E-01
	1457.64	0.50	1.62E+02		4.33E+01
	1528.10	0.28	4.53E+00		1.68E+01
Eu-154	123.07	40.40	-1.27E-02	8.01E-02	8.01E-02
	247.93	6.89	1.58E-01		5.05E-01
	591.76	4.95	9.32E-03		7.39E-01
	692.42	1.78	-1.58E+00		2.29E+00
	723.30	20.06	1.28E-01		2.70E-01
	756.80	4.52	6.49E-01		1.11E+00
	873.18	12.08	2.67E-01		4.34E-01

Analysis Report for 21-Nov-19-10026

L1-10203B-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-7.73E-02	8.01E-02	4.56E-01
	1004.76	18.01	1.54E-01		3.04E-01
	1274.43	34.80	-9.83E-04		1.73E-01
	1596.48	1.80	-1.05E+00		2.53E+00
Eu-155	45.30	1.31	-4.14E-02	1.90E-01	1.20E+01
	60.01	1.22	1.76E+00		1.28E+01
	86.55	30.70	3.93E-03		1.90E-01
	105.31	21.10	5.83E-02		2.01E-01
Ra-226	186.21	3.64	5.71E-01	9.76E-01	9.76E-01
Pa-231	27.36	10.30	1.58E+00	1.46E+00	1.50E+00
	283.69	1.70	-9.94E-01		1.95E+00
	300.07	2.47	7.88E-01		1.46E+00
	302.65	2.20	1.15E-01		1.52E+00
	330.06	1.40	9.51E-01		2.90E+00
U-235	143.76	10.96	1.69E-01	6.20E-02	3.51E-01
	163.33	5.08	1.24E-01		6.32E-01
	185.71	57.20	3.57E-02		6.20E-02
	202.11	1.08	1.07E+00		2.86E+00
	205.31	5.01	-5.04E-01		5.85E-01
Am-241	59.54	35.90	-1.72E-01	4.37E-01	4.37E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10027

L1-10203B-FSGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10027
Sample Description	: L1-10203B-FSGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.578E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:30:00AM
Acquisition Started	: 11/21/2019 10:57:15AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81500
Fill Height	: 1577.95 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 11:12:19AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10027

L1-10203B-FSGS-016SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.18	740 -	751	745.46	3.07E+01	12.24	4.73E+01	0.73
2	238.62	947 -	961	954.95	1.27E+02	18.83	7.76E+01	0.91
3	295.35	1177 -	1187	1181.62	2.68E+01	9.08	2.32E+01	0.36
4	338.22	1346 -	1360	1352.91	4.79E+01	10.19	1.91E+01	1.04
5	351.98	1402 -	1413	1407.89	7.32E+01	10.84	1.78E+01	1.13
6	583.22	2326 -	2339	2332.21	4.19E+01	8.83	1.31E+01	0.52
7	609.30	2429 -	2443	2436.49	5.88E+01	9.55	1.13E+01	1.46
8	910.97	3637 -	3650	3642.91	3.35E+01	7.94	1.05E+01	0.55
9	1460.65	5830 -	5854	5842.99	3.15E+02	18.10	3.11E+00	1.25

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.53E+00	4.71E-01
Tl-208	1.00	583.19	*	85.00	5.95E-02	1.31E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.98E-01	3.34E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.60E-01	2.78E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 21-Nov-19-10027

L1-10203B-FSGS-016SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.11E-01	3.86E-02
		351.93	*	35.60	1.77E-01	2.98E-02
		785.96		1.06		
Ra-226	1.00	186.21	*	3.64	5.13E-01	2.09E-01
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.56E-01	8.11E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.10E-01	5.06E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.97	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.27E-02	1.33E-02
		202.11		1.08		
		205.31		5.01		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10027

L1-10203B-FSGS-016SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.996	6.53E+00	4.71E-01	
	Tl-208	1.000	5.95E-02	1.31E-02	
X	Bi-211	0.877			
	Pb-212	1.000	1.98E-01	3.34E-02	
	Bi-214	1.000	1.60E-01	2.78E-02	
	Pb-214	0.999	1.52E-01	2.36E-02	
?	Ra-226	1.000	5.13E-01	2.09E-01	
	Ac-228	0.997	2.51E-01	4.29E-02	
?	U-235	0.975	3.27E-02	1.33E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10027

L1-10203B-FSGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 11:12:19AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.12E-02	5.73E-02	5.73E-02
	BE-7	477.60		10.44	-1.76E-01	3.78E-01	3.78E-01
+	K-40	1460.82	*	10.66	6.53E+00	3.12E-01	3.12E-01
	Mn-54	834.85		99.98	1.67E-02	4.39E-02	4.39E-02
	Co-60	1173.23		99.85	-7.38E-03	4.56E-02	5.64E-02
		1332.49		99.98	-2.30E-02		4.56E-02
	Nb-94	702.65		99.81	-8.85E-03	4.10E-02	4.10E-02
		871.09		99.89	-1.11E-02		4.58E-02
	Ag-108m	79.13		6.60	6.98E-02	4.04E-02	1.52E+00
		433.94		90.50	7.22E-03		4.04E-02
		614.28		89.80	-1.08E-02		6.44E-02
		722.94		90.80	5.32E-02		5.42E-02
	Sb-125	176.31		6.84	4.80E-02	1.32E-01	4.96E-01
		380.45		1.52	1.50E-01		2.36E+00
		427.87		29.60	8.41E-02		1.32E-01
		463.36		10.49	3.70E-01		3.90E-01
		600.60		17.65	-2.95E-01		2.24E-01
		606.71		4.98	1.81E+00		1.25E+00
		635.95		11.22	-1.37E-01		3.47E-01

Analysis Report for 21-Nov-19-10027

L1-10203B-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.44E+00	1.32E-01	2.19E+00
Ba-133	79.61	2.65	9.24E-02	6.77E-02	3.64E+00
	81.00	32.90	-2.24E-01		2.49E-01
	276.40	7.16	5.14E-02		4.56E-01
	302.85	18.34	1.69E-01		1.88E-01
	356.01	62.05	-5.91E-02		6.77E-02
	383.85	8.94	6.15E-02		3.97E-01
Cs-134	475.36	1.48	-6.48E-01	5.20E-02	2.51E+00
	563.25	8.34	-3.47E-01		4.54E-01
	569.33	15.37	1.37E-01		2.69E-01
	604.72	97.62	4.93E-03		6.13E-02
	795.86	85.46	2.73E-02		5.20E-02
	801.95	8.69	-9.90E-01		4.84E-01
	1038.61	0.99	-1.76E+00		4.61E+00
	1167.97	1.79	1.11E+00		3.44E+00
	1365.19	3.02	-2.90E-01		1.58E+00
Cs-137	661.66	85.10	4.31E-02	5.40E-02	5.40E-02
Eu-152	121.78	28.67	-3.09E-02	1.21E-01	1.21E-01
	244.70	7.61	1.83E-01		5.38E-01
	295.94	0.45	6.87E+00		8.90E+00
	344.28	26.60	-6.96E-02		1.28E-01
	367.79	0.86	-1.59E+00		3.96E+00
	411.12	2.24	6.50E-01		1.58E+00
	443.96	2.83	3.64E-01		1.24E+00
	488.68	0.42	-3.42E+00		7.89E+00
	563.99	0.49	1.91E+00		8.08E+00
	586.26	0.46	8.63E+00		1.23E+01
	678.62	0.47	9.89E-01		7.73E+00
	688.67	0.86	-3.27E+00		4.71E+00
	719.35	0.28	-1.42E+01		1.33E+01
	778.90	12.96	-3.07E-01		3.38E-01
	810.45	0.32	1.94E+00		1.30E+01
	867.37	4.26	-1.33E+00		1.00E+00
	919.33	0.43	1.72E+00		9.85E+00
	964.08	14.65	3.90E-01		4.52E-01
	1085.87	10.24	-3.66E-01		4.01E-01
	1089.74	1.73	-5.77E-01		2.61E+00
	1112.07	13.69	-9.55E-03		4.03E-01
	1212.95	1.43	3.30E-01		4.37E+00
	1249.94	0.19	3.67E+00		3.10E+01
	1299.14	1.63	-1.44E+00		3.24E+00
	1408.01	21.07	9.99E-02		2.32E-01
	1457.64	0.50	1.37E+02		3.91E+01
	1528.10	0.28	-1.48E+01		1.01E+01
Eu-154	123.07	40.40	2.51E-02	8.77E-02	8.77E-02
	247.93	6.89	-3.78E-01		4.84E-01
	591.76	4.95	8.01E-01		9.31E-01
	692.42	1.78	-3.56E-01		2.38E+00
	723.30	20.06	2.48E-01		2.48E-01
	756.80	4.52	5.22E-01		1.03E+00
	873.18	12.08	1.68E-01		3.90E-01

Analysis Report for 21-Nov-19-10027

L1-10203B-FSGS-016SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	2.66E-01	8.77E-02	4.70E-01
		1004.76		18.01	3.28E-02		2.43E-01
		1274.43		34.80	9.39E-02		1.46E-01
		1596.48		1.80	2.73E-01		2.38E+00
	Eu-155	45.30		1.31	7.80E+00	2.12E-01	1.92E+01
		60.01		1.22	2.94E+00		2.03E+01
		86.55		30.70	8.96E-02		2.37E-01
		105.31		21.10	-4.93E-02		2.12E-01
+	Ra-226	186.21	*	3.64	5.13E-01	6.66E-01	6.66E-01
	Pa-231	27.36		10.30	2.17E+00	1.49E+00	2.21E+00
		283.69		1.70	-2.63E-01		1.81E+00
		300.07		2.47	6.47E-01		1.49E+00
		302.65		2.20	7.86E-01		1.55E+00
		330.06		1.40	1.58E+00		2.72E+00
+	U-235	143.76		10.96	-1.42E-01	4.24E-02	3.52E-01
		163.33		5.08	-3.84E-01		6.55E-01
		185.71	*	57.20	3.27E-02		4.24E-02
		202.11		1.08	-8.55E-01		3.17E+00
		205.31		5.01	-5.07E-01		6.80E-01
	Am-241	59.54		35.90	-1.22E-01	7.06E-01	7.06E-01

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10028

L1-10203B-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10028
Sample Description	: L1-10203B-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.582E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:32:00AM
Acquisition Started	: 11/21/2019 11:16:57AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81501
Fill Height	: 1581.90 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 11:32:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Date Validated

1530 11-21-19

Analysis Report for 21-Nov-19-10028

L1-10203B-FSGS-017SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.68	473 -	481	477.54	1.54E+02	21.00	1.30E+02	1.13
2	295.34	587 -	593	590.73	5.94E+01	12.04	4.56E+01	1.20
3	351.96	700 -	708	703.87	1.16E+02	15.09	5.20E+01	1.17
4	583.20	1160 -	1170	1166.01	7.29E+01	11.64	2.61E+01	1.42
5	609.25	1212 -	1221	1218.07	8.37E+01	12.14	2.83E+01	1.01
6	910.96	1818 -	1827	1821.36	5.37E+01	8.92	1.13E+01	1.66
7	1460.41	2915 -	2928	2920.88	4.25E+02	20.98	5.95E+00	1.89

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.82	*	10.66	7.92E+00	5.20E-01
Tl-208	1.00	583.19	*	85.00	9.32E-02	1.59E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.15E-01	3.40E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.06E-01	3.23E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 21-Nov-19-10028

L1-10203B-FSGS-017SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.21E-01	4.82E-02
		351.93	*	35.60	2.53E-01	3.86E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.03E-01	5.20E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 21-Nov-19-10028

L1-10203B-FSGS-017SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.973	7.92E+00	5.20E-01	
	Tl-208	1.000	9.32E-02	1.59E-02	
X	Bi-211	0.880			
	Pb-212	1.000	2.15E-01	3.40E-02	
	Bi-214	1.000	2.06E-01	3.23E-02	
	Pb-214	0.999	2.40E-01	3.01E-02	
	Ac-228	0.997	3.03E-01	5.20E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10028

L1-10203B-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 11:32:00AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.48E-02	5.17E-02	5.17E-02
	BE-7	477.60		10.44	1.22E-01	3.65E-01	3.65E-01
+	K-40	1460.82	*	10.66	7.92E+00	2.98E-01	2.98E-01
	Mn-54	834.85		99.98	1.28E-02	4.08E-02	4.08E-02
	Co-60	1173.23		99.85	1.25E-02	4.99E-02	5.94E-02
		1332.49		99.98	2.38E-02		4.99E-02
	Nb-94	702.65		99.81	9.16E-03	3.36E-02	4.23E-02
		871.09		99.89	-2.69E-02		3.36E-02
	Ag-108m	79.13		6.60	4.43E-01	3.92E-02	1.23E+00
		433.94		90.50	3.44E-02		3.92E-02
		614.28		89.80	-1.27E-01		5.39E-02
		722.94		90.80	-1.09E-02		4.42E-02
	Sb-125	176.31		6.84	-1.57E-02	8.99E-02	5.20E-01
		380.45		1.52	2.94E-01		2.09E+00
		427.87		29.60	-6.13E-02		8.99E-02
		463.36		10.49	3.37E-01		3.96E-01
		600.60		17.65	5.14E-03		2.11E-01
		606.71		4.98	1.84E+00		1.30E+00
		635.95		11.22	2.11E-01		3.37E-01

Analysis Report for 21-Nov-19-10028

L1-10203B-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.26E-01	8.99E-02	1.97E+00
Ba-133	79.61	2.65	1.44E-01	7.81E-02	2.86E+00
	81.00	32.90	-2.44E-01		1.92E-01
	276.40	7.16	-2.97E-01		4.71E-01
	302.85	18.34	6.16E-02		1.89E-01
	356.01	62.05	-3.85E-02		7.81E-02
	383.85	8.94	-9.48E-02		3.48E-01
Cs-134	475.36	1.48	-3.72E-01	4.19E-02	2.54E+00
	563.25	8.34	1.38E-01		4.65E-01
	569.33	15.37	-3.14E-02		2.26E-01
	604.72	97.62	1.70E-03		5.94E-02
	795.86	85.46	-1.66E-02		4.19E-02
	801.95	8.69	-1.17E-02		4.22E-01
	1038.61	0.99	7.62E-01		4.67E+00
	1167.97	1.79	-7.42E-01		3.13E+00
	1365.19	3.02	7.24E-01		1.62E+00
Cs-137	661.66	85.10	1.45E-02	4.92E-02	4.92E-02
Eu-152	121.78	28.67	-2.11E-02	1.13E-01	1.13E-01
	244.70	7.61	1.27E-02		4.82E-01
	295.94	0.45	4.30E+00		9.20E+00
	344.28	26.60	-1.03E-01		1.31E-01
	367.79	0.86	-1.14E+00		3.57E+00
	411.12	2.24	6.00E-01		1.60E+00
	443.96	2.83	1.84E-01		1.15E+00
	488.68	0.42	4.46E+00		8.24E+00
	563.99	0.49	2.64E+00		7.67E+00
	586.26	0.46	-5.01E+00		1.28E+01
	678.62	0.47	-5.19E+00		6.96E+00
	688.67	0.86	3.08E+00		4.90E+00
	719.35	0.28	-4.90E+00		1.34E+01
	778.90	12.96	1.05E-02		2.82E-01
	810.45	0.32	5.82E+00		1.13E+01
	867.37	4.26	-5.47E-01		8.39E-01
	919.33	0.43	-4.02E+00		9.20E+00
	964.08	14.65	-8.62E-03		4.06E-01
	1085.87	10.24	-1.65E-01		4.84E-01
	1089.74	1.73	-1.94E-01		2.87E+00
	1112.07	13.69	-3.82E-01		2.94E-01
	1212.95	1.43	-1.24E+00		4.02E+00
	1249.94	0.19	-6.97E-01		2.53E+01
	1299.14	1.63	-1.70E+00		2.27E+00
	1408.01	21.07	7.69E-03		2.08E-01
	1457.64	0.50	-1.39E+01		4.07E+01
	1528.10	0.28	5.46E+00		1.31E+01
Eu-154	123.07	40.40	1.02E-02	8.28E-02	8.28E-02
	247.93	6.89	8.53E-02		4.65E-01
	591.76	4.95	1.55E-01		7.78E-01
	692.42	1.78	1.20E+00		2.38E+00
	723.30	20.06	1.53E-02		2.10E-01
	756.80	4.52	-8.15E-02		8.44E-01
	873.18	12.08	1.02E-01		3.15E-01

Analysis Report for 21-Nov-19-10028

L1-10203B-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-8.28E-02	8.28E-02	3.88E-01
	1004.76	18.01	2.16E-01		2.80E-01
	1274.43	34.80	-2.47E-03		1.31E-01
	1596.48	1.80	-1.58E+00		1.73E+00
Eu-155	45.30	1.31	8.50E-01	1.92E-01	1.23E+01
	60.01	1.22	-5.85E+00		1.28E+01
	86.55	30.70	7.52E-02		1.92E-01
	105.31	21.10	6.72E-02		1.95E-01
Ra-226	186.21	3.64	5.44E-01	1.05E+00	1.05E+00
Pa-231	27.36	10.30	1.06E+00	1.25E+00	1.25E+00
	283.69	1.70	4.13E-01		1.94E+00
	300.07	2.47	-1.85E+00		1.40E+00
	302.65	2.20	5.13E-01		1.57E+00
	330.06	1.40	2.00E+00		2.49E+00
U-235	143.76	10.96	1.05E-01	6.57E-02	2.99E-01
	163.33	5.08	-1.34E-01		7.01E-01
	185.71	57.20	9.83E-03		6.57E-02
	202.11	1.08	-1.03E+00		3.15E+00
	205.31	5.01	-1.35E-01		6.98E-01
Am-241	59.54	35.90	-2.21E-01	4.40E-01	4.40E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 23-Nov-19-10028

L1-10203B-FSGS-004SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 23-Nov-19-10028
Sample Description	: L1-10203B-FSGS-004SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.484E+03 grams
Facility	: Default
Sample Taken On	: 11/22/2019 9:25:00AM
Acquisition Started	: 11/23/2019 10:19:38AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/23/2019
Efficiency Calibration Description	:
Sample Number	: 81585
Fill Height	: 1483.95 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/23/2019 10:34:47AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 11-24-19

Analysis Report for 23-Nov-19-10028

L1-10203B-FSGS-004SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.87	949 -	960	955.06	1.43E+02	17.04	5.86E+01	1.00
2	295.39	1175 -	1188	1180.85	5.37E+01	10.63	2.13E+01	0.92
3	351.86	1399 -	1414	1406.46	1.13E+02	13.52	2.35E+01	0.61
4	609.23	2427 -	2442	2434.98	7.22E+01	11.73	2.18E+01	1.53
5	910.55	3635 -	3647	3639.65	3.17E+01	7.79	1.03E+01	0.43
6	1460.11	5825 -	5850	5838.37	3.40E+02	18.80	3.25E+00	1.72

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.92	1460.82	*	10.66	7.69E+00	5.41E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.29E-01	3.29E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.11E-01	3.65E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		

Analysis Report for 23-Nov-19-10028

L1-10203B-FSGS-004SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.31E-01	4.93E-02
		351.93	*	35.60	2.85E-01	4.11E-02
		785.96		1.06		
Ac-228	0.97	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.14E-01	5.36E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments

Analysis Report for 23-Nov-19-10028

L1-10203B-FSGS-004SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.922	7.69E+00	5.41E-01	
X	Bi-211	0.905			
	Pb-212	0.992	2.29E-01	3.29E-02	
	Bi-214	1.000	2.11E-01	3.65E-02	
	Pb-214	0.998	2.63E-01	3.16E-02	
	Ac-228	0.979	2.14E-01	5.36E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 23-Nov-19-10028

L1-10203B-FSGS-004SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/23/2019 10:34:47AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	1.48E-02	5.26E-02	5.26E-02
	BE-7	477.60		10.44	1.10E-02	3.61E-01	3.61E-01
+	K-40	1460.82	*	10.66	7.69E+00	3.51E-01	3.51E-01
	Mn-54	834.85		99.98	-2.02E-02	4.35E-02	4.35E-02
	Co-60	1173.23		99.85	-3.73E-02	5.82E-02	5.95E-02
		1332.49		99.98	3.78E-02		5.82E-02
	Nb-94	702.65		99.81	3.85E-02	3.53E-02	4.64E-02
		871.09		99.89	2.37E-02		3.53E-02
	Ag-108m	79.13		6.60	8.22E-01	4.10E-02	1.28E+00
		433.94		90.50	-1.46E-02		4.10E-02
		614.28		89.80	-7.06E-03		6.18E-02
		722.94		90.80	1.87E-02		5.20E-02
	Sb-125	176.31		6.84	3.64E-01	1.33E-01	4.37E-01
		380.45		1.52	-5.25E-01		2.54E+00
		427.87		29.60	7.87E-02		1.33E-01
		463.36		10.49	2.31E-01		4.09E-01
		600.60		17.65	1.24E-01		2.48E-01
		606.71		4.98	2.10E+00		1.48E+00
		635.95		11.22	7.93E-02		3.33E-01

Analysis Report for 23-Nov-19-10028

L1-10203B-FSGS-004SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-8.73E-01	1.33E-01	2.24E+00
Ba-133	79.61	2.65	8.68E-01	6.51E-02	3.04E+00
	81.00	32.90	-4.39E-01		1.94E-01
	276.40	7.16	2.07E-01		4.98E-01
	302.85	18.34	8.17E-02		2.07E-01
	356.01	62.05	-3.13E-02		6.51E-02
	383.85	8.94	3.44E-01		4.59E-01
Cs-134	475.36	1.48	2.22E-01	5.68E-02	2.65E+00
	563.25	8.34	-4.70E-01		4.34E-01
	569.33	15.37	1.03E-01		2.44E-01
	604.72	97.62	-1.66E-02		6.69E-02
	795.86	85.46	1.34E-02		5.68E-02
	801.95	8.69	-8.71E-01		5.29E-01
	1038.61	0.99	-1.18E-01		5.18E+00
	1167.97	1.79	-3.88E-01		3.69E+00
	1365.19	3.02	6.56E-01		1.53E+00
Cs-137	661.66	85.10	6.19E-02	6.46E-02	6.46E-02
Eu-152	121.78	28.67	-4.32E-02	1.24E-01	1.24E-01
	244.70	7.61	3.85E-01		5.06E-01
	295.94	0.45	3.21E+00		9.21E+00
	344.28	26.60	5.49E-02		1.31E-01
	367.79	0.86	-1.11E+00		3.75E+00
	411.12	2.24	5.22E-01		1.78E+00
	443.96	2.83	-3.37E-01		1.19E+00
	488.68	0.42	-9.94E-01		8.59E+00
	563.99	0.49	-4.43E+00		6.89E+00
	586.26	0.46	1.16E+01		1.30E+01
	678.62	0.47	-3.81E+00		8.14E+00
	688.67	0.86	3.28E+00		5.52E+00
	719.35	0.28	1.33E-01		1.58E+01
	778.90	12.96	-1.92E-01		3.31E-01
	810.45	0.32	-2.25E+00		1.49E+01
	867.37	4.26	-2.50E-01		9.20E-01
	919.33	0.43	-8.43E-01		1.20E+01
	964.08	14.65	1.82E-01		4.81E-01
	1085.87	10.24	1.97E-01		4.87E-01
	1089.74	1.73	1.71E-01		3.06E+00
	1112.07	13.69	-2.05E-01		4.12E-01
	1212.95	1.43	2.89E+00		5.14E+00
	1249.94	0.19	9.12E+00		3.06E+01
	1299.14	1.63	-3.03E-01		3.52E+00
	1408.01	21.07	-6.68E-02		1.92E-01
	1457.64	0.50	1.67E+02		4.43E+01
	1528.10	0.28	-7.76E-01		1.30E+01
Eu-154	123.07	40.40	8.79E-03	8.86E-02	8.86E-02
	247.93	6.89	-5.21E-01		4.30E-01
	591.76	4.95	8.75E-02		8.33E-01
	692.42	1.78	-1.97E-01		2.58E+00
	723.30	20.06	9.11E-02		2.39E-01
	756.80	4.52	2.16E-01		1.05E+00
	873.18	12.08	-9.12E-02		3.10E-01

Analysis Report for 23-Nov-19-10028

L1-10203B-FSGS-004SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-8.15E-02	8.86E-02	4.85E-01
	1004.76	18.01	2.54E-01		3.07E-01
	1274.43	34.80	9.13E-02		1.91E-01
	1596.48	1.80	6.12E-01		2.37E+00
Eu-155	45.30	1.31	-2.18E+00	1.84E-01	1.09E+01
	60.01	1.22	4.82E+00		1.38E+01
	86.55	30.70	9.63E-02		1.94E-01
	105.31	21.10	-7.89E-02		1.84E-01
Ra-226	186.21	3.64	2.97E-01	9.55E-01	9.55E-01
Pa-231	27.36	10.30	1.30E+00	1.40E+00	1.40E+00
	283.69	1.70	-1.48E+00		1.92E+00
	300.07	2.47	4.72E-01		1.54E+00
	302.65	2.20	1.36E+00		1.75E+00
	330.06	1.40	1.81E+00		2.83E+00
U-235	143.76	10.96	8.67E-02	6.16E-02	3.21E-01
	163.33	5.08	2.59E-01		6.38E-01
	185.71	57.20	4.04E-02		6.16E-02
	202.11	1.08	-1.26E+00		2.64E+00
	205.31	5.01	-6.04E-01		6.34E-01
Am-241	59.54	35.90	1.20E-01	4.78E-01	4.78E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 25-Nov-19-10002

L1-10203B-FSGS-004SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 25-Nov-19-10002
Sample Description	: L1-10203B-FSGS-004SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.484E+03 grams
Facility	: Default
Sample Taken On	: 11/22/2019 9:25:00AM
Acquisition Started	: 11/25/2019 6:33:39AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1802.8 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/25/2019
Efficiency Calibration Description	:
Sample Number	: 81599
Fill Height	: 1483.95 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/25/2019 7:03:45AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated
1500 11-25-19

Analysis Report for 25-Nov-19-10002

L1-10203B-FSGS-004SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	209.13	832 -	840	836.71	2.49E+01	14.44	8.61E+01	0.54
2	238.63	951 -	960	954.61	2.18E+02	21.50	1.03E+02	0.87
3	295.25	1176 -	1189	1180.90	1.11E+02	18.02	7.75E+01	1.17
4	338.36	1346 -	1358	1353.20	5.93E+01	14.90	6.17E+01	0.73
5	351.90	1401 -	1416	1407.33	1.74E+02	19.72	7.15E+01	1.02
6	511.14	2036 -	2051	2043.89	6.15E+01	15.27	5.65E+01	1.15
7	583.28	2323 -	2338	2332.34	8.90E+01	13.64	3.20E+01	0.76
8	609.35	2429 -	2444	2436.55	1.50E+02	15.09	2.58E+01	1.35
9	911.39	3637 -	3654	3644.51	8.80E+01	11.50	1.40E+01	1.17
10	969.34	3868 -	3882	3876.32	4.66E+01	8.58	9.38E+00	0.29
11	1120.28	4474 -	4486	4480.24	2.90E+01	7.97	1.30E+01	0.45
12	1460.97	5831 -	5855	5843.72	5.89E+02	24.79	6.25E+00	2.02

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	4.17E-02	1.07E-02
K-40	0.99	1460.82	*	10.66	7.41E+00	4.48E-01
Tl-208	0.99	583.19	*	85.00	7.48E-02	1.23E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.96E-01	2.50E-02

Analysis Report for 25-Nov-19-10002

L1-10203B-FSGS-004SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	1.00	300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.43E-01	2.85E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.16E-01	6.02E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.65E-01	4.81E-02
		351.93	*	35.60	2.46E-01	3.40E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25	*	3.89	2.36E-01	1.38E-01
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.56E-01	6.78E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.31E-01	4.55E-02
		964.77		4.99		
		968.97	*	15.80	2.98E-01	5.65E-02
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 25-Nov-19-10002

L1-10203B-FSGS-004SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.997	4.17E-02	1.07E-02	
	K-40	0.996	7.41E+00	4.48E-01	
	Tl-208	0.999	7.48E-02	1.23E-02	
X	Bi-211	0.896			
	Pb-212	1.000	1.96E-01	2.50E-02	
	Bi-214	1.000	2.38E-01	2.57E-02	
	Pb-214	1.000	2.52E-01	2.78E-02	
	Ac-228	0.994	3.01E-01	3.06E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 25-Nov-19-10002

L1-10203B-FSGS-004SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/25/2019 7:03:45AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	4.17E-02	3.21E-02	3.21E-02
	BE-7	477.60		10.44	-1.81E-02	2.84E-01	2.84E-01
+	K-40	1460.82	*	10.66	7.41E+00	2.53E-01	2.53E-01
	Mn-54	834.85		99.98	3.27E-02	3.70E-02	3.70E-02
	Co-60	1173.23		99.85	4.21E-02	4.25E-02	5.30E-02
		1332.49		99.98	1.97E-02		4.25E-02
	Nb-94	702.65		99.81	-1.78E-02	3.18E-02	3.18E-02
		871.09		99.89	-2.64E-03		3.79E-02
	Ag-108m	79.13		6.60	2.76E-02	3.26E-02	1.37E+00
		433.94		90.50	-3.86E-03		3.26E-02
		614.28		89.80	-1.75E-02		4.92E-02
		722.94		90.80	3.20E-02		3.89E-02
	Sb-125	176.31		6.84	3.07E-02	9.50E-02	4.29E-01
		380.45		1.52	1.32E+00		1.87E+00
		427.87		29.60	-7.20E-02		9.50E-02
		463.36		10.49	-1.04E-01		2.88E-01
		600.60		17.65	-2.36E-02		1.76E-01
		606.71		4.98	2.43E+00		1.08E+00
		635.95		11.22	-1.63E-01		2.60E-01

Analysis Report for 25-Nov-19-10002

L1-10203B-FSGS-004SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-6.21E-01	9.50E-02	1.76E+00
Ba-133	79.61	2.65	-1.24E+00	6.22E-02	3.24E+00
	81.00	32.90	-4.63E-01		2.24E-01
	276.40	7.16	4.03E-02		3.81E-01
	302.85	18.34	8.48E-02		1.53E-01
	356.01	62.05	1.23E-02		6.22E-02
	383.85	8.94	3.95E-02		3.07E-01
Cs-134	475.36	1.48	1.08E+00	4.18E-02	1.87E+00
	563.25	8.34	1.57E-01		3.82E-01
	569.33	15.37	-1.10E-01		1.95E-01
	604.72	97.62	-1.60E-02		4.87E-02
	795.86	85.46	9.57E-03		4.18E-02
	801.95	8.69	2.38E-01		3.90E-01
	1038.61	0.99	-1.17E+00		3.87E+00
	1167.97	1.79	-1.19E+00		2.81E+00
	1365.19	3.02	-5.20E-01		1.03E+00
Cs-137	661.66	85.10	6.27E-02	4.91E-02	4.91E-02
Eu-152	121.78	28.67	-6.87E-02	1.09E-01	1.14E-01
	244.70	7.61	5.68E-02		4.37E-01
	295.94	0.45	9.14E+00		8.09E+00
	344.28	26.60	2.01E-02		1.09E-01
	367.79	0.86	-1.50E-02		3.28E+00
	411.12	2.24	9.47E-02		1.27E+00
	443.96	2.83	9.50E-02		1.08E+00
	488.68	0.42	1.09E+00		7.49E+00
	563.99	0.49	2.33E+00		6.36E+00
	586.26	0.46	-7.22E+00		9.74E+00
	678.62	0.47	-3.78E+00		6.46E+00
	688.67	0.86	1.66E+00		4.12E+00
	719.35	0.28	3.08E+00		1.05E+01
	778.90	12.96	-9.95E-02		2.60E-01
	810.45	0.32	6.10E+00		1.01E+01
	867.37	4.26	-4.10E-01		8.93E-01
	919.33	0.43	-2.60E+00		7.31E+00
	964.08	14.65	-1.17E-02		3.31E-01
	1085.87	10.24	-1.58E-02		3.96E-01
	1089.74	1.73	9.64E-01		2.45E+00
	1112.07	13.69	5.88E-02		3.04E-01
	1212.95	1.43	-2.57E-01		3.79E+00
	1249.94	0.19	3.34E+00		2.58E+01
	1299.14	1.63	6.92E-01		2.24E+00
	1408.01	21.07	-1.07E-01		1.33E-01
	1457.64	0.50	1.56E+02		3.21E+01
	1528.10	0.28	-8.62E-01		9.61E+00
Eu-154	123.07	40.40	-2.41E-02	8.23E-02	8.23E-02
	247.93	6.89	-1.26E-02		4.23E-01
	591.76	4.95	-1.41E-01		5.98E-01
	692.42	1.78	-1.65E+00		1.89E+00
	723.30	20.06	1.29E-01		1.79E-01
	756.80	4.52	-3.09E-02		7.26E-01
	873.18	12.08	-1.13E-01		3.09E-01

Analysis Report for 25-Nov-19-10002

L1-10203B-FSGS-004SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.20E-01	8.23E-02	3.48E-01
	1004.76	18.01	-1.64E-01		1.78E-01
	1274.43	34.80	-1.16E-01		1.34E-01
	1596.48	1.80	-1.51E-01		1.90E+00
Eu-155	45.30	1.31	1.23E+01	1.95E-01	2.34E+01
	60.01	1.22	-8.62E+00		2.37E+01
	86.55	30.70	1.84E-03		1.98E-01
	105.31	21.10	-6.26E-02		1.95E-01
Ra-226	186.21	3.64	2.97E-01	8.43E-01	8.43E-01
Pa-231	27.36	10.30	1.29E+00	1.19E+00	2.42E+00
	283.69	1.70	2.06E-01		1.63E+00
	300.07	2.47	-2.80E-01		1.19E+00
	302.65	2.20	5.60E-01		1.27E+00
	330.06	1.40	7.23E-01		2.09E+00
U-235	143.76	10.96	-2.28E-01	5.35E-02	2.93E-01
	163.33	5.08	5.25E-01		6.06E-01
	185.71	57.20	3.80E-02		5.35E-02
	202.11	1.08	-1.49E-01		2.57E+00
	205.31	5.01	-1.17E-01		5.46E-01
Am-241	59.54	35.90	-3.91E-01	8.32E-01	8.32E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
\> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 23-Nov-19-10029

L1-10203B-FSGS-008SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 23-Nov-19-10029
Sample Description	: L1-10203B-FSGS-008SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.650E+03 grams
Facility	: Default
Sample Taken On	: 11/22/2019 9:35:00AM
Acquisition Started	: 11/23/2019 10:19:45AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/23/2019
Efficiency Calibration Description	:
Sample Number	: 81586
Fill Height	: 1649.95 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/23/2019 10:34:47AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated
0830 11-24-19

Analysis Report for 23-Nov-19-10029

L1-10203B-FSGS-008SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.61	949 -	961	954.92	1.12E+02	18.03	7.94E+01	1.15
2	295.29	1175 -	1188	1181.40	5.08E+01	11.69	3.12E+01	0.51
3	338.39	1346 -	1359	1353.62	3.97E+01	9.65	1.93E+01	1.11
4	351.98	1399 -	1414	1407.93	1.04E+02	12.53	1.76E+01	1.07
5	583.08	2327 -	2340	2331.65	4.75E+01	9.84	1.75E+01	0.76
6	609.47	2428 -	2445	2437.16	9.85E+01	10.64	4.50E+00	1.24
7	1460.70	5831 -	5854	5843.16	3.20E+02	18.53	5.88E+00	1.64

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.57E+00	4.75E-01
Tl-208	0.99	583.19	*	85.00	6.69E-02	1.44E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.73E-01	3.12E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.67E-01	3.30E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 23-Nov-19-10029

L1-10203B-FSGS-008SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.09E-01	5.08E-02
		351.93	*	35.60	2.51E-01	3.61E-02
		785.96		1.06		
Ac-228	0.57	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.93E-01	7.51E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 23-Nov-19-10029

L1-10203B-FSGS-008SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	6.57E+00	4.75E-01	
	Tl-208	0.998	6.69E-02	1.44E-02	
X	Bi-211	0.875			
	Pb-212	1.000	1.73E-01	3.12E-02	
	Bi-214	0.998	2.67E-01	3.30E-02	
	Pb-214	1.000	2.36E-01	2.95E-02	
	Ac-228	0.571	2.93E-01	7.51E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 23-Nov-19-10029

L1-10203B-FSGS-008SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/23/2019 10:34:47AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.68E-02	5.00E-02	5.00E-02
	BE-7	477.60		10.44	-8.62E-02	3.71E-01	3.71E-01
+	K-40	1460.82	*	10.66	6.57E+00	3.95E-01	3.95E-01
	Mn-54	834.85		99.98	5.70E-03	4.61E-02	4.61E-02
	Co-60	1173.23		99.85	-3.78E-02	5.19E-02	5.82E-02
		1332.49		99.98	2.90E-02		5.19E-02
	Nb-94	702.65		99.81	-2.10E-02	4.06E-02	4.06E-02
		871.09		99.89	-1.05E-02		4.53E-02
	Ag-108m	79.13		6.60	2.93E-01	3.89E-02	1.65E+00
		433.94		90.50	-1.40E-02		3.89E-02
		614.28		89.80	3.66E-03		7.79E-02
		722.94		90.80	-1.40E-02		5.42E-02
	Sb-125	176.31		6.84	2.43E-02	1.18E-01	5.00E-01
		380.45		1.52	2.71E-01		2.25E+00
		427.87		29.60	2.69E-02		1.18E-01
		463.36		10.49	-6.89E-02		3.68E-01
		600.60		17.65	-5.90E-02		2.13E-01
		606.71		4.98	1.92E+00		1.38E+00
		635.95		11.22	-7.37E-02		3.34E-01

Analysis Report for 23-Nov-19-10029

L1-10203B-FSGS-008SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.65E-01	1.18E-01	2.17E+00
Ba-133	79.61	2.65	7.07E-01	8.14E-02	4.02E+00
	81.00	32.90	-2.60E-01		2.81E-01
	276.40	7.16	2.42E-01		5.04E-01
	302.85	18.34	9.71E-02		2.02E-01
	356.01	62.05	-3.12E-03		8.14E-02
	383.85	8.94	3.16E-02		3.74E-01
Cs-134	475.36	1.48	-8.11E-01	4.85E-02	2.43E+00
	563.25	8.34	-1.37E-02		4.33E-01
	569.33	15.37	2.01E-01		2.61E-01
	604.72	97.62	-1.41E-03		6.48E-02
	795.86	85.46	1.80E-02		4.85E-02
	801.95	8.69	-2.12E-01		4.87E-01
	1038.61	0.99	-5.24E+00		5.44E+00
	1167.97	1.79	-1.42E-02		3.28E+00
	1365.19	3.02	1.10E+00		1.52E+00
Cs-137	661.66	85.10	4.24E-02	5.02E-02	5.02E-02
Eu-152	121.78	28.67	6.58E-02	1.26E-01	1.44E-01
	244.70	7.61	1.12E-01		5.13E-01
	295.94	0.45	2.18E-02		9.67E+00
	344.28	26.60	-6.42E-03		1.26E-01
	367.79	0.86	-6.73E-01		3.76E+00
	411.12	2.24	1.21E-01		1.63E+00
	443.96	2.83	2.47E-01		1.25E+00
	488.68	0.42	3.01E+00		8.13E+00
	563.99	0.49	2.64E+00		7.45E+00
	586.26	0.46	1.56E+01		1.22E+01
	678.62	0.47	-4.06E+00		8.16E+00
	688.67	0.86	2.69E-01		5.55E+00
	719.35	0.28	6.42E+00		1.67E+01
	778.90	12.96	-7.80E-02		3.70E-01
	810.45	0.32	-6.91E+00		1.26E+01
	867.37	4.26	-1.28E+00		1.01E+00
	919.33	0.43	-2.10E+01		1.11E+01
	964.08	14.65	-1.76E-01		4.36E-01
	1085.87	10.24	-1.39E-02		4.95E-01
	1089.74	1.73	1.36E+00		2.84E+00
	1112.07	13.69	-2.94E-01		4.16E-01
	1212.95	1.43	-3.81E+00		4.53E+00
	1249.94	0.19	8.71E+00		3.03E+01
	1299.14	1.63	2.23E+00		3.32E+00
	1408.01	21.07	-1.03E-01		1.97E-01
	1457.64	0.50	1.43E+02		3.93E+01
	1528.10	0.28	-6.82E+00		1.25E+01
Eu-154	123.07	40.40	-1.23E-01	9.61E-02	9.61E-02
	247.93	6.89	-8.38E-02		4.49E-01
	591.76	4.95	-2.55E-01		6.67E-01
	692.42	1.78	-5.65E-01		2.61E+00
	723.30	20.06	-7.02E-03		2.43E-01
	756.80	4.52	6.15E-01		1.01E+00
	873.18	12.08	4.51E-02		3.64E-01

Analysis Report for 23-Nov-19-10029

L1-10203B-FSGS-008SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.95E-01	9.61E-02	5.19E-01
	1004.76	18.01	1.72E-01		2.81E-01
	1274.43	34.80	4.03E-02		1.59E-01
	1596.48	1.80	-1.29E+00		2.35E+00
Eu-155	45.30	1.31	3.68E+00	2.25E-01	1.97E+01
	60.01	1.22	4.43E+00		2.34E+01
	86.55	30.70	-1.11E-01		2.31E-01
	105.31	21.10	-1.11E-01		2.25E-01
Ra-226	186.21	3.64	3.90E-01	1.06E+00	1.06E+00
Pa-231	27.36	10.30	1.67E+00	1.52E+00	2.29E+00
	283.69	1.70	4.86E-02		1.95E+00
	300.07	2.47	-5.62E-01		1.52E+00
	302.65	2.20	5.05E-01		1.68E+00
	330.06	1.40	-1.79E-01		2.37E+00
U-235	143.76	10.96	8.85E-02	6.83E-02	3.56E-01
	163.33	5.08	-7.20E-01		7.04E-01
	185.71	57.20	4.42E-02		6.83E-02
	202.11	1.08	-1.00E+00		3.35E+00
	205.31	5.01	-8.43E-01		7.04E-01
Am-241	59.54	35.90	-1.01E-01	8.06E-01	8.06E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10005

L1-10203B-FJGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10005
Sample Description	: L1-10203B-FJGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.582E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:40:00AM
Acquisition Started	: 11/21/2019 8:24:36AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81474
Fill Height	: 1581.57 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 8:39:39AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0700 11-22-19

Analysis Report for 21-Nov-19-10005

L1-10203B-FJGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.14	739 -	748	744.41	2.52E+01	11.14	4.38E+01	0.35
2	238.84	949 -	960	954.94	1.41E+02	17.00	5.88E+01	1.21
3	295.58	1172 -	1185	1181.59	5.38E+01	12.38	3.62E+01	0.48
4	338.79	1349 -	1359	1354.22	3.09E+01	8.48	1.71E+01	0.66
5	351.98	1400 -	1416	1406.92	1.02E+02	14.33	3.23E+01	1.10
6	582.99	2324 -	2336	2330.08	5.80E+01	9.32	1.10E+01	0.92
7	609.08	2427 -	2441	2434.38	7.19E+01	10.48	1.31E+01	0.83
8	1460.09	5826 -	5851	5838.31	3.26E+02	18.39	3.01E+00	1.83

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.91	1460.82	*	10.66	7.24E+00	5.16E-01
Tl-208	0.99	583.19	*	85.00	8.65E-02	1.49E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.23E-01	3.23E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.07E-01	3.26E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 21-Nov-19-10005

L1-10203B-FJGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.29E-01	5.57E-02
		351.93	*	35.60	2.54E-01	4.12E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	4.19E-01	1.88E-01
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.37E-01	6.79E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.98	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	2.66E-02	1.20E-02
		202.11		1.08		
		205.31		5.01		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10005

L1-10203B-FJGS-001SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.919	7.24E+00	5.16E-01	
	Tl-208	0.994	8.65E-02	1.49E-02	
X	Bi-211	0.877			
	Pb-212	0.994	2.23E-01	3.23E-02	
	Bi-214	0.996	2.07E-01	3.26E-02	
	Pb-214	0.994	2.45E-01	3.31E-02	
?	Ra-226	0.999	4.19E-01	1.88E-01	
	Ac-228	0.995	2.37E-01	6.79E-02	
?	U-235	0.980	2.66E-02	1.20E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10005

L1-10203B-FJGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 8:39:39AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	9.04E-02	5.96E-02	5.96E-02
	BE-7	477.60		10.44	3.39E-01	3.76E-01	3.76E-01
+	K-40	1460.82	*	10.66	7.24E+00	3.26E-01	3.26E-01
	Mn-54	834.85		99.98	6.17E-03	3.77E-02	3.77E-02
	Co-60	1173.23		99.85	4.93E-02	5.01E-02	6.44E-02
		1332.49		99.98	9.39E-03		5.01E-02
	Nb-94	702.65		99.81	-3.25E-03	3.96E-02	4.01E-02
		871.09		99.89	-8.97E-03		3.96E-02
	Ag-108m	79.13		6.60	1.57E+00	3.84E-02	1.30E+00
		433.94		90.50	-2.81E-02		3.84E-02
		614.28		89.80	-6.29E-02		5.44E-02
		722.94		90.80	-3.01E-03		5.12E-02
	Sb-125	176.31		6.84	-1.27E-01	1.23E-01	4.41E-01
		380.45		1.52	1.67E+00		2.31E+00
		427.87		29.60	5.37E-02		1.23E-01
		463.36		10.49	8.63E-02		4.03E-01
		600.60		17.65	1.42E-02		2.44E-01
		606.71		4.98	1.97E+00		1.41E+00
		635.95		11.22	-7.21E-02		3.66E-01

Analysis Report for 21-Nov-19-10005

L1-10203B-FJGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.73E+00	1.23E-01	2.50E+00
Ba-133	79.61	2.65	3.13E+00	6.96E-02	3.12E+00
	81.00	32.90	-2.77E-01		1.98E-01
	276.40	7.16	2.09E-01		4.42E-01
	302.85	18.34	6.95E-02		1.79E-01
	356.01	62.05	5.79E-03		6.96E-02
	383.85	8.94	-1.21E-01		3.60E-01
Cs-134	475.36	1.48	1.11E+00	4.75E-02	2.59E+00
	563.25	8.34	-4.42E-01		4.46E-01
	569.33	15.37	-1.58E-03		2.26E-01
	604.72	97.62	9.34E-03		6.72E-02
	795.86	85.46	4.59E-03		4.75E-02
	801.95	8.69	4.55E-01		5.29E-01
	1038.61	0.99	-9.48E-02		4.81E+00
	1167.97	1.79	7.08E-01		3.54E+00
	1365.19	3.02	-1.31E-01		1.40E+00
Cs-137	661.66	85.10	-1.83E-03	4.60E-02	4.60E-02
Eu-152	121.78	28.67	-3.39E-02	1.21E-01	1.24E-01
	244.70	7.61	3.57E-01		5.01E-01
	295.94	0.45	5.22E+00		9.84E+00
	344.28	26.60	-6.39E-02		1.21E-01
	367.79	0.86	-9.10E-01		3.62E+00
	411.12	2.24	1.30E+00		1.70E+00
	443.96	2.83	-3.38E-01		1.26E+00
	488.68	0.42	-2.37E+00		8.25E+00
	563.99	0.49	-7.54E+00		6.66E+00
	586.26	0.46	-7.93E+00		1.30E+01
	678.62	0.47	3.18E+00		9.32E+00
	688.67	0.86	-2.86E+00		4.75E+00
	719.35	0.28	4.00E+00		1.53E+01
	778.90	12.96	1.50E-01		3.37E-01
	810.45	0.32	7.66E-01		1.33E+01
	867.37	4.26	-2.48E-01		1.05E+00
	919.33	0.43	-3.44E+00		8.42E+00
	964.08	14.65	2.02E-01		4.44E-01
	1085.87	10.24	2.50E-01		5.07E-01
	1089.74	1.73	1.32E+00		3.01E+00
	1112.07	13.69	-8.96E-02		4.11E-01
	1212.95	1.43	1.29E+00		4.49E+00
	1249.94	0.19	-3.99E+00		3.55E+01
	1299.14	1.63	-2.21E+00		2.95E+00
	1408.01	21.07	-1.23E-01		1.70E-01
	1457.64	0.50	1.57E+02		4.25E+01
	1528.10	0.28	8.70E+00		1.57E+01
Eu-154	123.07	40.40	5.04E-03	8.75E-02	8.75E-02
	247.93	6.89	1.84E-01		4.87E-01
	591.76	4.95	3.17E-01		7.08E-01
	692.42	1.78	-1.76E+00		2.41E+00
	723.30	20.06	-1.57E-02		2.35E-01
	756.80	4.52	-2.51E-02		9.77E-01
	873.18	12.08	6.90E-03		3.57E-01

Analysis Report for 21-Nov-19-10005

L1-10203B-FJGS-001SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-1.29E-01	8.75E-02	4.42E-01
		1004.76		18.01	1.86E-01		2.88E-01
		1274.43		34.80	4.48E-02		1.71E-01
		1596.48		1.80	-2.38E+00		2.32E+00
	Eu-155	45.30		1.31	2.52E+00	1.92E-01	1.09E+01
		60.01		1.22	-8.07E+00		1.32E+01
		86.55		30.70	1.47E-01		2.01E-01
		105.31		21.10	7.23E-02		1.92E-01
+	Ra-226	186.21	*	3.64	4.19E-01	6.08E-01	6.08E-01
	Pa-231	27.36		10.30	9.93E-01	1.29E+00	1.29E+00
		283.69		1.70	5.06E-01		1.88E+00
		300.07		2.47	-1.75E+00		1.41E+00
		302.65		2.20	9.16E-01		1.51E+00
		330.06		1.40	-1.25E-01		2.35E+00
+	U-235	143.76		10.96	2.11E-01	3.87E-02	3.18E-01
		163.33		5.08	-2.24E-01		6.21E-01
		185.71	*	57.20	2.66E-02		3.87E-02
		202.11		1.08	2.62E-02		2.84E+00
		205.31		5.01	-4.86E-01		6.24E-01
	Am-241	59.54		35.90	-3.51E-01	4.66E-01	4.66E-01

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10006

L1-10203B-QJGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10006
Sample Description	: L1-10203B-QJGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.680E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:40:00AM
Acquisition Started	: 11/21/2019 8:43:36AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81479
Fill Height	: 1680.37 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 8:58:39AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0700 11-22-19

Analysis Report for 21-Nov-19-10006

L1-10203B-QJGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.75	948 -	960	954.57	1.35E+02	17.36	6.33E+01	0.96
2	270.18	1077 -	1084	1080.14	1.36E+01	7.99	2.24E+01	0.37
3	295.21	1176 -	1186	1180.12	4.96E+01	11.81	3.74E+01	0.54
4	351.87	1401 -	1415	1406.48	1.09E+02	13.80	2.83E+01	0.97
5	609.29	2428 -	2442	2435.20	8.48E+01	10.82	1.13E+01	1.44
6	910.72	3633 -	3648	3640.32	5.10E+01	9.36	1.20E+01	0.68
7	1459.99	5827 -	5850	5837.90	3.37E+02	18.95	5.63E+00	2.27

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.89	1460.82	*	10.66	7.38E+00	5.24E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.10E-01	3.20E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.40E-01	3.39E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 21-Nov-19-10006

L1-10203B-QJGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.08E-01	5.24E-02
		351.93	*	35.60	2.69E-01	4.03E-02
		785.96		1.06		
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24	*	3.46	2.88E-01	1.71E-01
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.35E-01	6.32E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 21-Nov-19-10006

L1-10203B-QJGS-001SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.895	7.38E+00	5.24E-01	
X	Bi-211	0.903			
	Pb-212	0.998	2.10E-01	3.20E-02	
	Bi-214	1.000	2.40E-01	3.39E-02	
	Pb-214	1.000	2.46E-01	3.20E-02	
	Ac-228	0.988	3.29E-01	5.93E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10006

L1-10203B-QJGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 8:58:39AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.87E-02	5.64E-02	5.64E-02
	BE-7	477.60		10.44	-1.82E-02	3.60E-01	3.60E-01
+	K-40	1460.82	*	10.66	7.38E+00	4.07E-01	4.07E-01
	Mn-54	834.85		99.98	1.04E-02	4.45E-02	4.45E-02
	Co-60	1173.23		99.85	-6.51E-03	3.76E-02	6.01E-02
		1332.49		99.98	1.96E-02		3.76E-02
	Nb-94	702.65		99.81	-1.41E-02	4.33E-02	4.33E-02
		871.09		99.89	3.19E-02		5.13E-02
	Ag-108m	79.13		6.60	5.65E-01	3.57E-02	1.18E+00
		433.94		90.50	-1.63E-02		3.57E-02
		614.28		89.80	-1.57E-02		5.83E-02
		722.94		90.80	1.94E-02		4.79E-02
	Sb-125	176.31		6.84	-3.61E-02	1.11E-01	4.42E-01
		380.45		1.52	3.99E-01		2.24E+00
		427.87		29.60	-4.33E-02		1.11E-01
		463.36		10.49	2.20E-01		3.99E-01
		600.60		17.65	1.15E-02		2.24E-01
		606.71		4.98	2.55E+00		1.42E+00
		635.95		11.22	2.99E-01		3.71E-01

Analysis Report for 21-Nov-19-10006

L1-10203B-QJGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.12E+00	1.11E-01	2.38E+00
Ba-133	79.61	2.65	5.82E-01	6.63E-02	2.83E+00
	81.00	32.90	-4.00E-01		1.86E-01
	276.40	7.16	-6.67E-03		4.86E-01
	302.85	18.34	9.28E-02		1.90E-01
	356.01	62.05	5.35E-03		6.63E-02
	383.85	8.94	1.93E-02		3.71E-01
Cs-134	475.36	1.48	3.59E-01	4.40E-02	2.56E+00
	563.25	8.34	-1.22E+00		4.35E-01
	569.33	15.37	3.54E-02		2.41E-01
	604.72	97.62	-5.69E-02		6.06E-02
	795.86	85.46	-4.07E-04		4.40E-02
	801.95	8.69	1.92E-01		4.45E-01
	1038.61	0.99	-1.46E-01		4.84E+00
	1167.97	1.79	8.18E-01		3.57E+00
	1365.19	3.02	-4.65E-01		1.48E+00
Cs-137	661.66	85.10	3.77E-02	5.51E-02	5.51E-02
Eu-152	121.78	28.67	3.81E-02	1.21E-01	1.21E-01
	244.70	7.61	4.00E-01		5.32E-01
	295.94	0.45	1.04E+01		1.05E+01
	344.28	26.60	-2.61E-02		1.24E-01
	367.79	0.86	2.15E+00		4.06E+00
	411.12	2.24	4.51E-01		1.71E+00
	443.96	2.83	-9.47E-01		1.22E+00
	488.68	0.42	-2.79E+00		7.93E+00
	563.99	0.49	-1.26E+01		7.49E+00
	586.26	0.46	1.37E+01		1.24E+01
	678.62	0.47	-3.53E+00		8.18E+00
	688.67	0.86	3.14E-01		4.90E+00
	719.35	0.28	-3.33E+00		1.39E+01
	778.90	12.96	-5.26E-02		2.98E-01
	810.45	0.32	3.78E+00		1.21E+01
	867.37	4.26	-2.12E-01		1.05E+00
	919.33	0.43	9.06E+00		1.23E+01
	964.08	14.65	6.01E-02		4.42E-01
	1085.87	10.24	-5.46E-01		4.72E-01
	1089.74	1.73	-8.15E-01		2.96E+00
	1112.07	13.69	-2.98E-01		3.72E-01
	1212.95	1.43	-2.94E+00		4.48E+00
	1249.94	0.19	1.59E+01		2.74E+01
	1299.14	1.63	5.89E-01		3.20E+00
	1408.01	21.07	5.97E-02		2.10E-01
	1457.64	0.50	1.58E+02		4.28E+01
	1528.10	0.28	5.95E-01		1.48E+01
Eu-154	123.07	40.40	1.08E-02	8.59E-02	8.59E-02
	247.93	6.89	1.12E-01		4.92E-01
	591.76	4.95	-7.03E-02		6.87E-01
	692.42	1.78	-1.17E+00		2.38E+00
	723.30	20.06	8.31E-02		2.17E-01
	756.80	4.52	-2.30E-01		9.34E-01
	873.18	12.08	1.40E-01		4.47E-01

Analysis Report for 21-Nov-19-10006

L1-10203B-QJGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.00E-01	8.59E-02	4.27E-01
	1004.76	18.01	3.18E-02		2.50E-01
	1274.43	34.80	-1.09E-01		1.66E-01
	1596.48	1.80	6.95E-01		1.89E+00
Eu-155	45.30	1.31	-1.65E+00	1.82E-01	1.09E+01
	60.01	1.22	-5.90E+00		1.32E+01
	86.55	30.70	-1.17E-01		1.82E-01
	105.31	21.10	9.36E-02		1.90E-01
Ra-226	186.21	3.64	1.00E+00	1.02E+00	1.02E+00
Pa-231	27.36	10.30	1.43E+00	1.39E+00	1.39E+00
	283.69	1.70	-1.31E+00		1.88E+00
	300.07	2.47	1.48E-01		1.47E+00
	302.65	2.20	7.99E-01		1.60E+00
	330.06	1.40	-8.45E-01		2.40E+00
U-235	143.76	10.96	1.35E-01	6.57E-02	3.35E-01
	163.33	5.08	2.52E-01		6.11E-01
	185.71	57.20	6.45E-02		6.57E-02
	202.11	1.08	-8.84E-01		2.74E+00
	205.31	5.01	-9.12E-02		5.76E-01
Am-241	59.54	35.90	-4.22E-01	4.53E-01	4.53E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10007

L1-10203B-FJGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10007
Sample Description	: L1-10203B-FJGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.623E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:42:00AM
Acquisition Started	: 11/21/2019 8:25:07AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81475
Fill Height	: 1623.29 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 8:40:10AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0700 11-22-19

Analysis Report for 21-Nov-19-10007

L1-10203B-FJGS-002SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.10	306 -	316	309.72	2.59E+01	13.60	6.31E+01	0.93
M	2	238.67	947 -	974	955.14	1.53E+02	14.99	3.60E+01	1.06
m	3	241.96	947 -	974	968.28	4.35E+01	7.90	2.40E+01	1.06
	4	295.19	1175 -	1188	1180.99	5.13E+01	10.96	2.48E+01	0.48
	5	338.35	1348 -	1359	1353.44	2.33E+01	8.84	2.17E+01	0.77
	6	351.84	1400 -	1415	1407.34	1.09E+02	14.10	2.98E+01	1.04
	7	582.98	2325 -	2337	2331.24	6.35E+01	8.98	6.50E+00	0.42
	8	609.31	2429 -	2444	2436.51	5.89E+01	11.32	2.31E+01	0.59
	9	911.06	3637 -	3651	3643.27	4.09E+01	7.81	7.06E+00	1.08
	10	1460.68	5828 -	5853	5843.08	3.74E+02	19.34	0.00E+00	0.72

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.71E+00	5.20E-01
Tl-208	0.99	583.19	*	85.00	8.97E-02	1.38E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.37E-01	3.01E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	2.41E-01	1.29E-01

Analysis Report for 21-Nov-19-10007

L1-10203B-FJGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	1.00	87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	1.60E-01	3.22E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	4.09E-01	8.11E-02
		295.22	*	18.42	2.11E-01	4.82E-02
		351.93	*	35.60	2.63E-01	3.99E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	4.24E-01	2.27E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.72E-01	6.69E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.55E-01	4.99E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10007

L1-10203B-FJGS-002SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	7.71E+00	5.20E-01	
	Tl-208	0.993	8.97E-02	1.38E-02	
X	Bi-211	0.910			
	Pb-212	1.000	2.37E-01	3.01E-02	
?	Pb212-XR	1.000	2.41E-01	1.29E-01	
	Bi-214	1.000	1.60E-01	3.22E-02	
	Pb-214	0.999	2.63E-01	2.87E-02	
?	Pb214-XR	1.000	4.24E-01	2.27E-01	
	Ac-228	0.999	2.26E-01	4.00E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10007

L1-10203B-FJGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 8:40:10AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.20E-02	4.98E-02	4.98E-02
	BE-7	477.60		10.44	2.74E-01	4.18E-01	4.18E-01
+	K-40	1460.82	*	10.66	7.71E+00	5.93E-02	5.93E-02
	Mn-54	834.85		99.98	2.84E-02	4.81E-02	4.81E-02
	Co-60	1173.23		99.85	-1.23E-01	5.21E-02	5.26E-02
		1332.49		99.98	2.33E-05		5.21E-02
	Nb-94	702.65		99.81	1.13E-02	4.35E-02	4.35E-02
		871.09		99.89	1.95E-03		5.06E-02
	Ag-108m	79.13		6.60	2.67E-02	4.02E-02	1.39E+00
		433.94		90.50	1.04E-03		4.02E-02
		614.28		89.80	-7.07E-03		7.03E-02
		722.94		90.80	4.79E-02		5.80E-02
	Sb-125	176.31		6.84	5.97E-02	1.21E-01	5.09E-01
		380.45		1.52	-1.69E+00		2.20E+00
		427.87		29.60	-1.65E-02		1.21E-01
		463.36		10.49	4.65E-01		3.85E-01
		600.60		17.65	-3.84E-02		2.33E-01
		606.71		4.98	2.25E+00		1.37E+00
		635.95		11.22	9.77E-02		3.40E-01

Analysis Report for 21-Nov-19-10007

L1-10203B-FJGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	8.68E-02	1.21E-01	2.33E+00
Ba-133	79.61	2.65	-6.63E-01	8.10E-02	3.36E+00
	81.00	32.90	3.88E-03		2.29E-01
	276.40	7.16	-2.69E-01		4.89E-01
	302.85	18.34	4.87E-03		1.74E-01
	356.01	62.05	-6.66E-03		8.10E-02
	383.85	8.94	1.83E-01		3.91E-01
Cs-134	475.36	1.48	2.23E+00	5.38E-02	2.73E+00
	563.25	8.34	-5.51E-01		4.17E-01
	569.33	15.37	2.78E-02		2.61E-01
	604.72	97.62	-1.12E-02		6.50E-02
	795.86	85.46	1.98E-02		5.38E-02
	801.95	8.69	-1.20E-01		4.81E-01
	1038.61	0.99	-2.21E+00		4.84E+00
	1167.97	1.79	-8.61E-01		3.29E+00
	1365.19	3.02	1.11E+00		1.53E+00
Cs-137	661.66	85.10	-3.19E-02	5.15E-02	5.15E-02
Eu-152	121.78	28.67	-2.86E-03	1.26E-01	1.40E-01
	244.70	7.61	-9.42E-02		4.87E-01
	295.94	0.45	5.63E+00		9.14E+00
	344.28	26.60	-4.52E-02		1.26E-01
	367.79	0.86	1.54E+00		3.84E+00
	411.12	2.24	-3.34E-01		1.65E+00
	443.96	2.83	-1.10E+00		1.20E+00
	488.68	0.42	8.78E+00		9.78E+00
	563.99	0.49	-6.27E+00		6.97E+00
	586.26	0.46	9.89E+00		1.26E+01
	678.62	0.47	2.04E+00		9.44E+00
	688.67	0.86	-6.26E+00		4.87E+00
	719.35	0.28	-4.07E+00		1.46E+01
	778.90	12.96	2.83E-01		3.63E-01
	810.45	0.32	2.80E+00		1.45E+01
	867.37	4.26	-5.00E-01		1.14E+00
	919.33	0.43	-1.46E+01		9.97E+00
	964.08	14.65	9.96E-02		4.07E-01
	1085.87	10.24	-2.10E-01		5.05E-01
	1089.74	1.73	-1.72E-01		3.34E+00
	1112.07	13.69	-2.17E-01		4.63E-01
	1212.95	1.43	-9.46E-01		4.75E+00
	1249.94	0.19	-1.94E+01		3.26E+01
	1299.14	1.63	2.17E-01		3.73E+00
	1408.01	21.07	1.22E-01		1.98E-01
	1457.64	0.50	1.67E+02		4.22E+01
	1528.10	0.28	-6.65E+00		1.25E+01
Eu-154	123.07	40.40	-6.01E-02	9.80E-02	9.80E-02
	247.93	6.89	1.04E-01		4.79E-01
	591.76	4.95	4.53E-01		8.04E-01
	692.42	1.78	1.11E+00		2.60E+00
	723.30	20.06	2.24E-01		2.65E-01
	756.80	4.52	-5.43E-01		8.30E-01
	873.18	12.08	-1.83E-01		4.09E-01

Analysis Report for 21-Nov-19-10007

L1-10203B-FJGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	4.84E-01	9.80E-02	5.15E-01
	1004.76	18.01	-2.80E-02		2.73E-01
	1274.43	34.80	-7.59E-02		1.62E-01
	1596.48	1.80	5.23E-01		1.63E+00
Eu-155	45.30	1.31	5.27E+00	2.36E-01	2.07E+01
	60.01	1.22	-7.77E+00		2.33E+01
	86.55	30.70	5.85E-02		2.40E-01
	105.31	21.10	1.11E-01		2.36E-01
Ra-226	186.21	3.64	2.49E-01	1.07E+00	1.07E+00
Pa-231	27.36	10.30	1.64E+00	1.43E+00	2.23E+00
	283.69	1.70	-1.31E-02		2.03E+00
	300.07	2.47	-2.71E-01		1.48E+00
	302.65	2.20	-2.81E-01		1.43E+00
	330.06	1.40	4.96E-01		2.60E+00
U-235	143.76	10.96	1.71E-02	6.80E-02	3.49E-01
	163.33	5.08	-9.72E-02		6.47E-01
	185.71	57.20	5.29E-03		6.80E-02
	202.11	1.08	-2.23E+00		3.17E+00
	205.31	5.01	-5.92E-01		7.02E-01
Am-241	59.54	35.90	-2.34E-01	8.28E-01	8.28E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10008

L1-10203B-FJGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10008
Sample Description	: L1-10203B-FJGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.554E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:44:00AM
Acquisition Started	: 11/21/2019 8:43:43AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81480
Fill Height	: 1554.46 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 8:58:45AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0700 11-22-19

Analysis Report for 21-Nov-19-10008

L1-10203B-FJGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.58	739 -	751	743.06	2.53E+01	12.71	5.07E+01	0.88
2	238.66	950 -	961	955.13	1.45E+02	17.71	6.58E+01	1.38
3	295.17	1174 -	1187	1180.90	6.09E+01	12.56	3.51E+01	1.01
4	351.78	1397 -	1414	1407.10	1.03E+02	12.97	2.02E+01	1.06
5	583.10	2325 -	2338	2331.71	4.33E+01	9.30	1.57E+01	0.61
6	609.28	2428 -	2444	2436.40	7.40E+01	10.54	1.20E+01	1.26
7	1120.25	4474 -	4486	4480.28	1.98E+01	5.36	3.24E+00	0.53
8	1460.71	5829 -	5853	5843.19	3.36E+02	19.40	9.53E+00	1.41

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.01E+00	5.06E-01
Tl-208	0.99	583.19	*	85.00	6.18E-02	1.38E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.27E-01	3.32E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.03E-01	3.14E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 21-Nov-19-10008

L1-10203B-FJGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29	*	14.92	2.46E-01	6.75E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.53E-01	5.59E-02
		351.93	*	35.60	2.49E-01	3.73E-02
		785.96		1.06		
Ra-226	0.93	186.21	*	3.64	4.24E-01	2.15E-01
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	2.70E-02	1.37E-02
		202.11		1.08		
		205.31		5.01		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	7.01E+00	5.06E-01	
	Tl-208	0.999	6.18E-02	1.38E-02	
X	Bi-211	0.923			

Analysis Report for 21-Nov-19-10008

L1-10203B-FJGS-003SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	Pb-212	1.000	2.27E-01	3.32E-02	
	Bi-214	1.000	2.11E-01	2.84E-02	
	Pb-214	0.998	2.50E-01	3.10E-02	
?	Ra-226	0.939	4.24E-01	2.15E-01	
?	U-235	0.998	2.70E-02	1.37E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10008

L1-10203B-FJGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 8:58:45AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.48E-02	5.24E-02	5.24E-02
	BE-7	477.60		10.44	1.87E-01	4.09E-01	4.09E-01
+	K-40	1460.82	*	10.66	7.01E+00	5.06E-01	5.06E-01
	Mn-54	834.85		99.98	-1.23E-02	3.82E-02	3.82E-02
	Co-60	1173.23		99.85	2.59E-02	5.68E-02	6.91E-02
		1332.49		99.98	1.14E-02		5.68E-02
	Nb-94	702.65		99.81	1.57E-02	4.16E-02	4.71E-02
		871.09		99.89	8.73E-03		4.16E-02
	Ag-108m	79.13		6.60	-3.20E-01	3.57E-02	1.49E+00
		433.94		90.50	8.23E-03		3.57E-02
		614.28		89.80	-6.98E-04		6.89E-02
		722.94		90.80	5.47E-03		4.98E-02
	Sb-125	176.31		6.84	-1.80E-01	1.19E-01	4.73E-01
		380.45		1.52	-1.58E+00		2.02E+00
		427.87		29.60	2.67E-02		1.19E-01
		463.36		10.49	-6.04E-02		3.88E-01
		600.60		17.65	5.44E-02		2.53E-01
		606.71		4.98	1.53E+00		1.36E+00
		635.95		11.22	8.28E-02		3.28E-01

Analysis Report for 21-Nov-19-10008

L1-10203B-FJGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.97E-01	1.19E-01	2.13E+00
Ba-133	79.61	2.65	-1.60E+00	7.72E-02	3.56E+00
	81.00	32.90	-1.62E-01		2.57E-01
	276.40	7.16	1.01E-01		4.96E-01
	302.85	18.34	1.10E-01		1.87E-01
	356.01	62.05	2.21E-03		7.72E-02
	383.85	8.94	1.98E-02		3.78E-01
Cs-134	475.36	1.48	1.89E+00	5.77E-02	2.85E+00
	563.25	8.34	-1.09E-01		4.08E-01
	569.33	15.37	5.63E-02		2.52E-01
	604.72	97.62	-1.76E-02		6.71E-02
	795.86	85.46	-1.46E-03		5.77E-02
	801.95	8.69	-2.45E-01		5.23E-01
	1038.61	0.99	9.84E-01		5.29E+00
	1167.97	1.79	1.60E-02		3.54E+00
	1365.19	3.02	1.23E-01		1.55E+00
Cs-137	661.66	85.10	-2.47E-02	5.48E-02	5.48E-02
Eu-152	121.78	28.67	9.49E-03	1.27E-01	1.42E-01
	244.70	7.61	2.01E-02		5.16E-01
	295.94	0.45	1.06E+01		1.04E+01
	344.28	26.60	-3.70E-02		1.27E-01
	367.79	0.86	4.20E-01		4.01E+00
	411.12	2.24	-1.13E+00		1.54E+00
	443.96	2.83	7.97E-02		1.29E+00
	488.68	0.42	4.99E+00		9.00E+00
	563.99	0.49	-2.56E+00		7.04E+00
	586.26	0.46	1.12E+01		1.26E+01
	678.62	0.47	4.90E+00		7.88E+00
	688.67	0.86	1.01E+00		4.92E+00
	719.35	0.28	7.35E+00		1.36E+01
	778.90	12.96	1.32E-01		3.39E-01
	810.45	0.32	-1.39E+00		1.40E+01
	867.37	4.26	-5.89E-01		9.90E-01
	919.33	0.43	-2.00E+01		1.10E+01
	964.08	14.65	4.80E-01		4.31E-01
	1085.87	10.24	-5.39E-01		5.56E-01
	1089.74	1.73	-2.12E+00		3.50E+00
	1112.07	13.69	3.29E-01		4.38E-01
	1212.95	1.43	1.96E+00		4.28E+00
	1249.94	0.19	-8.69E+00		3.21E+01
	1299.14	1.63	-6.92E-01		3.25E+00
	1408.01	21.07	6.23E-02		1.93E-01
	1457.64	0.50	1.57E+02		4.11E+01
	1528.10	0.28	2.04E-01		1.27E+01
Eu-154	123.07	40.40	-2.02E-02	9.98E-02	9.98E-02
	247.93	6.89	6.78E-02		4.98E-01
	591.76	4.95	-3.09E-02		8.21E-01
	692.42	1.78	6.30E-01		2.59E+00
	723.30	20.06	7.35E-02		2.31E-01
	756.80	4.52	4.88E-02		9.94E-01
	873.18	12.08	-1.84E-01		3.03E-01

Analysis Report for 21-Nov-19-10008

L1-10203B-FJGS-003SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-4.42E-03	9.98E-02	5.40E-01
		1004.76		18.01	-1.65E-01		2.58E-01
		1274.43		34.80	2.56E-02		1.56E-01
		1596.48		1.80	7.93E-01		1.93E+00
	Eu-155	45.30		1.31	4.46E+00	2.14E-01	2.03E+01
		60.01		1.22	-1.48E+01		2.09E+01
		86.55		30.70	7.49E-02		2.35E-01
		105.31		21.10	-5.73E-02		2.14E-01
+	Ra-226	186.21	*	3.64	4.24E-01	7.11E-01	7.11E-01
	Pa-231	27.36		10.30	2.04E+00	1.48E+00	2.37E+00
		283.69		1.70	-1.84E+00		1.97E+00
		300.07		2.47	-1.24E+00		1.48E+00
		302.65		2.20	1.06E-01		1.55E+00
		330.06		1.40	4.69E-01		2.62E+00
+	U-235	143.76		10.96	-7.43E-02	4.52E-02	3.50E-01
		163.33		5.08	1.07E-01		6.90E-01
		185.71	*	57.20	2.70E-02		4.52E-02
		202.11		1.08	8.04E-01		3.47E+00
		205.31		5.01	-2.82E-01		7.34E-01
	Am-241	59.54		35.90	-8.71E-02	7.42E-01	7.42E-01

+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10009

L1-10203B-FJGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10009
Sample Description	: L1-10203B-FJGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.552E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:46:00AM
Acquisition Started	: 11/21/2019 9:02:49AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81482
Fill Height	: 1552.06 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 9:17:52AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0700 11-22-19

Analysis Report for 21-Nov-19-10009

L1-10203B-FJGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.79	947 -	960	954.73	1.39E+02	17.76	6.43E+01	0.51
2	295.22	1175 -	1186	1180.17	5.13E+01	11.49	3.17E+01	0.99
3	351.71	1401 -	1414	1405.86	9.55E+01	13.57	3.15E+01	1.03
4	383.73	1530 -	1538	1533.79	1.25E+01	4.71	4.50E+00	0.46
5	582.76	2325 -	2334	2329.17	3.62E+01	8.22	1.38E+01	1.20
6	609.08	2427 -	2441	2434.37	7.42E+01	11.07	1.68E+01	0.87
7	1460.05	5826 -	5849	5838.13	3.34E+02	19.54	1.20E+01	1.88

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.90	1460.82	*	10.66	7.46E+00	5.44E-01
Tl-208	0.97	583.19	*	85.00	5.42E-02	1.27E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.20E-01	3.33E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.14E-01	3.44E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 21-Nov-19-10009

L1-10203B-FJGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.19E-01	5.20E-02
		351.93	*	35.60	2.40E-01	3.91E-02
		785.96		1.06		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.909	7.46E+00	5.44E-01	
	Tl-208	0.972	5.42E-02	1.27E-02	
X	Bi-211	0.936			
	Pb-212	0.996	2.20E-01	3.33E-02	
	Bi-214	0.996	2.14E-01	3.44E-02	
	Pb-214	0.996	2.32E-01	3.12E-02	

Analysis Report for 21-Nov-19-10009

L1-10203B-FJGS-004SS

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10009

L1-10203B-FJGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 9:17:52AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
4	383.73	1.38889E-02	37.66	Tol.	Ba-133

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.12E-02	5.07E-02	5.07E-02
	BE-7	477.60		10.44	2.26E-01	3.89E-01	3.89E-01
+	K-40	1460.82	*	10.66	7.46E+00	5.89E-01	5.89E-01
	Mn-54	834.85		99.98	5.80E-03	4.30E-02	4.30E-02
	Co-60	1173.23		99.85	1.50E-02	5.16E-02	6.87E-02
		1332.49		99.98	3.04E-02		5.16E-02
	Nb-94	702.65		99.81	1.56E-02	4.81E-02	4.82E-02
		871.09		99.89	2.35E-02		4.81E-02
	Ag-108m	79.13		6.60	1.62E+00	3.89E-02	1.34E+00
		433.94		90.50	-2.42E-03		3.89E-02
		614.28		89.80	-4.09E-02		5.56E-02
		722.94		90.80	3.25E-02		5.58E-02
	Sb-125	176.31		6.84	-1.93E-01	1.40E-01	4.12E-01
		380.45		1.52	-1.26E+00		2.28E+00
		427.87		29.60	6.35E-02		1.40E-01
		463.36		10.49	-2.61E-02		3.63E-01
		600.60		17.65	2.37E-01		2.36E-01
		606.71		4.98	2.03E+00		1.44E+00

Analysis Report for 21-Nov-19-10009

L1-10203B-FJGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	635.95	11.22	1.84E-01	1.40E-01	3.24E-01
	671.44	1.79	-7.20E-01		1.91E+00
Ba-133	79.61	2.65	3.37E+00	7.14E-02	3.24E+00
	81.00	32.90	-4.96E-01		1.96E-01
	276.40	7.16	-2.77E-02		4.41E-01
	302.85	18.34	3.84E-02		1.89E-01
	356.01	62.05	1.12E-02		7.14E-02
	383.85	8.94	-6.93E-02		3.66E-01
Cs-134	475.36	1.48	7.54E-01	5.29E-02	2.52E+00
	563.25	8.34	-6.11E-01		5.13E-01
	569.33	15.37	-3.54E-01		2.45E-01
	604.72	97.62	-2.76E-02		6.48E-02
	795.86	85.46	1.44E-02		5.29E-02
	801.95	8.69	4.19E-01		5.23E-01
	1038.61	0.99	2.81E+00		5.21E+00
	1167.97	1.79	-2.84E+00		3.51E+00
	1365.19	3.02	-1.31E-01		1.41E+00
Cs-137	661.66	85.10	2.52E-02	5.96E-02	5.96E-02
Eu-152	121.78	28.67	1.00E-01	1.15E-01	1.29E-01
	244.70	7.61	2.49E-01		4.96E-01
	295.94	0.45	5.96E+00		1.01E+01
	344.28	26.60	-7.33E-02		1.15E-01
	367.79	0.86	6.13E-01		3.79E+00
	411.12	2.24	-3.80E-01		1.50E+00
	443.96	2.83	-9.08E-02		1.18E+00
	488.68	0.42	1.32E+00		8.39E+00
	563.99	0.49	-5.21E+00		8.52E+00
	586.26	0.46	-7.37E+00		1.26E+01
	678.62	0.47	-4.44E+00		7.13E+00
	688.67	0.86	-2.80E+00		4.62E+00
	719.35	0.28	-1.06E+01		1.44E+01
	778.90	12.96	-2.35E-01		2.98E-01
	810.45	0.32	-3.04E+00		1.45E+01
	867.37	4.26	3.90E-01		1.14E+00
	919.33	0.43	1.32E+00		1.07E+01
	964.08	14.65	3.11E-01		5.02E-01
	1085.87	10.24	4.25E-03		5.44E-01
	1089.74	1.73	-3.76E-01		3.42E+00
	1112.07	13.69	6.46E-02		4.26E-01
	1212.95	1.43	6.91E-01		4.92E+00
	1249.94	0.19	-2.02E+00		3.03E+01
	1299.14	1.63	2.30E+00		3.41E+00
	1408.01	21.07	1.87E-01		2.49E-01
	1457.64	0.50	1.61E+02		4.40E+01
	1528.10	0.28	8.75E+00		1.58E+01
Eu-154	123.07	40.40	2.75E-02	8.94E-02	8.94E-02
	247.93	6.89	-1.92E-01		4.47E-01
	591.76	4.95	-3.74E-01		7.47E-01
	692.42	1.78	8.55E-01		2.52E+00
	723.30	20.06	9.50E-02		2.50E-01
	756.80	4.52	7.21E-02		8.72E-01

Analysis Report for 21-Nov-19-10009

L1-10203B-FJGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	2.61E-01	8.94E-02	3.86E-01
	996.29	10.48	1.88E-01		4.44E-01
	1004.76	18.01	-6.59E-02		2.60E-01
	1274.43	34.80	-4.83E-02		1.63E-01
	1596.48	1.80	-2.84E-01		1.59E+00
Eu-155	45.30	1.31	-4.97E+00	1.79E-01	1.11E+01
	60.01	1.22	-2.52E+00		1.24E+01
	86.55	30.70	-5.41E-02		1.79E-01
	105.31	21.10	3.00E-02		2.02E-01
Ra-226	186.21	3.64	7.74E-01	9.16E-01	9.16E-01
Pa-231	27.36	10.30	1.45E+00	1.39E+00	1.39E+00
	283.69	1.70	3.96E-01		2.08E+00
	300.07	2.47	5.88E-01		1.47E+00
	302.65	2.20	2.56E-01		1.58E+00
	330.06	1.40	4.43E-01		2.75E+00
U-235	143.76	10.96	-1.86E-01	5.63E-02	3.10E-01
	163.33	5.08	3.31E-01		6.54E-01
	185.71	57.20	9.15E-03		5.63E-02
	202.11	1.08	-6.92E-01		3.06E+00
	205.31	5.01	-3.38E-01		6.51E-01
Am-241	59.54	35.90	9.12E-03	4.40E-01	4.40E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 21-Nov-19-10010

L1-10203B-FJGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 21-Nov-19-10010
Sample Description	: L1-10203B-FJGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.615E+03 grams
Facility	: Default
Sample Taken On	: 11/20/2019 8:48:00AM
Acquisition Started	: 11/21/2019 9:02:57AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/21/2019
Efficiency Calibration Description	:
Sample Number	: 81483
Fill Height	: 1615.01 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/21/2019 9:18:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0700 11-22-19

Analysis Report for 21-Nov-19-10010

L1-10203B-FJGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.48	948 -	962	954.39	1.36E+02	16.89	5.18E+01	0.99
2	295.17	1174 -	1187	1180.89	5.73E+01	11.21	2.47E+01	0.58
3	338.33	1347 -	1360	1353.38	3.06E+01	9.61	2.24E+01	0.88
4	351.88	1399 -	1414	1407.51	9.72E+01	13.21	2.58E+01	1.21
5	510.57	2034 -	2049	2041.77	4.69E+01	9.47	1.41E+01	1.48
6	583.07	2325 -	2338	2331.59	4.26E+01	9.52	1.74E+01	1.18
7	609.18	2427 -	2444	2435.99	8.08E+01	10.82	1.12E+01	0.86
8	910.94	3635 -	3649	3642.79	4.44E+01	7.77	5.57E+00	1.68
9	1460.54	5829 -	5854	5842.53	3.04E+02	18.95	1.30E+01	2.12

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.97	511.00	*	100.00	5.24E-02	1.12E-02
K-40	0.98	1460.82	*	10.66	6.27E+00	4.76E-01
Tl-208	0.99	583.19	*	85.00	6.02E-02	1.39E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.11E-01	3.13E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.20E-01	3.22E-02
		768.36		4.89		

Analysis Report for 21-Nov-19-10010

L1-10203B-FJGS-005SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.36E-01	4.99E-02
		351.93	*	35.60	2.34E-01	3.69E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.27E-01	7.35E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.77E-01	4.99E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

INTERFERENCE CORRECTED REPORT

Analysis Report for 21-Nov-19-10010

L1-10203B-FJGS-005SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.971	5.24E-02	1.12E-02	
	K-40	0.987	6.27E+00	4.76E-01	
	Tl-208	0.998	6.02E-02	1.39E-02	
X	Bi-211	0.901			
	Pb-212	0.997	2.11E-01	3.13E-02	
	Bi-214	0.999	2.20E-01	3.22E-02	
	Pb-214	1.000	2.35E-01	2.97E-02	
	Ac-228	0.997	2.61E-01	4.13E-02	

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 21-Nov-19-10010

L1-10203B-FJGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/21/2019 9:18:00AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	5.24E-02	2.80E-02	2.80E-02
	BE-7	477.60		10.44	1.67E-01	4.35E-01	4.35E-01
+	K-40	1460.82	*	10.66	6.27E+00	5.79E-01	5.79E-01
	Mn-54	834.85		99.98	-3.65E-02	3.94E-02	3.94E-02
	Co-60	1173.23		99.85	1.61E-02	4.41E-02	6.00E-02
		1332.49		99.98	1.67E-02		4.41E-02
	Nb-94	702.65		99.81	1.51E-02	3.84E-02	3.84E-02
		871.09		99.89	-1.58E-02		4.12E-02
	Ag-108m	79.13		6.60	-6.66E-01	3.91E-02	1.50E+00
		433.94		90.50	8.75E-03		3.91E-02
		614.28		89.80	1.69E-02		7.14E-02
		722.94		90.80	1.66E-02		5.06E-02
	Sb-125	176.31		6.84	-1.13E-01	1.25E-01	4.98E-01
		380.45		1.52	6.47E-01		2.26E+00
		427.87		29.60	-1.82E-02		1.25E-01
		463.36		10.49	-6.90E-02		3.86E-01
		600.60		17.65	1.20E-01		2.51E-01
		606.71		4.98	5.86E-01		1.35E+00
		635.95		11.22	4.99E-02		3.40E-01

Analysis Report for 21-Nov-19-10010

L1-10203B-FJGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	7.81E-01	1.25E-01	2.45E+00
Ba-133	79.61	2.65	1.67E+00	7.35E-02	3.79E+00
	81.00	32.90	-4.79E-01		2.62E-01
	276.40	7.16	-3.31E-01		4.98E-01
	302.85	18.34	1.84E-01		2.06E-01
	356.01	62.05	-7.66E-03		7.35E-02
	383.85	8.94	-3.66E-01		3.54E-01
Cs-134	475.36	1.48	-2.08E-01	4.95E-02	2.94E+00
	563.25	8.34	1.76E-02		4.89E-01
	569.33	15.37	-1.80E-02		2.62E-01
	604.72	97.62	5.05E-03		6.68E-02
	795.86	85.46	-1.47E-03		4.95E-02
	801.95	8.69	-4.37E-01		4.81E-01
	1038.61	0.99	-3.49E+00		5.08E+00
	1167.97	1.79	-8.23E-01		3.30E+00
	1365.19	3.02	-4.09E-01		1.25E+00
Cs-137	661.66	85.10	1.70E-02	5.32E-02	5.32E-02
Eu-152	121.78	28.67	-6.35E-02	1.35E-01	1.45E-01
	244.70	7.61	5.36E-01		5.03E-01
	295.94	0.45	1.12E+01		9.81E+00
	344.28	26.60	-3.18E-03		1.35E-01
	367.79	0.86	-1.63E+00		3.88E+00
	411.12	2.24	-6.23E-01		1.55E+00
	443.96	2.83	1.72E-01		1.17E+00
	488.68	0.42	1.18E+00		8.94E+00
	563.99	0.49	4.79E-01		8.23E+00
	586.26	0.46	1.37E+01		1.24E+01
	678.62	0.47	-5.08E-01		7.69E+00
	688.67	0.86	-2.39E+00		5.18E+00
	719.35	0.28	-3.86E+00		1.48E+01
	778.90	12.96	-4.99E-01		3.68E-01
	810.45	0.32	1.42E+01		1.47E+01
	867.37	4.26	-1.32E-01		1.14E+00
	919.33	0.43	-1.61E+01		1.07E+01
	964.08	14.65	6.41E-02		4.12E-01
	1085.87	10.24	7.96E-02		5.57E-01
	1089.74	1.73	-5.41E-01		3.26E+00
	1112.07	13.69	-2.11E-01		3.59E-01
	1212.95	1.43	-4.93E-01		4.66E+00
	1249.94	0.19	2.43E+01		3.04E+01
	1299.14	1.63	-1.90E+00		3.46E+00
	1408.01	21.07	1.12E-01		1.91E-01
	1457.64	0.50	1.39E+02		3.92E+01
	1528.10	0.28	-7.73E+00		1.18E+01
Eu-154	123.07	40.40	4.79E-02	1.04E-01	1.04E-01
	247.93	6.89	-1.85E-01		4.85E-01
	591.76	4.95	-2.62E-01		7.25E-01
	692.42	1.78	1.94E+00		2.57E+00
	723.30	20.06	4.46E-02		2.26E-01
	756.80	4.52	-2.43E-01		8.00E-01
	873.18	12.08	-1.19E-01		3.35E-01

Analysis Report for 21-Nov-19-10010

L1-10203B-FJGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.91E-02	1.04E-01	5.02E-01
	1004.76	18.01	1.01E-02		2.90E-01
	1274.43	34.80	5.71E-02		1.72E-01
	1596.48	1.80	1.44E+00		2.46E+00
Eu-155	45.30	1.31	1.30E+01	2.18E-01	2.14E+01
	60.01	1.22	-1.22E+01		2.23E+01
	86.55	30.70	-1.93E-01		2.28E-01
	105.31	21.10	-8.87E-02		2.18E-01
Ra-226	186.21	3.64	4.29E-01	1.03E+00	1.03E+00
Pa-231	27.36	10.30	1.66E+00	1.50E+00	2.47E+00
	283.69	1.70	5.60E-01		2.04E+00
	300.07	2.47	-9.32E-02		1.50E+00
	302.65	2.20	5.10E-01		1.69E+00
	330.06	1.40	2.42E+00		2.71E+00
U-235	143.76	10.96	-4.01E-01	6.73E-02	3.54E-01
	163.33	5.08	2.64E-01		7.06E-01
	185.71	57.20	6.83E-02		6.73E-02
	202.11	1.08	3.01E+00		3.55E+00
	205.31	5.01	-2.21E-01		7.27E-01
Am-241	59.54	35.90	-6.77E-01	7.75E-01	7.75E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Apex-Gamma

Analysis Report for 23-Nov-19-10008

L1-10203B-FJGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 23-Nov-19-10008
Sample Description	: L1-10203B-FJGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.466E+03 grams
Facility	: Default
Sample Taken On	: 11/21/2019 1:00:00PM
Acquisition Started	: 11/23/2019 7:15:37AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.05 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/23/2019
Efficiency Calibration Description	:
Sample Number	: 81565
Fill Height	: 1465.79 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/23/2019 7:30:47AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 11-24-19

Analysis Report for 23-Nov-19-10008

L1-10203B-FJGS-006SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.17	305 -	315	309.99	4.39E+01	20.11	1.49E+02	0.53
	2	238.59	949 -	962	954.83	2.73E+02	28.07	1.79E+02	1.09
M	3	295.15	1175 -	1206	1180.81	1.61E+02	13.62	5.12E+01	1.12
m	4	299.98	1175 -	1206	1200.14	2.63E+01	7.74	6.69E+01	1.12
	5	338.45	1347 -	1362	1353.85	8.60E+01	15.62	5.20E+01	1.15
	6	351.91	1399 -	1415	1407.64	2.83E+02	20.29	4.15E+01	1.27
	7	583.15	2322 -	2339	2331.93	1.01E+02	14.54	3.38E+01	0.84
	8	609.24	2428 -	2444	2436.21	2.27E+02	17.90	2.98E+01	1.40
	9	911.21	3636 -	3651	3643.87	6.03E+01	11.20	2.17E+01	1.44
	10	968.88	3868 -	3882	3874.59	4.68E+01	9.23	1.32E+01	1.26
	11	1120.19	4475 -	4486	4480.04	2.90E+01	10.69	3.40E+01	0.39
	12	1460.47	5829 -	5855	5842.24	7.10E+02	28.26	2.03E+01	1.80

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	1.50E+01	8.86E-01
Tl-208	1.00	583.19	*	85.00	1.46E-01	2.28E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	4.30E-01	5.63E-02
		300.09	*	3.30	6.20E-01	1.89E-01

Analysis Report for 23-Nov-19-10008

L1-10203B-FJGS-006SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	4.10E-01	1.92E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	6.31E-01	6.25E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	3.66E-01	1.36E-01
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	6.75E-01	7.86E-02
		351.93	*	35.60	6.94E-01	7.46E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	7.22E-01	3.41E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	6.49E-01	1.29E-01
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.86E-01	7.34E-02
		964.77		4.99		
		968.97	*	15.80	5.08E-01	1.03E-01
		1588.20		3.22		

* = Energy line found in the spectrum.
\- = Manually added nuclide.
? = Manually edited nuclide.
@ = Energy line not used for Weighted Mean Activity
Energy Tolerance : 1.000 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.000sigma

Analysis Report for 23-Nov-19-10008

L1-10203B-FJGS-006SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.980	1.50E+01	8.86E-01	
	Tl-208	1.000	1.46E-01	2.28E-02	
X	Bi-211	0.893			
	Pb-212	1.000	4.46E-01	5.40E-02	
?	Pb212-XR	1.000	4.10E-01	1.92E-01	
	Bi-214	0.999	5.85E-01	5.68E-02	
	Pb-214	1.000	6.85E-01	5.41E-02	
?	Pb214-XR	1.000	7.22E-01	3.41E-01	
	Ac-228	0.999	4.66E-01	5.42E-02	
X	Pa-231	1.000			

? = nuclide is part of an undetermined solution
X = nuclide rejected by the interference analysis
@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

Analysis Report for 23-Nov-19-10008

L1-10203B-FJGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/23/2019 7:30:47AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide

All peaks were identified.

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1.000sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ZION LIB-BNL.NLB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	9.23E-02	6.91E-02	6.91E-02
	BE-7	477.60		10.44	-9.84E-02	5.31E-01	5.31E-01
+	K-40	1460.82	*	10.66	1.50E+01	7.38E-01	7.38E-01
	Mn-54	834.85		99.98	9.00E-05	6.48E-02	6.48E-02
	Co-60	1173.23		99.85	4.97E-02	6.34E-02	8.59E-02
		1332.49		99.98	7.39E-03		6.34E-02
	Nb-94	702.65		99.81	2.01E-02	6.48E-02	6.48E-02
		871.09		99.89	2.55E-02		6.83E-02
	Ag-108m	79.13		6.60	-4.14E-01	5.25E-02	2.04E+00
		433.94		90.50	-5.38E-03		5.25E-02
		614.28		89.80	-2.33E-02		1.14E-01
		722.94		90.80	5.45E-02		7.13E-02
	Sb-125	176.31		6.84	3.00E-01	1.65E-01	7.69E-01
		380.45		1.52	-4.36E-01		3.36E+00
		427.87		29.60	-3.43E-02		1.65E-01
		463.36		10.49	5.18E-01		5.35E-01
		600.60		17.65	-9.63E-03		3.07E-01
		606.71		4.98	5.58E+00		2.22E+00
		635.95		11.22	5.60E-01		5.22E-01

Analysis Report for 23-Nov-19-10008

L1-10203B-FJGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.96E+00	1.65E-01	3.11E+00
Ba-133	79.61	2.65	2.79E-01	1.19E-01	5.05E+00
	81.00	32.90	3.89E-02		3.34E-01
	276.40	7.16	-3.53E-01		7.09E-01
	302.85	18.34	6.24E-02		2.78E-01
	356.01	62.05	-2.69E-03		1.19E-01
	383.85	8.94	-2.11E-01		5.62E-01
Cs-134	475.36	1.48	1.76E+00	7.64E-02	3.66E+00
	563.25	8.34	-4.59E-03		6.03E-01
	569.33	15.37	-2.08E-01		3.41E-01
	604.72	97.62	-5.68E-02		1.05E-01
	795.86	85.46	3.36E-02		7.64E-02
	801.95	8.69	-4.88E-01		6.71E-01
	1038.61	0.99	7.19E+00		8.22E+00
	1167.97	1.79	-1.29E+00		4.53E+00
	1365.19	3.02	-1.80E+00		1.88E+00
Cs-137	661.66	85.10	2.49E-02	7.06E-02	7.06E-02
Eu-152	121.78	28.67	-6.71E-02	1.88E-01	1.93E-01
	244.70	7.61	1.79E-01		7.84E-01
	295.94	0.45	-3.93E+00		1.52E+01
	344.28	26.60	4.38E-02		1.88E-01
	367.79	0.86	2.28E+00		5.77E+00
	411.12	2.24	9.28E-01		2.28E+00
	443.96	2.83	4.83E-01		1.72E+00
	488.68	0.42	2.21E+00		1.39E+01
	563.99	0.49	-2.72E+00		1.02E+01
	586.26	0.46	4.51E-01		1.78E+01
	678.62	0.47	-4.25E-01		1.15E+01
	688.67	0.86	1.52E+00		7.18E+00
	719.35	0.28	-1.04E-01		1.96E+01
	778.90	12.96	-5.25E-01		4.80E-01
	810.45	0.32	6.90E+00		1.84E+01
	867.37	4.26	-2.39E+00		1.61E+00
	919.33	0.43	-1.65E+01		1.47E+01
	964.08	14.65	-1.29E-01		6.00E-01
	1085.87	10.24	-7.54E-01		7.06E-01
	1089.74	1.73	-1.29E+00		4.52E+00
	1112.07	13.69	-7.22E-01		5.86E-01
	1212.95	1.43	-4.63E+00		5.70E+00
	1249.94	0.19	-4.63E+01		4.54E+01
	1299.14	1.63	-3.46E+00		4.39E+00
	1408.01	21.07	-7.04E-02		3.30E-01
	1457.64	0.50	3.21E+02		6.00E+01
	1528.10	0.28	-1.04E+00		1.73E+01
Eu-154	123.07	40.40	-4.38E-02	1.40E-01	1.40E-01
	247.93	6.89	-8.54E-02		7.13E-01
	591.76	4.95	-1.92E-01		1.04E+00
	692.42	1.78	8.21E-01		3.52E+00
	723.30	20.06	1.53E-01		3.19E-01
	756.80	4.52	1.15E-03		1.32E+00
	873.18	12.08	4.80E-01		5.85E-01

Analysis Report for 23-Nov-19-10008

L1-10203B-FJGS-006SS

Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29		10.48	-5.17E-01	1.40E-01	6.47E-01
	1004.76		18.01	6.36E-02		3.88E-01
	1274.43		34.80	-1.77E-02		2.21E-01
	1596.48		1.80	-2.57E+00		3.20E+00
Eu-155	45.30		1.31	-1.13E+01	3.13E-01	2.73E+01
	60.01		1.22	5.13E+00		3.08E+01
	86.55		30.70	-1.49E-01		3.13E-01
	105.31		21.10	9.75E-02		3.28E-01
Ra-226	186.21		3.64	1.11E+00	1.55E+00	1.55E+00
Pa-231	27.36		10.30	3.85E+00	1.33E+00	3.36E+00
	283.69		1.70	-1.71E+00		2.81E+00
	300.07	*	2.47	8.29E-01		1.33E+00
	302.65		2.20	1.32E-01		2.30E+00
	330.06		1.40	3.93E-01		3.59E+00
U-235	143.76		10.96	8.58E-02	1.00E-01	4.86E-01
	163.33		5.08	7.05E-01		1.03E+00
	185.71		57.20	1.02E-01		1.00E-01
	202.11		1.08	1.97E+00		4.89E+00
	205.31		5.01	-1.16E+00		1.03E+00
Am-241	59.54		35.90	-1.56E-01	1.08E+00	1.08E+00

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

ATTACHMENT 8
EBERLINE ANALYTICAL REPORTS

EBERLINE ANALYTICAL

EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD
OAK RIDGE, TENNESSEE 37830
PHONE (865) 481-0683
FAX (865) 483-4621

EBS-OR-46668

February 4, 2020

Jeffrey Graham
Zion Solutions, LLC
2701 Deborah Avenue
Zion, IL 60099

CASE NARRATIVE
Work Order # 19-12107-OR

SAMPLE RECEIPT

This work order contains sixteen soil samples received 12/23/2019. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-10204-A-FSGS-019-SS-A	19-12107-04	L1-10203-A-FSGS-010-SS-A	19-12107-12
L1-10204-A-FQGS-019-SS-A	19-12107-05	L1-10203-A-FSGS-012-SS-A	19-12107-13
L1-10204-B-FSGS-001-SS-A	19-12107-06	L1-10203-B-FSGS-005-SS-A	19-12107-14
L1-10204-B-FSGS-013-SS-A	19-12107-07	L1-10203-B-FSGS-010-SS-A	19-12107-15
L1-10204-C-FSGS-004-SS-A	19-12107-08	L1-10203-B-FSGS-013-SS-A	19-12107-16
L1-10204-C-FSGS-011-SS-A	19-12107-09	L1-10203-B-FSGS-004-SB-A	19-12107-17
L1-10204-D-FSGS-012-SS-A	19-12107-10	L1-10203-C-FJGS-001-SS-A	19-12107-18
L1-10204-D-FSGS-008-SB-A	19-12107-11	L1-10203-C-FJGS-003-SS-A	19-12107-19

ANALYTICAL METHODS

Total Strontium was analyzed using EIChroM Method SRW01 Modified. Tritium was performed using Method LANL ER-210 Modified. Nickel-63 was performed using Method ASTM 3500-Ni Modified. Gamma Spectroscopy was performed using EPA Method 901.1 Modified.

Laboratory qualifiers are as follows:

U - Result is less than the MDA.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

Minimum Detectable Activity (MDA) values for data represented in this report are sample-specific. MDA measurements are determined based on factors and conditions including instrument settings, aliquot size and matrix type.

ANALYTICAL RESULTS CONTINUED

TOTAL STRONTIUM

Samples were prepared by acid digestion as appropriate for the matrix. Digested samples were acidified and were selectively extracted and precipitated. Precipitates were then mounted on 47mm filters. Filters were reweighed to determine aliquot size. Sample activities were determined by gas flow proportional counting.

Samples demonstrated acceptable results for all Total Strontium analyses. Strontium-90 results are reported from Total Strontium. Chemical recovery was acceptable for all samples. The Total Strontium method blank demonstrated an acceptable result. Results for the Total Strontium duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Total Strontium laboratory control sample demonstrated an acceptable percent recovery.

TRITIUM

A representative aliquot of each sample was equilibrated with Tritium free water. Equilibrates were transferred into round-bottomed distillation flasks and attached to single stage stills. A portion of each middle distillation fraction was transferred to a liquid scintillation vial and cocktail was added. Samples were counted by beta liquid scintillation.

Samples demonstrated acceptable results for all Tritium analyses. The Tritium method blank demonstrated an acceptable result. Due to the presence of static in the method blank, the process blank was used in lieu of the method blank. Results for the Tritium duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Tritium laboratory control sample demonstrated an acceptable percent recovery.

NICKEL-63

A representative aliquot of each sample was prepared by leaching in acids. Aliquots were placed into appropriately sized beakers. Stable elemental Nickel carrier was added to each sample prior to digestion. Samples were digested in concentrated Nitric acid. After digestion, each sample pH was adjusted and Nickel-63 was precipitated selectively with Dimethylglyoxime. Precipitates were selectively separated, redissolved, and residual acid was effectively neutralized. Sample residuals were placed into scintillation vials, scintillation cocktail was added and Nickel-63 activity was determined by beta liquid scintillation.

Samples demonstrated acceptable results for all Nickel-63 analyses. The Nickel-63 method blank demonstrated an acceptable result. Results for the Nickel-63 duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Nickel-63 laboratory control sample demonstrated an acceptable percent recovery.

GAMMA SPECTROSCOPY

Samples for Gamma Spectroscopy analysis were prepared by transferring a known mass of each homogenized sample to a standard geometry container. Samples were counted on High Purity Germanium (HPGe) gamma ray detectors.

ANALYTICAL RESULTS CONTINUED

GAMMA SPECTROSCOPY CONTINUED

Samples demonstrated acceptable results for all gamma-emitting radionuclides as reported. The method blank demonstrated acceptable results for all radionuclides as reported. Results for the Cobalt-60 and Cesium-137 replicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Potassium-40 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Cobalt-60 and Cesium-137 laboratory control sample demonstrated an acceptable percent recovery.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.

M.R. McDougall
Laboratory Manager

Date: 2/4/2020

Eberline Analytical wants and encourages your feedback regarding our performance providing radioanalytical services. Please visit http://eberlineanalytical.com/ to provide us with feedback on our services.

Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-01	LCS	KNOWN	12/23/19 00:00	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	2.01E+02	7.23E+00				pCi/g
19-12107-01	LCS	SPIKE	12/23/19 00:00	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	2.48E+02	8.30E+00	1.62E+01	5.39E+00		pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	0.00E+00	3.11E+00	3.11E+00	5.41E+00	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	-3.76E-01	3.11E+00	3.11E+00	5.43E+00	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	-5.56E-01	3.06E+00	3.06E+00	5.36E+00	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	9.00E-01	3.03E+00	3.03E+00	5.20E+00	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	1.46E+00	3.08E+00	3.08E+00	5.26E+00	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	2.00E+00	3.10E+00	3.11E+00	5.26E+00	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	-1.88E+00	3.05E+00	3.05E+00	5.43E+00	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	5.34E-01	2.98E+00	2.98E+00	5.14E+00	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	2.20E+00	3.14E+00	3.14E+00	5.31E+00	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	3.18E+00	3.06E+00	3.06E+00	5.10E+00	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	1.44E+00	3.05E+00	3.05E+00	5.20E+00	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	1.79E+00	3.05E+00	3.05E+00	5.18E+00	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	-7.54E-01	3.10E+00	3.10E+00	5.44E+00	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	0.00E+00	2.93E+00	2.93E+00	5.09E+00	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	-1.76E-01	2.91E+00	2.91E+00	5.07E+00	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	9.37E-01	3.15E+00	3.15E+00	5.42E+00	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	-3.57E-01	2.95E+00	2.95E+00	5.15E+00	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	1/4/2020	19-12107	Tritium	LANL ER-210 Modified	1.08E+00	3.04E+00	3.04E+00	5.20E+00	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

EBERLINE ANALYTICAL

EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-01	LCS	KNOWN	12/23/19 00:00	12/23/2019	1/2/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	1.50E+03	4.50E+01				pCi/g
19-12107-01	LCS	SPIKE	12/23/19 00:00	12/23/2019	1/2/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	1.48E+03	1.30E+01	8.81E+01	3.28E+00		pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	1/2/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-8.64E-02	1.90E+00	1.90E+00	3.28E+00	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	1/2/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-8.89E-01	1.93E+00	1.93E+00	3.37E+00	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	1/2/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-6.18E-01	1.92E+00	1.92E+00	3.35E+00	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	1/2/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-1.00E+00	1.98E+00	1.98E+00	3.45E+00	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	1/2/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-7.19E-01	2.24E+00	2.24E+00	3.89E+00	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	1/2/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-6.53E-01	2.03E+00	2.03E+00	3.54E+00	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	1/2/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-1.96E+00	1.81E+00	1.82E+00	3.23E+00	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	1/3/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-7.66E-01	1.85E+00	1.85E+00	3.23E+00	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	1/3/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	4.01E-01	1.78E+00	1.78E+00	3.04E+00	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	1/3/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	3.45E-01	1.91E+00	1.91E+00	3.27E+00	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	1/3/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	4.36E-01	1.93E+00	1.93E+00	3.30E+00	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	1/3/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-1.31E+00	2.03E+00	2.03E+00	3.56E+00	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	1/3/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	1.74E-01	1.92E+00	1.92E+00	3.30E+00	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	1/3/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-6.98E-01	1.90E+00	1.90E+00	3.31E+00	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	1/3/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-1.10E+00	1.98E+00	1.98E+00	3.46E+00	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	1/3/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	6.59E-01	1.83E+00	1.83E+00	3.12E+00	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	1/3/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-1.39E+00	1.87E+00	1.87E+00	3.29E+00	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	1/3/2020	19-12107	Nickel-63	ASTM 3500-Ni Modified	-2.64E-01	1.93E+00	1.93E+00	3.33E+00	U	pCi/g

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Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-01	LCS	KNOWN	12/23/19 00:00	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	5.05E+01	2.83E-01				pCi/g
19-12107-01	LCS	SPIKE	12/23/19 00:00	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	4.23E+01	2.42E+00	1.49E+01	1.30E+00		pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	2.91E-01	3.48E-01	3.62E-01	9.25E-01	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	6.29E-01	3.14E-01	3.83E-01	7.75E-01	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	3.18E-01	3.22E-01	3.41E-01	8.49E-01	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	4.16E-01	2.96E-01	3.30E-01	7.61E-01	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	3.94E-01	2.80E-01	3.12E-01	7.15E-01	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	5.28E-01	3.64E-01	4.08E-01	9.37E-01	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	2.35E-01	2.54E-01	2.67E-01	6.73E-01	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	6.91E-01	2.97E-01	3.82E-01	7.12E-01	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	2.67E-02	3.12E-01	3.12E-01	8.64E-01	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	1.38E-01	3.39E-01	3.43E-01	9.24E-01	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	3.44E-01	3.46E-01	3.66E-01	9.11E-01	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	1.84E-02	3.43E-01	3.43E-01	9.51E-01	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	3.25E-01	3.12E-01	3.32E-01	8.19E-01	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	4.18E-01	2.96E-01	3.30E-01	7.57E-01	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	2.51E-01	3.83E-01	3.92E-01	1.03E+00	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	2.02E-01	3.72E-01	3.79E-01	1.01E+00	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	-9.37E-02	3.99E-01	4.01E-01	1.12E+00	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	1/7/2020	19-12107	Strontium-90	ElChroM SRW01 Modified	5.35E-01	4.02E-01	4.43E-01	1.03E+00	U	pCi/g
19-12107-01	LCS	KNOWN	12/23/19 00:00	12/23/2019	12/27/2019	19-12107	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
19-12107-01	LCS	KNOWN	12/23/19 00:00	12/23/2019	12/27/2019	19-12107	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
19-12107-01	LCS	SPIKE	12/23/19 00:00	12/23/2019	12/27/2019	19-12107	Cobalt-60	EPA 901.1 Modified	1.29E+02	7.88E+00	1.03E+01	1.53E+00		pCi/g
19-12107-01	LCS	SPIKE	12/23/19 00:00	12/23/2019	12/27/2019	19-12107	Cesium-137	EPA 901.1 Modified	8.55E+01	7.68E+00	8.84E+00	2.00E+00		pCi/g

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Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	4.35E-02	6.23E-02	6.23E-02	1.11E-01	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	1.77E-02	1.94E-02	1.94E-02	2.40E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-5.36E-02	4.83E-02	4.84E-02	6.27E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	-3.75E-03	2.56E-02	2.56E-02	3.77E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	4.16E-02	5.10E-02	5.11E-02	8.52E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	-6.34E-03	1.80E-02	1.80E-02	2.88E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	2.48E-03	8.77E-03	8.77E-03	2.87E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	7.95E-03	1.98E-02	1.98E-02	3.16E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	3.61E-02	8.09E-02	8.09E-02	7.92E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	1.64E-02	3.93E-02	3.93E-02	3.94E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	-4.53E-02	4.50E-02	4.50E-02	5.76E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	1.01E-03	3.50E-02	3.50E-02	3.38E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	-4.06E-02	7.82E-02	7.82E-02	1.10E-01	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	1.56E-01	1.67E-01	1.67E-01	2.67E-01	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	7.94E-04	2.24E-02	2.24E-02	3.29E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	-2.31E-03	1.29E-02	1.29E-02	2.21E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	7.58E-03	2.00E-02	2.00E-02	3.22E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	5.28E-01	4.23E-01	4.24E-01	6.89E-01	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	3.62E-02	3.03E-02	3.03E-02	5.17E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	7.89E-03	4.38E-02	4.38E-02	6.84E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	5.15E-03	5.99E-02	5.99E-02	9.03E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	4.16E-02	5.10E-02	5.11E-02	8.52E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	-2.03E-03	4.51E-02	4.51E-02	7.04E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	9.74E-01	3.92E-01	3.95E-01	6.78E-01	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	3.89E-02	6.15E-02	6.16E-02	9.93E-02	U	pCi/g
19-12107-02	MBL	BLANK	12/23/19 00:00	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	9.01E-02	1.11E-01	1.11E-01	1.80E-01	U	pCi/g

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Final Report of Analysis

Report To:
Jeffrey Graham
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2701 Deborah Ave
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SDG: 19-12107
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Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	3.61E-01	1.22E-01	1.23E-01	2.21E-01		pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	-1.13E-02	3.08E-02	3.09E-02	4.13E-02	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-6.78E-02	9.09E-02	9.09E-02	1.09E-01	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	-4.59E-02	5.36E-02	5.36E-02	6.06E-02	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	4.24E-01	9.79E-02	1.00E-01	1.49E-01		pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	-2.37E-03	3.51E-02	3.51E-02	5.57E-02	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	-2.75E-03	2.25E-02	2.25E-02	5.27E-02	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	2.92E-02	2.98E-02	2.99E-02	4.88E-02	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	-1.46E-02	1.31E-01	1.31E-01	1.71E-01	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	2.34E-02	9.64E-02	9.64E-02	8.53E-02	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	4.27E-02	8.17E-02	8.18E-02	1.31E-01	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	1.12E-03	5.29E-02	5.29E-02	6.45E-02	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	9.60E-02	9.07E-02	9.08E-02	1.42E-01	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	7.59E+00	1.19E+00	1.25E+00	7.70E-01		pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	8.19E-04	3.74E-02	3.74E-02	5.68E-02	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	2.48E-02	2.82E-02	2.82E-02	3.47E-02	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	-4.58E-03	3.41E-02	3.41E-02	5.08E-02	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	8.77E-01	9.15E-01	9.16E-01	1.52E+00	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	3.02E-01	7.57E-02	7.72E-02	1.51E-01		pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	3.56E-01	1.11E-01	1.12E-01	2.01E-01		pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	7.85E-03	1.29E-01	1.29E-01	1.70E-01	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	4.24E-01	9.79E-02	1.00E-01	1.49E-01		pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	-1.75E-02	8.29E-02	8.29E-02	1.37E-01	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	3.24E-01	8.26E-01	8.27E-01	1.10E+00	U	pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	3.65E-01	1.10E-01	1.11E-01	3.56E-02		pCi/g
19-12107-03	DUP	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	-2.27E-02	2.52E-01	2.52E-01	3.23E-01	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

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Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	3.75E-01	1.30E-01	1.32E-01	2.85E-01		pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	-3.73E-02	4.60E-02	4.60E-02	3.78E-02	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-1.04E-02	4.22E-02	4.22E-02	1.07E-01	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	-7.28E-03	2.14E-02	2.14E-02	5.78E-02	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	3.96E-01	9.15E-02	9.37E-02	1.14E-01		pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	-4.11E-03	3.62E-02	3.62E-02	5.30E-02	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	-2.93E-03	1.60E-02	1.60E-02	5.13E-02	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	1.08E-03	4.51E-02	4.51E-02	6.64E-02	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	4.18E-02	1.34E-01	1.34E-01	1.64E-01	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	-6.47E-02	1.22E-01	1.22E-01	8.58E-02	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	-2.11E-02	1.02E-01	1.02E-01	1.29E-01	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	-5.78E-03	6.04E-02	6.04E-02	5.88E-02	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	1.12E-02	9.23E-02	9.23E-02	1.25E-01	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	7.42E+00	1.15E+00	1.21E+00	6.48E-01		pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	-6.76E-03	4.17E-02	4.17E-02	5.91E-02	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	3.66E-03	2.87E-02	2.87E-02	4.45E-02	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	4.88E-03	3.00E-02	3.00E-02	4.92E-02	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	1.47E+00	9.69E-01	9.72E-01	1.57E+00	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	3.57E-01	8.51E-02	8.70E-02	1.77E-01		pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	4.28E-01	1.17E-01	1.19E-01	1.84E-01		pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	-5.64E-02	1.30E-01	1.30E-01	1.63E-01	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	3.96E-01	9.15E-02	9.37E-02	1.14E-01		pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	-2.44E-02	7.39E-02	7.39E-02	1.22E-01	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	8.00E-01	8.77E-01	8.78E-01	1.35E+00	U	pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	3.74E-01	1.20E-01	1.22E-01	1.43E-01		pCi/g
19-12107-04	DO	L1-10204-A-FSGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	-1.70E-01	2.56E-01	2.56E-01	3.15E-01	U	pCi/g

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Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	5.00E-01	1.68E-01	1.70E-01	3.12E-01		pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	1.03E-02	2.34E-02	2.34E-02	5.37E-02	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-1.38E-01	8.69E-02	8.72E-02	1.25E-01	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	-5.32E-02	1.06E-01	1.06E-01	9.88E-02	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	4.64E-01	1.08E-01	1.11E-01	1.31E-01		pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	2.25E-04	4.71E-02	4.71E-02	7.11E-02	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	1.44E-02	2.07E-02	2.08E-02	7.09E-02	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	1.01E-01	7.01E-02	7.03E-02	1.12E-01	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	1.04E-02	8.43E-02	8.43E-02	1.78E-01	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	2.62E-02	1.18E-01	1.18E-01	9.21E-02	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	6.59E-02	9.62E-02	9.63E-02	1.44E-01	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	-3.43E-02	6.69E-02	6.69E-02	6.89E-02	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	9.18E-02	2.07E-01	2.07E-01	3.37E-01	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	8.26E+00	1.35E+00	1.42E+00	7.53E-01		pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	1.41E-03	5.01E-02	5.01E-02	7.87E-02	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	4.98E-03	3.72E-02	3.72E-02	4.68E-02	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	-9.65E-04	1.40E-02	1.40E-02	6.15E-02	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	1.37E+00	1.19E+00	1.19E+00	1.96E+00	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	3.51E-01	9.36E-02	9.53E-02	1.88E-01		pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	4.32E-01	1.11E-01	1.13E-01	1.92E-01		pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	7.79E-02	1.36E-01	1.37E-01	2.27E-01	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	4.64E-01	1.08E-01	1.11E-01	1.31E-01		pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	8.85E-02	1.18E-01	1.18E-01	1.92E-01	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	1.64E+00	1.30E+00	1.30E+00	2.04E+00	U	pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	3.98E-01	1.35E-01	1.37E-01	2.34E-01		pCi/g
19-12107-05	TRG	L1-10204-A-FQGS-019-SS-A	11/15/19 14:06	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	2.05E-01	2.39E-01	2.40E-01	3.75E-01	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

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SDG: 19-12107
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Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	4.55E-01	1.46E-01	1.47E-01	2.46E-01		pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	6.92E-03	4.48E-02	4.48E-02	4.17E-02	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-7.35E-02	8.22E-02	8.23E-02	1.21E-01	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	-2.12E-02	2.25E-02	2.25E-02	8.16E-02	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	3.81E-01	1.00E-01	1.02E-01	1.46E-01		pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	0.00E+00	4.29E-02	4.29E-02	4.74E-02	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	1.59E-02	2.09E-02	2.09E-02	7.44E-02	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	1.30E-01	4.91E-02	4.95E-02	6.88E-02		pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	-1.85E-01	1.50E-01	1.50E-01	1.72E-01	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	-5.27E-02	9.77E-02	9.77E-02	8.74E-02	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	-1.33E-01	9.66E-02	9.68E-02	1.30E-01	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	-3.72E-02	6.65E-02	6.66E-02	6.14E-02	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	-6.18E-02	1.38E-01	1.38E-01	1.96E-01	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	8.14E+00	1.23E+00	1.30E+00	7.49E-01		pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	-4.92E-02	5.29E-02	5.29E-02	5.95E-02	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	-5.65E-03	3.33E-02	3.33E-02	4.08E-02	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	-6.11E-03	1.70E-02	1.70E-02	4.76E-02	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	2.97E-01	7.53E-01	7.53E-01	1.14E+00	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	2.43E-01	7.66E-02	7.76E-02	1.50E-01		pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	3.30E-01	1.02E-01	1.04E-01	1.54E-01		pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	4.19E-02	1.13E-01	1.13E-01	1.70E-01	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	3.81E-01	1.00E-01	1.02E-01	1.46E-01		pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	-2.74E-02	9.09E-02	9.09E-02	1.29E-01	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	1.13E+00	8.09E-01	8.11E-01	1.25E+00	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	2.52E-01	1.26E-01	1.27E-01	2.54E-01	U	pCi/g
19-12107-06	TRG	L1-10204-B-FSGS-001-SS-A	11/07/19 08:45	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	7.85E-02	2.34E-01	2.34E-01	3.53E-01	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

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EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	5.43E-01	1.79E-01	1.81E-01	4.75E-01		pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	5.84E-03	2.50E-02	2.50E-02	5.89E-02	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-1.05E-01	8.39E-02	8.41E-02	1.25E-01	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	-9.10E-03	2.01E-02	2.01E-02	9.31E-02	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	3.94E-01	1.24E-01	1.26E-01	1.95E-01		pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	1.00E-02	5.57E-02	5.57E-02	7.58E-02	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	5.42E-03	1.88E-02	1.88E-02	6.41E-02	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	6.16E-02	5.24E-02	5.25E-02	8.48E-02	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	-3.33E-01	2.27E-01	2.28E-01	1.80E-01	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	3.98E-02	1.28E-01	1.28E-01	9.26E-02	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	1.47E-01	9.16E-02	9.19E-02	1.86E-01	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	5.75E-02	6.28E-02	6.29E-02	6.76E-02	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	-4.81E-02	2.00E-01	2.00E-01	3.20E-01	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	1.09E+01	1.65E+00	1.74E+00	1.15E+00		pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	2.27E-02	4.98E-02	4.98E-02	8.06E-02	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	-1.96E-02	4.15E-02	4.15E-02	5.89E-02	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	-5.85E-03	1.97E-02	1.97E-02	5.39E-02	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	1.08E+00	1.27E+00	1.27E+00	2.13E+00	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	4.38E-01	1.07E-01	1.09E-01	2.02E-01		pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	4.70E-01	1.16E-01	1.19E-01	3.74E-01		pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	5.78E-02	1.34E-01	1.34E-01	2.21E-01	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	3.94E-01	1.24E-01	1.26E-01	1.95E-01		pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	-5.46E-03	6.17E-02	6.17E-02	1.79E-01	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	1.12E+00	7.19E-01	7.21E-01	1.23E+00	U	pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	3.71E-01	1.44E-01	1.45E-01	2.22E-01		pCi/g
19-12107-07	TRG	L1-10204-B-FSGS-013-SS-A	11/07/19 10:09	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	7.72E-02	2.51E-01	2.51E-01	3.75E-01	U	pCi/g

0030

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Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Jeffrey Graham		SDG:	19-12107
Zion Solutions		Purchase Order:	677118
2701 Deborah Ave		Analysis Category:	ENVIRONMENTAL
Zion, IL 60099		Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	3.26E-01	1.32E-01	1.33E-01	2.41E-01		pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	-1.44E-02	4.92E-02	4.92E-02	4.74E-02	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-1.04E-01	9.49E-02	9.50E-02	1.27E-01	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	-7.26E-03	7.02E-02	7.02E-02	8.12E-02	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	4.12E-01	9.65E-02	9.88E-02	1.52E-01		pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	3.26E-03	3.95E-02	3.95E-02	5.14E-02	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	1.14E-03	2.58E-02	2.58E-02	6.70E-02	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	1.05E-01	5.52E-02	5.55E-02	8.52E-02		pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	1.85E-02	5.59E-02	5.59E-02	1.66E-01	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	4.17E-03	1.34E-01	1.34E-01	8.44E-02	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	7.39E-02	9.47E-02	9.48E-02	1.42E-01	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	1.75E-02	6.84E-02	6.84E-02	6.08E-02	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	7.07E-02	1.35E-01	1.35E-01	2.04E-01	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	9.96E+00	1.39E+00	1.48E+00	7.43E-01		pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	2.11E-02	2.50E-02	2.50E-02	4.13E-02	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	-1.97E-02	3.76E-02	3.76E-02	4.54E-02	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	6.23E-03	2.99E-02	2.99E-02	4.50E-02	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	8.04E-01	8.36E-01	8.37E-01	1.28E+00	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	3.62E-01	1.16E-01	1.17E-01	1.65E-01		pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	3.37E-01	1.10E-01	1.11E-01	1.82E-01		pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	2.47E-02	1.11E-01	1.11E-01	1.67E-01	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	4.12E-01	9.65E-02	9.88E-02	1.52E-01		pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	1.72E-02	8.60E-02	8.60E-02	1.35E-01	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	1.39E+00	8.40E-01	8.43E-01	1.32E+00	U	pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	2.92E-01	1.10E-01	1.11E-01	2.07E-01		pCi/g
19-12107-08	TRG	L1-10204-C-FSGS-004-SS-A	11/11/19 13:08	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	1.44E-01	2.40E-01	2.40E-01	3.66E-01	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

EBERLINE ANALYTICAL

EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	3.24E-01	1.19E-01	1.20E-01	2.57E-01		pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	2.58E-03	2.07E-02	2.07E-02	3.59E-02	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-2.54E-02	8.78E-02	8.78E-02	1.11E-01	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	-5.72E-03	2.28E-02	2.28E-02	5.51E-02	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	3.81E-01	1.04E-01	1.06E-01	1.80E-01		pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	1.11E-02	4.43E-02	4.43E-02	5.38E-02	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	3.73E-03	1.68E-02	1.68E-02	5.48E-02	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	7.23E-02	4.82E-02	4.84E-02	7.61E-02	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	-1.43E-02	1.45E-01	1.45E-01	1.60E-01	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	5.25E-03	5.51E-02	5.51E-02	8.34E-02	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	1.33E-02	9.94E-02	9.94E-02	1.30E-01	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	-3.84E-02	6.44E-02	6.44E-02	6.08E-02	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	1.18E-01	1.01E-01	1.01E-01	1.57E-01	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	9.23E+00	1.32E+00	1.40E+00	7.67E-01		pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	-1.00E-02	3.39E-02	3.39E-02	5.07E-02	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	-3.56E-03	1.12E-02	1.12E-02	4.27E-02	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	3.66E-03	3.21E-02	3.21E-02	5.00E-02	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	1.15E-01	9.52E-01	9.52E-01	1.24E+00	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	5.03E-01	1.21E-01	1.24E-01	1.49E-01		pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	4.83E-01	1.08E-01	1.11E-01	1.77E-01		pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	-8.62E-02	1.36E-01	1.36E-01	1.63E-01	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	3.81E-01	1.04E-01	1.06E-01	1.80E-01		pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	6.07E-02	6.90E-02	6.91E-02	1.29E-01	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	-8.14E-02	8.83E-01	8.83E-01	1.13E+00	U	pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	4.47E-01	1.13E-01	1.15E-01	3.50E-02		pCi/g
19-12107-09	TRG	L1-10204-C-FSGS-011-SS-A	11/11/19 13:22	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	1.65E-01	2.49E-01	2.49E-01	3.42E-01	U	pCi/g

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CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	4.41E-01	1.49E-01	1.51E-01	2.14E-01		pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	-1.94E-02	5.25E-02	5.26E-02	5.46E-02	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-1.12E-01	8.60E-02	8.62E-02	1.24E-01	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	5.97E-03	2.59E-02	2.59E-02	9.41E-02	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	3.25E-01	1.76E-01	1.76E-01	2.73E-01		pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	2.99E-02	6.24E-02	6.24E-02	1.05E-01	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	-1.54E-01	9.10E-02	9.13E-02	8.41E-02	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	5.38E-02	4.03E-02	4.04E-02	6.25E-02	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	1.81E-02	9.91E-02	9.91E-02	1.69E-01	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	-8.47E-02	1.51E-01	1.51E-01	8.59E-02	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	4.05E-02	9.77E-02	9.77E-02	1.47E-01	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	-1.03E-02	7.46E-02	7.46E-02	6.82E-02	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	-8.43E-02	2.13E-01	2.13E-01	3.35E-01	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	9.24E+00	1.47E+00	1.55E+00	7.89E-01		pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	9.34E-03	4.83E-02	4.83E-02	7.86E-02	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	-1.49E-02	4.08E-02	4.08E-02	4.90E-02	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	-2.26E-02	3.97E-02	3.97E-02	5.53E-02	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	7.42E-01	9.44E-01	9.45E-01	1.55E+00	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	3.53E-01	9.33E-02	9.51E-02	1.45E-01		pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	3.53E-01	1.09E-01	1.10E-01	1.88E-01		pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	-2.29E-03	1.41E-01	1.41E-01	2.30E-01	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	3.25E-01	1.76E-01	1.76E-01	2.73E-01		pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	7.30E-03	1.08E-01	1.08E-01	1.68E-01	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	7.95E-01	7.20E-01	7.21E-01	1.22E+00	U	pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	3.93E-01	1.17E-01	1.18E-01	5.70E-02		pCi/g
19-12107-10	TRG	L1-10204-D-FSGS-012-SS-A	11/13/19 09:02	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	3.93E-02	2.51E-01	2.51E-01	3.75E-01	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

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Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	3.95E-01	1.25E-01	1.27E-01	2.52E-01		pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	6.84E-03	1.15E-02	1.15E-02	3.65E-02	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-8.86E-02	8.15E-02	8.16E-02	1.10E-01	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	8.95E-03	1.58E-02	1.59E-02	7.73E-02	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	3.53E-01	9.43E-02	9.60E-02	1.46E-01		pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	-2.09E-02	3.55E-02	3.55E-02	3.97E-02	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	3.78E-03	1.28E-02	1.28E-02	5.50E-02	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	1.05E-02	3.90E-02	3.90E-02	5.57E-02	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	-1.06E-02	1.17E-01	1.17E-01	1.49E-01	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	1.52E-02	9.26E-02	9.26E-02	7.52E-02	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	5.74E-02	6.39E-02	6.39E-02	1.25E-01	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	2.37E-02	5.59E-02	5.59E-02	5.26E-02	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	3.59E-02	1.19E-01	1.19E-01	1.78E-01	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	7.36E+00	1.06E+00	1.13E+00	5.74E-01		pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	2.40E-04	3.54E-02	3.54E-02	4.88E-02	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	6.03E-03	3.20E-02	3.20E-02	3.65E-02	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	1.23E-02	2.51E-02	2.51E-02	4.16E-02	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	4.52E-01	7.21E-01	7.21E-01	1.08E+00	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	3.33E-01	7.86E-02	8.04E-02	1.31E-01		pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	2.71E-01	9.06E-02	9.16E-02	1.53E-01		pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	-4.29E-02	9.75E-02	9.75E-02	1.40E-01	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	3.53E-01	9.43E-02	9.60E-02	1.46E-01		pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	7.54E-02	7.29E-02	7.30E-02	1.23E-01	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	1.11E+00	9.42E-01	9.43E-01	1.56E+00	U	pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	2.92E-01	9.61E-02	9.73E-02	1.18E-01		pCi/g
19-12107-11	TRG	L1-10204-D-FSGS-008-SB-A	11/15/19 14:30	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	-6.79E-02	2.05E-01	2.05E-01	2.95E-01	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

EBERLINE ANALYTICAL
EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	2.51E-01	1.32E-01	1.33E-01	3.01E-01	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	-1.64E-03	1.69E-02	1.69E-02	3.93E-02	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-1.40E-02	1.02E-01	1.02E-01	1.25E-01	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	-7.83E-04	2.31E-02	2.31E-02	6.12E-02	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	3.64E-01	1.04E-01	1.06E-01	1.75E-01		pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	3.61E-02	2.40E-02	2.41E-02	4.88E-02	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	1.75E-03	1.65E-02	1.65E-02	5.33E-02	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	1.18E-01	5.29E-02	5.32E-02	7.77E-02		pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	1.21E-02	1.49E-01	1.49E-01	1.72E-01	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	-6.07E-03	3.53E-02	3.53E-02	8.56E-02	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	1.19E-01	9.95E-02	9.96E-02	1.64E-01	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	-1.39E-02	6.10E-02	6.10E-02	5.87E-02	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	-1.50E-02	1.16E-01	1.16E-01	1.44E-01	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	1.04E+01	1.44E+00	1.53E+00	7.47E-01		pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	9.45E-03	3.56E-02	3.56E-02	5.84E-02	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	-1.66E-02	3.14E-02	3.14E-02	4.17E-02	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	1.80E-02	2.82E-02	2.82E-02	4.86E-02	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	1.10E+00	9.25E-01	9.26E-01	1.31E+00	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	5.48E-01	1.27E-01	1.30E-01	1.44E-01		pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	3.67E-01	1.01E-01	1.02E-01	1.65E-01		pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	6.01E-02	1.23E-01	1.23E-01	1.70E-01	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	3.64E-01	1.04E-01	1.06E-01	1.75E-01		pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	-7.08E-03	7.79E-02	7.79E-02	1.30E-01	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	4.43E-01	9.35E-01	9.35E-01	1.25E+00	U	pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	4.04E-01	1.20E-01	1.22E-01	1.68E-01		pCi/g
19-12107-12	TRG	L1-10203-A-FSGS-010-SS-A	11/20/19 12:58	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	6.22E-02	2.58E-01	2.58E-01	3.43E-01	U	pCi/g

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Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	5.50E-01	1.71E-01	1.74E-01	3.25E-01		pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	2.00E-02	4.18E-02	4.18E-02	5.84E-02	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-9.34E-02	8.34E-02	8.35E-02	1.21E-01	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	1.40E-02	2.50E-02	2.50E-02	9.09E-02	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	3.04E-01	8.89E-02	9.03E-02	1.26E-01		pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	-2.64E-02	5.73E-02	5.73E-02	7.80E-02	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	-3.12E-02	2.92E-02	2.92E-02	6.76E-02	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	1.07E-01	5.45E-02	5.48E-02	9.99E-02	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	-2.46E-03	9.20E-02	9.20E-02	1.63E-01	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	1.10E-01	1.11E-01	1.11E-01	8.57E-02	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	3.00E-01	1.03E-01	1.04E-01	1.72E-01		pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	5.52E-02	4.68E-02	4.69E-02	8.06E-02	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	-9.36E-02	1.99E-01	1.99E-01	3.13E-01	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	1.10E+01	1.58E+00	1.68E+00	6.92E-01		pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	1.49E-02	4.70E-02	4.70E-02	7.51E-02	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	1.64E-03	3.48E-02	3.48E-02	5.47E-02	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	9.12E-03	3.29E-02	3.29E-02	5.55E-02	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	1.47E+00	8.42E-01	8.45E-01	1.45E+00	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	4.05E-01	1.34E-01	1.36E-01	1.88E-01		pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	3.66E-01	1.23E-01	1.24E-01	1.82E-01		pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	-2.79E-02	1.33E-01	1.33E-01	2.13E-01	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	3.04E-01	8.89E-02	9.03E-02	1.26E-01		pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	-5.62E-02	1.25E-01	1.25E-01	1.80E-01	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	1.05E+00	7.08E-01	7.10E-01	1.21E+00	U	pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	3.12E-01	1.02E-01	1.04E-01	5.01E-02		pCi/g
19-12107-13	TRG	L1-10203-A-FSGS-012-SS-A	11/20/19 13:02	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	1.99E-01	2.38E-01	2.38E-01	3.70E-01	U	pCi/g

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Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
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Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	4.93E-01	1.81E-01	1.82E-01	2.92E-01		pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	-1.24E-02	5.27E-02	5.27E-02	4.96E-02	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-1.72E-01	1.19E-01	1.20E-01	1.50E-01	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	1.26E-02	2.08E-02	2.08E-02	9.88E-02	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	4.54E-01	1.05E-01	1.08E-01	3.26E-01		pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	5.95E-04	4.90E-02	4.90E-02	7.44E-02	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	5.28E-03	2.34E-02	2.34E-02	7.43E-02	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	1.68E-01	6.18E-02	6.24E-02	8.83E-02		pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	5.54E-02	1.27E-01	1.27E-01	1.95E-01	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	-5.79E-02	1.29E-01	1.29E-01	9.78E-02	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	1.24E-01	8.35E-02	8.37E-02	1.64E-01	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	6.30E-02	6.82E-02	6.82E-02	7.37E-02	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	-3.77E-02	1.58E-01	1.58E-01	2.28E-01	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	1.21E+01	1.65E+00	1.76E+00	8.45E-01		pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	4.09E-02	3.55E-02	3.55E-02	1.00E-01	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	-2.39E-03	4.45E-02	4.45E-02	5.02E-02	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	-2.05E-03	1.19E-02	1.19E-02	6.13E-02	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	8.73E-01	9.61E-01	9.62E-01	1.60E+00	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	4.85E-01	1.06E-01	1.09E-01	2.05E-01		pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	4.21E-01	1.33E-01	1.35E-01	2.12E-01		pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	-1.75E-02	1.33E-01	1.33E-01	1.95E-01	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	4.54E-01	1.05E-01	1.08E-01	3.26E-01		pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	4.32E-02	1.04E-01	1.04E-01	1.65E-01	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	1.63E+00	9.57E-01	9.61E-01	1.50E+00	U	pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	4.61E-01	1.19E-01	1.21E-01	1.56E-01		pCi/g
19-12107-14	TRG	L1-10203-B-FSGS-005-SS-A	11/20/19 08:08	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	1.80E-01	2.65E-01	2.66E-01	4.08E-01	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

EBERLINE ANALYTICAL

EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	3.43E-01	1.18E-01	1.20E-01	2.07E-01		pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	6.69E-03	1.65E-02	1.65E-02	4.12E-02	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	4.44E-03	4.49E-02	4.49E-02	1.16E-01	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	3.64E-03	3.31E-02	3.31E-02	6.12E-02	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	3.24E-01	8.95E-02	9.10E-02	1.37E-01		pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	2.50E-02	4.21E-02	4.21E-02	6.88E-02	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	2.31E-03	1.39E-02	1.39E-02	5.42E-02	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	2.78E-01	7.13E-02	7.27E-02	9.16E-02		pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	7.83E-02	1.28E-01	1.28E-01	1.66E-01	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	4.59E-02	1.04E-01	1.04E-01	8.47E-02	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	-1.05E-01	1.06E-01	1.06E-01	1.25E-01	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	-2.14E-03	6.19E-02	6.19E-02	6.08E-02	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	5.43E-02	9.93E-02	9.93E-02	1.42E-01	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	9.82E+00	1.40E+00	1.49E+00	7.98E-01		pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	-1.43E-02	3.84E-02	3.84E-02	5.56E-02	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	1.53E-02	3.07E-02	3.07E-02	4.97E-02	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	-2.44E-02	3.63E-02	3.64E-02	4.78E-02	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	9.34E-01	9.17E-01	9.19E-01	1.52E+00	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	3.44E-01	8.28E-02	8.47E-02	1.42E-01		pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	4.68E-01	9.80E-02	1.01E-01	1.54E-01		pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	-5.89E-02	1.42E-01	1.42E-01	1.76E-01	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	3.24E-01	8.95E-02	9.10E-02	1.37E-01		pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	-2.09E-02	7.88E-02	7.88E-02	1.31E-01	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	9.28E-01	9.93E-01	9.94E-01	1.66E+00	U	pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	3.14E-01	1.15E-01	1.16E-01	1.81E-01		pCi/g
19-12107-15	TRG	L1-10203-B-FSGS-010-SS-A	11/20/19 08:18	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	-1.60E-01	2.78E-01	2.79E-01	3.41E-01	U	pCi/g

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Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Actinium-228	EPA 901.1 Modified	5.56E-01	1.84E-01	1.87E-01	3.23E-01		pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Silver-108m	EPA 901.1 Modified	-1.08E-02	4.81E-02	4.81E-02	5.78E-02	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Americium-241	EPA 901.1 Modified	-9.66E-02	8.49E-02	8.51E-02	1.26E-01	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Barium-133	EPA 901.1 Modified	2.39E-03	1.99E-02	1.99E-02	9.65E-02	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Bismuth-214	EPA 901.1 Modified	4.43E-01	1.17E-01	1.19E-01	7.65E-02		pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Cobalt-60	EPA 901.1 Modified	4.15E-02	5.50E-02	5.51E-02	8.46E-02	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Cesium-134	EPA 901.1 Modified	7.90E-03	2.33E-02	2.33E-02	7.66E-02	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Cesium-137	EPA 901.1 Modified	2.13E-01	7.67E-02	7.74E-02	1.09E-01		pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Europium-152	EPA 901.1 Modified	2.50E-02	8.57E-02	8.57E-02	1.85E-01	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Europium-154	EPA 901.1 Modified	-8.45E-02	1.84E-01	1.84E-01	9.43E-02	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Europium-155	EPA 901.1 Modified	1.16E-01	9.07E-02	9.09E-02	1.56E-01	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Holmium-166m	EPA 901.1 Modified	-5.78E-02	8.46E-02	8.47E-02	7.21E-02	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Iodine-129	EPA 901.1 Modified	-1.64E-02	2.22E-01	2.22E-01	3.59E-01	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Potassium-40	EPA 901.1 Modified	1.13E+01	1.64E+00	1.74E+00	7.29E-01		pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Manganese-54	EPA 901.1 Modified	-3.20E-03	4.93E-02	4.93E-02	7.51E-02	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	-2.32E-02	3.90E-02	3.90E-02	5.40E-02	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Niobium-94	EPA 901.1 Modified	3.53E-03	4.35E-02	4.35E-02	5.80E-02	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Lead-210	EPA 901.1 Modified	1.58E+00	9.62E-01	9.66E-01	1.63E+00	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Lead-212	EPA 901.1 Modified	4.00E-01	1.04E-01	1.06E-01	2.06E-01		pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Lead-214	EPA 901.1 Modified	4.04E-01	1.34E-01	1.35E-01	2.13E-01		pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Promethium-145	EPA 901.1 Modified	-5.96E-02	1.45E-01	1.45E-01	2.29E-01	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Radium-226	EPA 901.1 Modified	4.43E-01	1.17E-01	1.19E-01	7.65E-02		pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Antimony-125	EPA 901.1 Modified	3.42E-02	9.45E-02	9.46E-02	1.91E-01	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Thorium-234	EPA 901.1 Modified	1.34E+00	1.42E+00	1.42E+00	2.37E+00	U	pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Thallium-208	EPA 901.1 Modified	4.44E-01	1.40E-01	1.41E-01	5.31E-02		pCi/g
19-12107-16	TRG	L1-10203-B-FSGS-013-SS-A	11/20/19 08:24	12/23/2019	12/24/2019	19-12107	Uranium-235	EPA 901.1 Modified	2.19E-01	2.63E-01	2.64E-01	4.07E-01	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

0039

Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
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Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Actinium-228	EPA 901.1 Modified	3.61E-01	1.21E-01	1.22E-01	2.40E-01		pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Silver-108m	EPA 901.1 Modified	-2.16E-02	4.08E-02	4.08E-02	3.97E-02	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Americium-241	EPA 901.1 Modified	1.41E-02	3.10E-02	3.10E-02	1.18E-01	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Barium-133	EPA 901.1 Modified	2.49E-03	1.60E-02	1.60E-02	7.58E-02	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Bismuth-214	EPA 901.1 Modified	3.71E-01	8.55E-02	8.76E-02	1.34E-01		pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Cobalt-60	EPA 901.1 Modified	9.76E-03	3.79E-02	3.79E-02	5.20E-02	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Cesium-134	EPA 901.1 Modified	2.79E-02	2.36E-02	2.36E-02	6.07E-02	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Cesium-137	EPA 901.1 Modified	5.81E-02	4.18E-02	4.19E-02	6.69E-02	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Europium-152	EPA 901.1 Modified	-1.92E-01	1.44E-01	1.45E-01	1.57E-01	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Europium-154	EPA 901.1 Modified	-7.71E-02	1.01E-01	1.01E-01	7.87E-02	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Europium-155	EPA 901.1 Modified	1.45E-01	9.76E-02	9.79E-02	1.61E-01	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Holmium-166m	EPA 901.1 Modified	-5.36E-02	6.79E-02	6.79E-02	5.64E-02	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Iodine-129	EPA 901.1 Modified	3.53E-02	1.20E-01	1.20E-01	1.80E-01	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Potassium-40	EPA 901.1 Modified	1.02E+01	1.42E+00	1.51E+00	9.53E-01		pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Manganese-54	EPA 901.1 Modified	-1.57E-02	4.07E-02	4.07E-02	5.35E-02	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	2.22E-02	3.11E-02	3.11E-02	3.84E-02	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Niobium-94	EPA 901.1 Modified	-6.52E-03	3.62E-02	3.62E-02	4.61E-02	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Lead-210	EPA 901.1 Modified	1.49E+00	7.80E-01	7.84E-01	1.23E+00	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Lead-212	EPA 901.1 Modified	4.92E-01	1.10E-01	1.13E-01	1.28E-01		pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Lead-214	EPA 901.1 Modified	3.31E-01	8.41E-02	8.58E-02	2.45E-01		pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Promethium-145	EPA 901.1 Modified	-3.85E-02	1.02E-01	1.02E-01	1.47E-01	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Radium-226	EPA 901.1 Modified	3.71E-01	8.55E-02	8.76E-02	1.34E-01		pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Antimony-125	EPA 901.1 Modified	1.86E-02	8.58E-02	8.58E-02	1.32E-01	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Thorium-234	EPA 901.1 Modified	1.03E+00	7.90E-01	7.92E-01	1.20E+00	U	pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Thallium-208	EPA 901.1 Modified	2.56E-01	8.60E-02	8.70E-02	1.72E-01		pCi/g
19-12107-17	TRG	L1-10203-B-FSGS-004-SB-A	11/22/19 09:25	12/23/2019	12/27/2019	19-12107	Uranium-235	EPA 901.1 Modified	9.51E-02	2.21E-01	2.21E-01	3.34E-01	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

0040

Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Actinium-228	EPA 901.1 Modified	9.73E-01	2.76E-01	2.80E-01	5.05E-01		pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Silver-108m	EPA 901.1 Modified	1.29E-02	3.66E-02	3.66E-02	7.40E-02	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Americium-241	EPA 901.1 Modified	-1.57E-02	8.56E-02	8.56E-02	2.22E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Barium-133	EPA 901.1 Modified	5.66E-02	5.94E-02	5.95E-02	1.00E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Bismuth-214	EPA 901.1 Modified	1.27E+00	2.17E-01	2.27E-01	2.96E-01		pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Cobalt-60	EPA 901.1 Modified	-1.59E-02	8.60E-02	8.60E-02	1.03E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Cesium-134	EPA 901.1 Modified	5.95E-04	3.96E-02	3.96E-02	9.34E-02	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Cesium-137	EPA 901.1 Modified	1.32E-01	9.03E-02	9.06E-02	1.45E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Europium-152	EPA 901.1 Modified	1.15E-01	2.00E-01	2.00E-01	2.94E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Europium-154	EPA 901.1 Modified	-2.65E-01	2.31E-01	2.31E-01	1.52E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Europium-155	EPA 901.1 Modified	1.87E-01	1.36E-01	1.36E-01	2.22E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Holmium-166m	EPA 901.1 Modified	2.04E-03	1.09E-01	1.09E-01	1.17E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Iodine-129	EPA 901.1 Modified	2.41E-01	1.84E-01	1.84E-01	2.73E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Potassium-40	EPA 901.1 Modified	2.67E+01	3.16E+00	3.44E+00	1.15E+00		pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Manganese-54	EPA 901.1 Modified	5.86E-03	6.61E-02	6.61E-02	1.03E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	1.90E-02	5.14E-02	5.14E-02	7.08E-02	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Niobium-94	EPA 901.1 Modified	-2.86E-02	5.71E-02	5.71E-02	8.00E-02	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Lead-210	EPA 901.1 Modified	1.78E+00	1.52E+00	1.52E+00	2.50E+00	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Lead-212	EPA 901.1 Modified	1.33E+00	2.28E-01	2.38E-01	3.19E-01		pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Lead-214	EPA 901.1 Modified	1.59E+00	2.69E-01	2.81E-01	2.52E-01		pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Promethium-145	EPA 901.1 Modified	5.79E-02	2.32E-01	2.32E-01	3.08E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Radium-226	EPA 901.1 Modified	1.27E+00	2.17E-01	2.27E-01	2.96E-01		pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Antimony-125	EPA 901.1 Modified	1.30E-02	1.43E-01	1.43E-01	2.37E-01	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Thorium-234	EPA 901.1 Modified	1.66E+00	1.95E+00	1.96E+00	3.16E+00	U	pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Thallium-208	EPA 901.1 Modified	1.16E+00	2.33E-01	2.40E-01	2.77E-01		pCi/g
19-12107-18	TRG	L1-10203-C-FJGS-001-SS-A	11/22/19 13:00	12/23/2019	12/27/2019	19-12107	Uranium-235	EPA 901.1 Modified	1.68E-01	4.48E-01	4.48E-01	5.94E-01	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

0041

Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12107
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Actinium-228	EPA 901.1 Modified	4.35E-01	2.55E-01	2.56E-01	4.55E-01	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Silver-108m	EPA 901.1 Modified	8.18E-03	3.39E-02	3.39E-02	6.66E-02	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Americium-241	EPA 901.1 Modified	-1.85E-01	1.11E-01	1.11E-01	1.61E-01	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Barium-133	EPA 901.1 Modified	1.42E-02	2.80E-02	2.80E-02	1.44E-01	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Bismuth-214	EPA 901.1 Modified	7.67E-01	1.49E-01	1.54E-01	8.95E-02		pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Cobalt-60	EPA 901.1 Modified	2.01E-02	6.80E-02	6.81E-02	8.82E-02	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Cesium-134	EPA 901.1 Modified	1.05E-02	2.10E-02	2.10E-02	9.36E-02	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Cesium-137	EPA 901.1 Modified	6.88E-02	5.43E-02	5.44E-02	1.18E-01	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Europium-152	EPA 901.1 Modified	-1.36E-02	1.62E-01	1.62E-01	2.32E-01	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Europium-154	EPA 901.1 Modified	4.72E-04	1.70E-01	1.70E-01	1.22E-01	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Europium-155	EPA 901.1 Modified	4.63E-02	1.04E-01	1.04E-01	2.01E-01	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Holmium-166m	EPA 901.1 Modified	4.30E-03	9.10E-02	9.10E-02	9.03E-02	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Iodine-129	EPA 901.1 Modified	-1.90E-01	2.76E-01	2.77E-01	4.22E-01	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Potassium-40	EPA 901.1 Modified	1.67E+01	2.24E+00	2.40E+00	1.17E+00		pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Manganese-54	EPA 901.1 Modified	-4.27E-02	6.35E-02	6.35E-02	8.79E-02	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Molybdenum-93	EPA 901.1 Modified	9.68E-03	4.56E-02	4.56E-02	7.22E-02	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Niobium-94	EPA 901.1 Modified	-3.10E-03	3.11E-02	3.11E-02	8.78E-02	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Lead-210	EPA 901.1 Modified	1.91E+00	1.30E+00	1.30E+00	2.11E+00	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Lead-212	EPA 901.1 Modified	6.76E-01	1.53E-01	1.57E-01	2.31E-01		pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Lead-214	EPA 901.1 Modified	7.97E-01	1.89E-01	1.94E-01	2.56E-01		pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Promethium-145	EPA 901.1 Modified	-8.61E-02	1.77E-01	1.77E-01	2.81E-01	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Radium-226	EPA 901.1 Modified	7.67E-01	1.49E-01	1.54E-01	8.95E-02		pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Antimony-125	EPA 901.1 Modified	1.05E-01	1.39E-01	1.39E-01	2.30E-01	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Thorium-234	EPA 901.1 Modified	1.75E+00	9.62E-01	9.67E-01	1.64E+00	U	pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Thallium-208	EPA 901.1 Modified	8.10E-01	2.11E-01	2.15E-01	1.53E-01		pCi/g
19-12107-19	TRG	L1-10203-C-FJGS-003-SS-A	11/22/19 13:04	12/23/2019	12/27/2019	19-12107	Uranium-235	EPA 901.1 Modified	1.52E-01	2.94E-01	2.94E-01	4.92E-01	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

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ZION SOLUTIONS LLC
An EnergySolutions Company

ZS-WM-131
Revision 0
Information Use

REC'D DEC 23 2019

19-12107

Attachment 1 – Chain-of-Custody Form

	Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
4	L1-10204-A-FSGS-019-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/15/19	1406	5 ROC HTD	NA	1043.76
5	L1-10204-A-FQGS-019-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/15/19	1406	5 ROC HTD	NA	977.21
6	L1-10204-B-FSGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/07/19	0845	5 ROC HTD	NA	954.70
7	L1-10204-B-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/07/19	1009	5 ROC HTD	NA	1033.88
8	L1-10204-C-FSGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/11/19	1308	5 ROC HTD	NA	982.38
9	L1-10204-C-FSGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/11/19	1322	5 ROC HTD	NA	1013.39
10	L1-10204-D-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/13/19	0902	5 ROC HTD	NA	919.65
11	L1-10204-D-FSGS-008-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/15/19	1430	5 ROC HTD	NA	1148.05
12	L1-10203-A-FSGS-010-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	1258	5 ROC HTD	NA	989.28
13	L1-10203-A-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	1302	5 ROC HTD	NA	938.63
14	L1-10203-B-FSGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	0808	5 ROC HTD	NA	938.58
15	L1-10203-B-FSGS-010-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	0818	5 ROC HTD	NA	992.39
16	L1-10203-B-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	0824	5 ROC HTD	NA	969.63
17	L1-10203-B-FSGS-004-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/22/19	0925	5 ROC HTD	NA	1061.94
18	L1-10203-C-FJGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/22/19	1300	5 ROC HTD	NA	747.67
19	L1-10213-C-FJGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/22/19	1304	5 ROC HTD	NA	883.59

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19-12107 updated COC 1/24/20

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Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container				Sample Date	Sample Time	Analysis Type	Preservative	Remarks
				Vol	Unit	Type	Qty					
L1-10204-A-FSGS-019-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/15/19	1406	5 ROC HTD	NA	1043.76
L1-10204-A-FQGS-019-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/15/19	1406	5 ROC HTD	NA	977.21
L1-10204-B-FSGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/07/19	0845	5 ROC HTD	NA	954.7
L1-10204-B-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/07/19	1009	5 ROC HTD	NA	1033.88
L1-10204-C-FSGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/11/19	1308	5 ROC HTD	NA	982.38
L1-10204-C-FSGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/11/19	1322	5 ROC HTD	NA	1013.39
L1-10204-D-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/13/19	0902	5 ROC HTD	NA	919.65
L1-10204-D-FSGS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/15/19	1430	5 ROC HTD	NA	1148.05
L1-10203-A-FSGS-010-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	1258	5 ROC HTD	NA	989.28
L1-10203-A-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	1302	5 ROC HTD	NA	938.63
L1-10203-B-FSGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	0808	5 ROC HTD	NA	938.58
L1-10203-B-FSGS-010-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	0818	5 ROC HTD	NA	992.39
L1-10203-B-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	0824	5 ROC HTD	NA	969.63
L1-10203-B-FSGS-004-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/22/19	0925	5 ROC HTD	NA	1061.94
L1-10203-C-FJGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/22/19	1300	5 ROC HTD	NA	747.67
L1-10203-C-FJGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/22/19	1304	5 ROC HTD	NA	883.59

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19-12107

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Laboratory:	Date Submitted To Lab:		Ship Container No.:	Cooler Temperature:	Airbill Number:
EBERLINE LABS			**NA**	**N/A**	FedEx Ground 7772 8518 8500

Relinquished by: Jack Mucia	Date (mm/dd/yyyy): 12/18/19	Time: 0835	Received by: Richard F. Rickert	Date: (mm/dd/yyyy): 12/18/2019	0835
Relinquished by: Richard F. Rickert	Date (mm/dd/yyyy): ~~12/19/2019~~ 12/19/19	Time: 1600	Received by: FedEx Ground	Date: (mm/dd/yyyy): 12/19/2019	1600
Relinquished by: FedEx Ground	Date (mm/dd/yyyy):	Time:	Received by: Randolph Spencer	Date: (mm/dd/yyyy): 12/23/2019	1038
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	

Comments

PO # HTD's 67718

14 Day Turn Around

0007

EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD
OAK RIDGE, TENNESSEE 37830
PHONE (865) 481-0683
FAX (865) 483-4621

EBS-OR-46839

February 26, 2020

Jeffrey Graham
Zion Solutions, LLC
2701 Deborah Avenue
Zion, IL 60099

CASE NARRATIVE
Work Order # 20-02089-OR

SAMPLE RECEIPT

This work order contains sixteen soil samples relogged 02/18/2020 per client request. Samples were analyzed for Total Strontium.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-12205A-FSGS-101-SB-A	20-02089-04	L1-10213C-FIGS-003-SB-A	20-02089-12
L1-12205D-FSGS-111-SB-A	20-02089-05	L1-12201C-FSGS-013-SB-A	20-02089-13
L1-10208B-FSGS-017-SB-A	20-02089-06	L1-10203B-FSGS-004-SB-A	20-02089-14
L1-10207D-FIGS-001-SB-A	20-02089-07	L1-10213B-FIGS-001-SB-A	20-02089-15
L1-10208D-FIGS-004-SB-A	20-02089-08	L1-10213B-FIGS-002-SB-A	20-02089-16
L1-10208D-FIGS-006-SB-A	20-02089-09	L1-10213B-FIGS-008-SB-A	20-02089-17
L1-10206A-FSGS-003-SB-A	20-02089-10	L2-10214E-FSGS-006-SB-A	20-02089-18
L1-12205B-FSGS-116-SB-A	20-02089-11	L1-10212C-FSGS-009-SB-A	20-02089-19

ANALYTICAL METHODS

Total Strontium was analyzed using EIChroM Method SRW01 Modified.

Laboratory qualifiers are as follows:

U - Result is less than the MDA.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

Minimum Detectable Activity (MDA) values for data represented in this report are sample-specific. MDA measurements are determined based on factors and conditions including instrument settings, aliquot size and matrix type.

ANALYTICAL RESULTS CONTINUED

TOTAL STRONTIUM

Samples were prepared by acid digestion as appropriate for the matrix. Chemical separations were conducted by selective precipitations. Strontium was precipitated and mounted on filter media and then attached to planchets. Chemical recovery was determined by use of a stable Strontium carrier and subsequent mass measurements. Samples were counted by gas flow proportional counting and corrected for Yttrium-90 ingrowth.

Large aliquots were analyzed to improve method detection limits as best possible. Samples demonstrated acceptable results for all Total Strontium determinations. Strontium-90 results are reported from Total Strontium assuming secular equilibrium. Chemical recovery was acceptable for all samples. Results for the Total Strontium method blank demonstrated acceptable results. Results for the Total Strontium duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Total Strontium laboratory control sample demonstrated an acceptable percent recovery.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.

M.R. McDougall
Laboratory Manager

Date: 2/26/2020

Eberline Analytical wants and encourages your feedback regarding our performance providing radioanalytical services. Please visit http://eberlineanalytical.com/ to provide us with feedback on our services.

Eberline Analytical
Final Report of Analysis

Report To:

Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	**20-02089**
Purchase Order:	677118
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-02089-01	LCS	KNOWN	02/18/20 00:00	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	4.97E+01	2.79E-01				pCi/g
20-02089-01	LCS	SPIKE	02/18/20 00:00	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	4.97E+01	1.40E+00	1.74E+01	7.18E-01		pCi/g
20-02089-02	MBL	BLANK	02/18/20 00:00	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	1.18E-01	3.80E-01	3.83E-01	7.99E-01	U	pCi/g
20-02089-03	DUP	L1-12205A-FSGS-101-SB-A	10/01/19 08:25	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	4.92E-02	3.41E-02	3.82E-02	6.72E-02	U	pCi/g
20-02089-04	DO	L1-12205A-FSGS-101-SB-A	10/01/19 08:25	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	2.59E-02	2.99E-02	3.12E-02	6.09E-02	U	pCi/g
20-02089-05	TRG	L1-12205D-FSGS-111-SB-A	09/16/19 14:00	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	2.77E-02	3.04E-02	3.19E-02	6.19E-02	U	pCi/g
20-02089-06	TRG	L1-10208B-FSGS-017-SB-A	09/05/19 08:20	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	6.85E-02	4.23E-02	4.85E-02	8.33E-02	U	pCi/g
20-02089-07	TRG	L1-10207D-FIGS-001-SB-A	09/17/19 14:40	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	2.12E-02	3.86E-02	3.93E-02	8.01E-02	U	pCi/g
20-02089-08	TRG	L1-10208D-FIGS-004-SB-A	10/21/19 13:00	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	-1.75E-03	3.64E-02	3.64E-02	7.76E-02	U	pCi/g
20-02089-09	TRG	L1-10208D-FIGS-006-SB-A	10/17/19 14:40	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	1.84E-03	3.33E-02	3.34E-02	7.11E-02	U	pCi/g
20-02089-10	TRG	L1-10206A-FSGS-003-SB-A	11/22/19 08:04	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	-3.81E-03	3.64E-02	3.64E-02	7.80E-02	U	pCi/g
20-02089-11	TRG	L1-12205B-FSGS-116-SB-A	10/01/19 08:35	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	5.29E-02	3.90E-02	4.31E-02	7.76E-02	U	pCi/g
20-02089-12	TRG	L1-10213C-FIGS-003-SB-A	11/14/19 12:35	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	2.62E-02	3.34E-02	3.46E-02	6.85E-02	U	pCi/g
20-02089-13	TRG	L1-12201C-FSGS-013-SB-A	09/23/19 08:45	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	4.06E-02	3.11E-02	3.41E-02	6.18E-02	U	pCi/g
20-02089-14	TRG	L1-10203B-FSGS-004-SB-A	11/22/19 09:25	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	5.10E-02	3.17E-02	3.63E-02	6.17E-02	U	pCi/g
20-02089-15	TRG	L1-10213B-FIGS-001-SB-A	11/06/19 10:30	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	5.03E-02	3.95E-02	4.32E-02	7.91E-02	U	pCi/g
20-02089-16	TRG	L1-10213B-FIGS-002-SB-A	11/06/19 10:32	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	4.09E-02	2.97E-02	3.29E-02	5.88E-02	U	pCi/g
20-02089-17	TRG	L1-10213B-FIGS-008-SB-A	11/06/19 10:44	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	2.20E-02	3.25E-02	3.34E-02	6.70E-02	U	pCi/g
20-02089-18	TRG	L2-10214E-FSGS-006-SB-A	12/11/19 12:55	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	4.27E-02	3.29E-02	3.61E-02	6.54E-02	U	pCi/g
20-02089-19	TRG	L1-10212C-FSGS-009-SB-A	09/23/19 12:35	2/18/2020	2/19/2020	20-02089	Strontium-90	ElChroM SRW01 Modified	2.84E-02	3.18E-02	3.33E-02	6.48E-02	U	pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (1-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

EBERLINE ANALYTICAL

EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

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19-10093 PS 2-18-20

20-02089

Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L1-12107-A-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/26/2019	0722	5 ROC HTD	NA	939.51
L1-12105-A-FSGS-016-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/30/2019	1330	5 ROC HTD	NA	1026.88
L1-12105-A-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/30/2019	1302	5 ROC HTD	NA	969.33
L1-12107-A-FSGS-010-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/30/2019	1225	5 ROC HTD	NA	923.24
L1-12205-A-FSGS-111-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1305	5 ROC HTD	NA	952.09
L1-12104-A-FSGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/1/2019	0920	5 ROC HTD	NA	1013.10
L1-12104-A-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/1/2019	0924	5 ROC HTD	NA	975.70
L1-12205-A-FSGS-101-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/1/2019	0825	5 ROC HTD	NA	859.10
L1-12109-A-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/17/2019	0922	5 ROC HTD	NA	1013.58
L1-12205-C-FSGS-105-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/24/2019	1308	5 ROC HTD	NA	979.04
L1-12111-A-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/16/2019	0806	5 ROC HTD	NA	1122.70
L1-12205-D-FSGS-111-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/16/2019	1400	5 ROC HTD	NA	974.36
L1-12205-E-FSGS-104-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1306	5 ROC HTD	NA	1087.82
L1-12205-E-QIGS-101-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/11/2019	0900	5 ROC HTD	NA	829.86
L1-12205-D-FSGS-117-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1022	5 ROC HTD	NA	1028.72
L1-12205-E-FSGS-117-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1332	5 ROC HTD	NA	1106.09
L1-12205-A-FSGS-116-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1315	5 ROC HTD	NA	1078.92

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20-02089

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Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
LI-10207-A-FIGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/28/19	1451	5 ROC HTD	NA	801.99
L1-10207-A-FSGS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/16/19	1334	5 ROC HTD	NA	811.21
L1-10207-A-FIGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/29/19	1330	5 ROC HTD	NA	922.44
L1-10207-A-FIGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/29/19	1332	5 ROC HTD	NA	841.51
L1-10207-A-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/16/19	1324	5 ROC HTD	NA	876.15
L1-10207-A-FIGS-015-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/29/19	1336	5 ROC HTD	NA	893.62
L1-10207-A-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/16/19	1328	5 ROC HTD	NA	746.34
L1-10207-A-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/16/19	1322	5 ROC HTD	NA	867.31
L1-10208-B-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	8/12/19	0834	5 ROC HTD	NA	1071.96
L1-10208-B-FSGS-017-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/5/19	0820	5 ROC HTD	NA	970.53
L1-10207-A-FIGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	0749	5 ROC HTD	NA	853.76
L1-10207-A-FIGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	0801	5 ROC HTD	NA	837.38
L1-10207-A-FIGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	0747	5 ROC HTD	NA	896.71
L1-10207-A-FIGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	0745	5 ROC HTD	NA	939.31
L1-10208-C-QIGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/4/19	1330	5 ROC HTD	NA	959.99
L1-10207-A-FIGS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	0803	5 ROC HTD	NA	814.48
L1-10208-A-FSGS-021-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/8/19	1340	5 ROC HTD	NA	855.69

REC 11-8-19 O ID15

Container ID L1-10207-A-FSGS-005-SS-A

REC'D FEB 17 2020

~~REC'D NOV 18 2019~~

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ZION SOLUTIONS LLC
An Energy Solutions Company

2-02089

~~19-110785~~

Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L1-10208-D-FIGS-004-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/21/19	1300	5 ROC HTD	NA	914.30
L1-10207-D-FSGS-016-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/4/19	0802	5 ROC HTD	NA	1024.75
L1-10207-B-FSGS-011-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/5/19	1025	5 ROC HTD	NA	872.84
L1-10208-D-FIGS-006-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/17/19	1440	5 ROC HTD	NA	905.70
L110207-B-FIGS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/3/19	1334	5 ROC HTD	NA	1010.14
L1-10207-D-FIGS-001-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/17/19	1440	5 ROC HTD	NA	862.15
L1-10207-C-FSGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	8/28/19	1308	5 ROC HTD	NA	818.80
L1-10207-C-FSGS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	8/28/19	1312	5 ROC HTD	NA	885.89
L1-10207-C-FIGS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	8/28/19	0904	5 ROC HTD	NA	876.14
L1-10208-D-FIGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/17/19	1434	5 ROC HTD	NA	828.80
L1-10207-C-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	8/28/19	1326	5 ROC HTD	NA	934.84
L1-10207-B-FIGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	8-29-19	0704	5 ROC HTD	NA	1023.19
L1-10207-B-FSGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/18/19	0720	5 ROC HTD	NA	1076.31
L1-10207-A-FIGS-018-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/30/19	1304	5 ROC HTD	NA	1031.36
L1-10208-D-FSGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/21/19	1300	5 ROC HTD	NA	937.47
L1-10207-D-FIGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/6/19	1250	5 ROC HTD	NA	994.32

R, D Jennifer Owens 11/18/19 8:30am 1 of 2

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Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L1-10206-A -FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/9/19	0830	5 ROC HTD	NA	704.46
L1-10206-A-FSGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/9/19	0820	5 ROC HTD	NA	698.73
L1-10206-A-FQGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/9/19	0805	5 ROC HTD	NA	652.41
L1-10206-A-FSGS-003-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/22/19	0804	5 ROC HTD	NA	699.36
L1-10206-B-FSGS-010-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/28/19	1318	5 ROC HTD	NA	628.06
L1-10206-B-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/28/19	1322	5 ROC HTD	NA	736.13
L1-10206-B-FIGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/19/19	1232	5 ROC HTD	NA	743.97
L1-10206-C-FSGS-007-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/28/19	0912	5 ROC HTD	NA	671.93
L1-10206-C-FSGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/28/19	0920	5 ROC HTD	NA	643.92
L1-10206-D-FIGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/4/19	0820	5 ROC HTD	NA	755.09
L1-10206-D-FSGS-017-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/4/19	0852	5 ROC HTD	NA	773.48
L1-10206-E-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/5/19	0902	5 ROC HTD	NA	692.88
L1-10206-E-FSGS-014-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/5/19	0926	5 ROC HTD	NA	834.10
L1-12205-B-FSGS-116-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/1/19	0835	5 ROC HTD	NA	679.58
L1-12205-C-FSGS-109-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/24/19	0924	5 ROC HTD	NA	681.98
L1-12209-C-FIGS-009-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/22/19	1434	5 ROC HTD	NA	661.17

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Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L1-12201-A-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/7/19	0822	5 ROC HTD	NA	857.35
L1-12201-A-FSGS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/7/19	0830	5 ROC HTD	NA	800.06
L1-12201-B-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/23/19	0824	5 ROC HTD	NA	944.12
L1-12201-B-FSGS-015-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/23/19	0828	5 ROC HTD	NA	836.06
L1-12201-C-FSGS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/1/19	1240	5 ROC HTD	NA	753.32
L1-12201-C-FSGS-013-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/23/19	0845	5 ROC HTD	NA	712.42
L1-12202-A-FSGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/8/19	0800	5 ROC HTD	NA	779.07
L1-12202-A-FSGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/8/19	0806	5 ROC HTD	NA	797.37
L1-12202-B-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/8/19	0722	5 ROC HTD	NA	844.73
L1-12202-B-FSGS-007-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/8/19	0732	5 ROC HTD	NA	671.18
L1-10207-E-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	1302	5 ROC HTD	NA	705.16
L1-10207-E-FSGS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	1314	5 ROC HTD	NA	889.02
L1-10213-C-FIGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/14/19	0906	5 ROC HTD	NA	526.84
L1-10213-C-QIGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/14/19	0906	5 ROC HTD	NA	670.18
L1-10213-C-FIGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/14/19	0914	5 ROC HTD	NA	579.96
L1-10213-C-FIGS-003-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/14/19	1235	5 ROC HTD	NA	626.28

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Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L1-10204-A-FSGS-019-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/15/19	1406	5 ROC HTD	NA	1043.76
L1-10204-A-FQGS-019-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/15/19	1406	5 ROC HTD	NA	977.21
L1-10204-B-FSGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/07/19	0845	5 ROC HTD	NA	954.70
L1-10204-B-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/07/19	1009	5 ROC HTD	NA	1033.88
L1-10204-C-FSGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/11/19	1308	5 ROC HTD	NA	982.38
L1-10204-C-FSGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/11/19	1322	5 ROC HTD	NA	1013.39
L1-10204-D-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/13/19	0902	5 ROC HTD	NA	919.65
L1-10204-D-FSGS-008-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/15/19	1430	5 ROC HTD	NA	1148.05
L1-10203-A-FSGS-010-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	1258	5 ROC HTD	NA	989.28
L1-10203-A-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	1302	5 ROC HTD	NA	938.63
L1-10203-B-FSGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	0808	5 ROC HTD	NA	938.58
L1-10203-B-FSGS-010-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	0818	5 ROC HTD	NA	992.39
L1-10203-B-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/20/19	0824	5 ROC HTD	NA	969.63
L1-10203-B-FSGS-004-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/22/19	0925	5 ROC HTD	NA	1061.94
L1-10203-C-FJGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/22/19	1300	5 ROC HTD	NA	747.67
L1-10213-C-FJGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/22/19	1304	5 ROC HTD	NA	883.59

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Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L1-10213-B-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/15/19	0747	5 ROC HTD	NA	544.86
L1-10213-B-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/15/19	0749	5 ROC HTD	NA	743.46
L1-10213-B-FSGS-007-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/15/19	0757	5 ROC HTD	NA	505.98
L1-10213-B-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/15/19	0807	5 ROC HTD	NA	603.84
L1-10213-B-FSGS-014-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/15/19	0811	5 ROC HTD	NA	520.34
L1-10213-B-FSGS-015-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/15/19	0813	5 ROC HTD	NA	523.89
L1-10213-B-FSGS-016-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/15/19	0815	5 ROC HTD	NA	581.97
L1-10213-B-FQGS-015-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/15/19	0813	5 ROC HTD	NA	561.59
L1-10213-B-FIGS-001-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/6/19	1030	5 ROC HTD	NA	696.43
L1-10213-B-FIGS-002-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/6/19	1032	5 ROC HTD	NA	827.62
L1-10213-B-FIGS-008-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	11/6/19	1044	5 ROC HTD	NA	777.38

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Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L2-10214-A-FIGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/16/19	1334	5 ROC HTD	NA	706.48
L2-10214-A-QIGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/16/19	1334	5 ROC HTD	NA	624.27
L2-10214-A-FIGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/16/19	1336	5 ROC HTD	NA	640.46
L2-10214-B-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/14/19	1234	5 ROC HTD	NA	586.29
L2-10214-B-FSGS-015-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/14/19	1258	5 ROC HTD	NA	700.59
L2-10214-C-FSGS-016-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/13/19	1330	5 ROC HTD	NA	493.05
L2-10214-C-FIGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/13/19	1308	5 ROC HTD	NA	679.18
L2-10214-D-FSGS-007-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/11/19	1002	5 ROC HTD	NA	488.04
L2-10214-D-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/11/19	0924	5 ROC HTD	NA	541.25
L2-10214-D-FIGS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/11/19	0930	5 ROC HTD	NA	538.3
L2-10214-E-FSGS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/10/19	1244	5 ROC HTD	NA	659.59
L2-10214-E-FSGS-006-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/11/19	1255	5 ROC HTD	NA	842.9
L2-10214-F-FSGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/12/19	1000	5 ROC HTD	NA	572.48
L2-10214-F-QIGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/12/19	1245	5 ROC HTD	NA	557.5
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Attachment 1 – Chain-of-Custody Form

	Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
4	L1-10212C-FSGS-011-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	9/23/19	0936	5 ROC HTD	NA	456.07
5	L1-10212C-FSGS-014-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	9/23/19	0944	5 ROC HTD	NA	380.67
6	L1-10212C-FSGS-009-SB-A	NA	NA	SOIL	250	ml	MARINELLI	1	9/23/19	1235	5 ROC HTD	NA	508.99
7	L1-10212D-FSGS-007-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	8/15/19	0842	5 ROC HTD	NA	443.80
8	L1-10212D-FSGS-008-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	8/15/19	0844	5 ROC HTD	NA	395.12
9	L1-10212D-FSGS-010-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	8/15/19	0848	5 ROC HTD	NA	455.83
10	L1-10212D-FSGS-014-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	8/15/19	0858	5 ROC HTD	NA	417.26
11	L1-10212D-FSGS-020-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	8/15/19	0912	5 ROC HTD	NA	472.61
12	L1-10212D-FQGS-010-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	8/15/19	0848	5 ROC HTD	NA	471.95
13	L1-10212D-FSGS-103-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	9/5/19	1314	5 ROC HTD	NA	383.96
14	L1-10212D-FSGS-105-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	9/5/19	1318	5 ROC HTD	NA	414.19
15	L1-10212D-FSGS-107-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	9/5/19	1322	5 ROC HTD	NA	464.13
16	L1-10212D-FSG-108-SS-A			SOIL	250	ml	MARINELLI	1	9/5/19	1324	5 ROC HTD	NA	445.79
17	L1-10212D-FSGS-109-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	9/5/19	1326	5 ROC HTD	NA	464.03
18	L1-10212D-FSGS-110-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	9/5/19	1328	5 ROC HTD	NA	486.23
19	L1-10212D-FSGS-112-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	9/5/19	1332	5 ROC HTD	NA	355.60

Laboratory: REC RS 1-14-20 | Date Submitted To Lab: | Ship Container No.: | Cooler Temperature: | Airbill Number:

(C) 0956