ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

CONSTRUCTION PARKING AREA

SURVEY UNIT 10214E

REVISION 1

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TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 7
2. SURVEY UNIT DESCRIPTION 7
3. CLASSIFICATION BASIS 8
4. DATA QUALITY OBJECTIVES 11
5. SURVEY DESIGN 15
6. SURVEY IMPLEMENTATION 22
7. SURVEY RESULTS 23
8. QUALITY CONTROL 31
9. INVESTIGATIONS AND RESULTS 31
10. REMEDIATION AND RESULTS 31
11. CHANGES FROM THE SURVEY PLAN 31
12. DATA QUALITY ASSESSMENT 31
13. ANOMALIES 32
14. CONCLUSION 32
15. REFERENCES 33
16. ATTACHMENTS 34
ATTACHMENT 1 - FIGURES AND MAP 35
ATTACHMENT 2 - SCAN DATA 39
ATTACHMENT 3 - CONSULTATION TRIGGERS FOR RESIDENTIAL AND COMMERCIAL/INDUSTRIAL SOIL CONTAMINATION 46
ATTACHMENT 4 - SIGN TEST 48
ATTACHMENT 5 - QC SAMPLE ASSESSMENT 50
ATTACHMENT 6 - GRAPHICAL PRESENTATIONS 52
ATTACHMENT 7 - SAMPLE ANALYTICAL REPORTS 59
ATTACHMENT 8 - EBERLINE ANALYTICAL REPORTS 230

LIST OF TABLES

Table 1 - Dose Significant Radionuclides and Mixture 12
Table 2 - Base Case DCGLs for Surface Soils ($BcDCGL_{SS}$) 13
Table 3 - Base Case DCGLs for Subsurface Soils ($BcDCGL_{SB}$) 13
Table 4 - Operational DCGLs for Surface Soils ($OpDCGL_{SS}$) 14
Table 5 - Operational DCGLs for Subsurface Soils ($OpDCGL_{SB}$) 14
Table 6 - Surrogate Ratios 16
Table 7 - Investigation Levels 17
Table 8 - Systematic Sample Measurement Locations 19
Table 9 - Synopsis of Survey Design 21
Table 10 - Instruments and Detectors 23
Table 11 - Synopsis of Scan Results 24
Table 12 - Summary of Gamma Spectroscopy Results for Surface Soil Samples Comprising the Statistical Sample Population 26
Table 13 - Summary of Gamma Spectroscopy Results for Investigation Samples 27
Table 14 - Summary of Gamma Spectroscopy Results for Subsurface Soil Samples 27
Table 15 - Off-Site Analysis Results 28
Table 16 - Summary of Gamma Spectroscopy Results for QC Soil Samples 28
Table 17 - Sum of Fractions for Surface Soil Samples compared to the OpDCGLs (Systematic) 29
Table 18 - Sum of Fractions for Investigation Samples compared to the OpDCGLs 30
Table 19 - Sum of Fractions for Subsurface Soil Samples compared to the OpDCGLs 30
Table 20 - Sum of Fractions for QC Soil Samples compared to the OpDCGLs 30
Table 21 - Basic Statistical Properties of Systematic Sample Population 30

LIST OF FIGURES

Figure 1 - Class 3 Open Land Survey Units Outside of "Radiologically Restricted Area" from Figure 2-5 of the LTP 8
Figure 2 - The Four Class 2 and Two Class 1 Open Land Survey Units Created from the Original Class 3 Survey Unit 10214 10

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 10214E, "Construction Parking 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 (L1-10214E-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. Two (2) small areas of elevated activity were detected during the scans (see Section 9 for further discussion). The analytical results for all soil samples (systematic and investigation) taken in survey unit 10214E 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. For the systematic samples, the maximum Operational SOF (OpSOF) was 0.090 with a mean OpSOF of 0.030. The mean Base Case SOF (BcSOF), when the analytical results were compared to the Base Case DCGLs (BcDCGL), was 0.008, which results in a dose assigned to the survey unit of 0.195 mrem/year Total Effective Dose Equivalent (TEDE). Therefore, the null hypothesis is rejected and survey unit 10214E is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 10214E, "Construction Parking Area," is a Class 1 open land survey unit and is 1,989 m^2 in size. It is bounded on the west by survey unit 10214D, the east by survey units 10212B and 10213A; the north by a non-impacted area and the south by survey unit 10214D.

The topography of the survey unit is mainly flat with some small dips and depressions. The top surface is a mixture of gravel and loam.

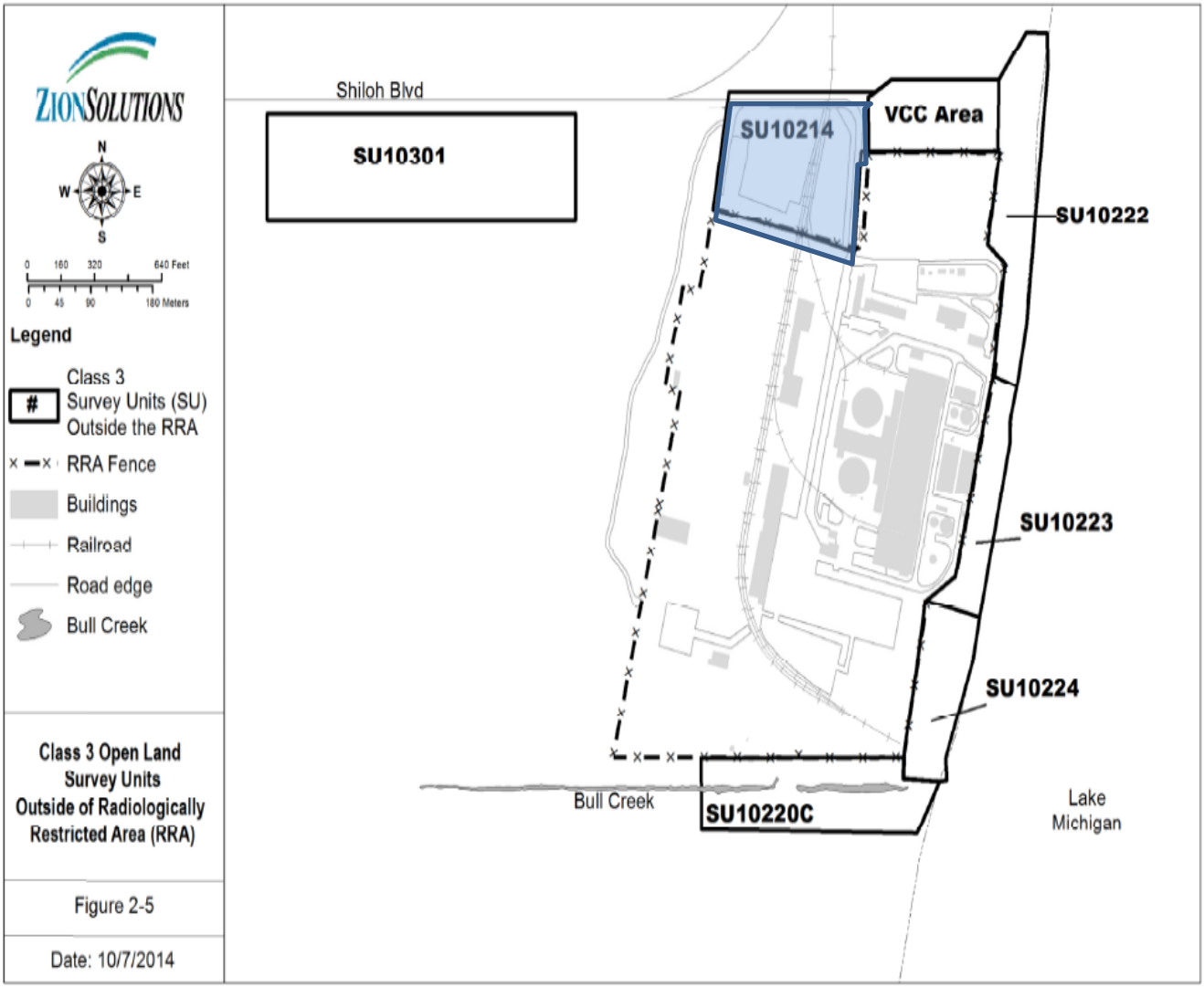
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 10214E 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 "Construction Parking Area" and was located within survey unit 10214 as identified in Figure 4 of the HSA. This area was subsequently described as the "Construction Parking Lot" (survey unit 10214) in Table 2-4 of the LTP as represented in Figure 2-5 of the LTP and replicated below as Figure 1.

Figure 1 - Class 3 Open Land Survey Units Outside of "Radiologically Restricted Area" from Figure 2-5 of the LTP



The HSA states that this area contained the construction parking area which consisted of crushed rock. The top surface of the survey unit is still mostly comprised of crushed gravel.

Characterization surveys were performed in September and October of 2013 for the Class 3 survey unit 10214. The following data was obtained:

- Thirteen (13) judgmental surface samples taken at the direction of the cognizant Radiological Engineer (RE).
- Seventeen (17) random surface samples and three (3) random subsurface samples.
- One (1) investigation surface sample taken in an area identified by a scan alarm.
- Sodium iodide (NaI) walkover scans of approximately 10% of the surface area in survey unit.

The results of the characterization survey were:

- Three (3) of the thirteen (13) judgmental surface samples were positive for Cs-137 with the highest result being 0.11 pCi/g.
- All seventeen (17) of the random surface samples and the three (3) random subsurface samples were < Minimum Detectable Concentration (MDC) for the Radionuclides of Concern (ROC).
- The one (1) investigation surface sample was positive for Cs-137 with an activity of 0.09 pCi/g.

On June 12, 2017, due to changing radiological and operational conditions brought about by site decommissioning activities inside or adjacent to this area, survey unit 10214 was reclassified as Class 2, and divided into four survey units: 10214A, 10214B, 10214C and 10214D to comply with the survey unit size recommendations from MARSSIM Section 4.6.

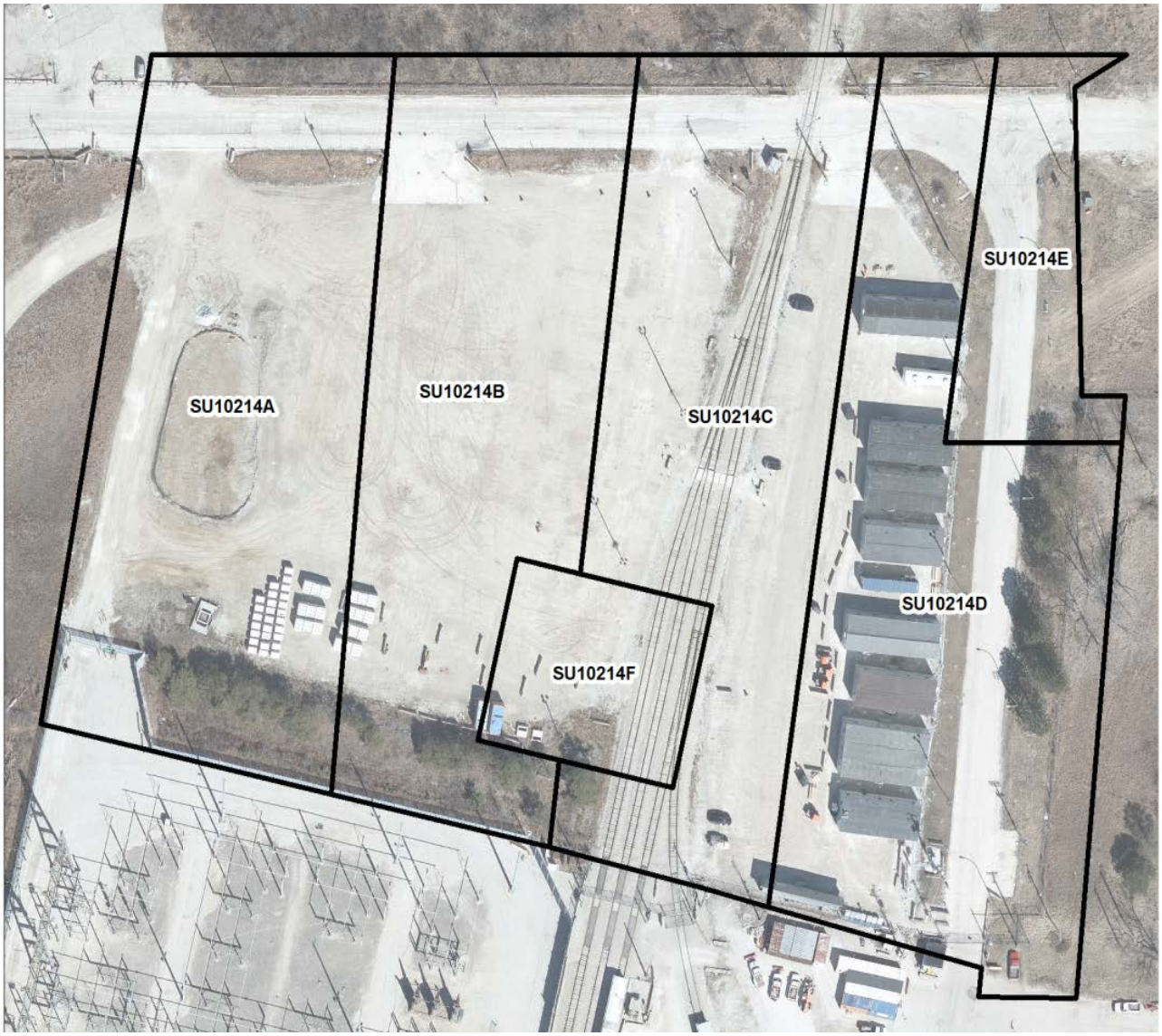
While performing a Radiological Assessment survey in March of 2019, a particle was found in the northeast portion of survey unit 10214D with an activity of 1.26 µCi. This area was subsequently reclassified as Class 1 and designated survey unit 10214E.

In November of 2019, a small radioactive particle with an activity of 0.02 µCi was discovered by the Radiation Protection group in the southwest portion of survey unit 10214C. The small particle was captured and removed. Due to the discovery of the small particle, the area around where it was found was reclassified as Class 1 and designated survey unit 10214F.

These changes in classification, discussed above, were a conservative response and ensured that the survey units was surveyed with the appropriate rigor.

Figure 2 below shows the boundaries of the Class 1 and Class 2 survey units.

Figure 2 - The Four Class 2 and Two Class 1 Open Land Survey Units Created from the Original Class 3 Survey Unit 10214



In November of 2019, gamma scans were performed in areas where asphalt was removed from the roadway in survey units 10214C, 10214D and 10214E. Three (3) soil samples were collected in areas where scan alarms occurred. Significant concentrations of Naturally Occurring Radioactive Material were identified in these samples. However, none of the samples showed positively detected concentrations above MDC for the ROC. Fifty (50) additional soil samples were collected in the areas where the asphalt was removed. All of these samples were less than MDC for the ROC. A layer of gravel was subsequently laid down over the newly exposed soils.

An RE and a Characterization/License Termination (C/LT) Supervisor performed a visual inspection and walk-down of the survey unit on December 5, 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 10214E 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 ZSRP 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 10214E 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 10214E. 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 10214E, 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 OpDCGL 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, 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 Plan NAD 1983 standard topographical grid coordinate system. The number of samples generated by VSP for a systematic triangular grid was 17. 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: $A = \frac{A_{SU}}{N} = \frac{1989}{17} = 117.0\ m^2$
- 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* 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 (L1-10214E-FQGS-008-SS) was selected randomly for split sample analysis for the FSS of this survey unit. One (1) additional QC split sample was obtained at investigational sample location L1-10214E-QIGS-001-SB.

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 L1-10214E-FSGS-006-SB and L1-10214E-FSGS-007-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)
L1-10214E-FSGS-001-SS	642124.20	343617.33
L1-10214E-FSGS-002-SS	642124.20	343628.95
L1-10214E-FSGS-003-SS	642124.20	343640.57
L1-10214E-FSGS-004-SS	642124.20	343652.20
L1-10214E-FSGS-005-SS	642134.26	343623.14
L1-10214E-FSGS-006-SS	642134.26	343634.76
L1-10214E-FSGS-007-SS	642144.33	343628.95
L1-10214E-FSGS-008-SS	642144.33	343640.57
L1-10214E-FSGS-009-SS	642154.39	343623.14
L1-10214E-FSGS-010-SS	642154.39	343634.76
L1-10214E-FSGS-011-SS	642164.46	343628.95
L1-10214E-FSGS-012-SS	642164.46	343640.57
L1-10214E-FSGS-013-SS	642174.53	343634.76
L1-10214E-FSGS-014-SS	642184.59	343628.95
L1-10214E-FSGS-015-SS	642184.59	343640.57
L1-10214E-FSGS-016-SS	642194.66	343634.76
L1-10214E-FSGS-017-SS	642194.66	343646.39
L1-10214E-FSGS-006-SB	642134.26	343634.76
L1-10214E-FSGS-007-SB	642144.33	343628.95

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 a 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. Only one (1) sample, L1-10214E-FSGS-006-SB, exceeded an OpSOF of 0.1 during the FSS of survey unit 10214E.

One (1) additional soil sample was selected to meet the requirement that 10% of the samples collected for the FSS of open land areas be analyzed for HTD ROC. Sample number L1-10214E-FSGS-008-SS was selected based on exhibiting the highest Cs-137 concentration 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 10214E.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	1,989 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, Table 5-7)
HTD ROC Analysis	A minimum of two (2) soil samples selected for HTD ROC analysis	(LTP, Section 5.1)
Measurement Investigation Level	Operational DCGL	(LTP, Table 5-25)
Scan Survey Area Coverage	100%	(LTP, Table 5-24)
QC	Two (2) samples selected randomly for split sample analysis (1 systematic, 1 investigational)	(LTP, Section 5.9)
Number of Subsurface Soil Samples	Two (2) systematic surface soil sample locations 6 and 7	(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 L1-10214E-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 10214E, 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 encountered during the FSS of survey unit 10214E while performing gamma scans in rows 36 and 43 (see Section 9 for further discussion). One (1) surface and one (1) subsurface investigation soil sample was taken in each of these locations (L1-10214E-FIGS-001-SS, L1-10214E-FIGS-002-SS, L1-10214E-FIGS-001-SB and L1-10214E-FIGS-002-SB).

FSS field activities were conducted under FSS sample plan L1-10214E-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 December 7, 2019, and concluding on December 11, 2019.

The seventeen (17) systematic surface soil sample locations were marked with flags based on GPS coordinates provided by VSP.

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-inch x 2-inch) 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. Two (2) areas of elevated activity were detected on the scans (see Section 9 for further discussion).

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	304708/PR321892	09/04/2020
Ludlum 2350-1/Ludlum 44-10	293136/PR316938	06/18/2020
Ludlum 2350-1/Ludlum 44-10	216173/ES0118	10/07/2020
Ludlum 2350-1/Ludlum 44-10	304726/PR363452	08/28/2020
Ludlum 2350-1/Ludlum 44-10	266656/PR311750	07/24/2020

In accordance with the survey design, seventeen (17) surface soil samples were collected at the designated systematic sample points along with two (2) subsurface samples taken at randomly selected sample locations. In addition, two (2) surface samples and two (2) subsurface samples were collected as part of the investigation of two (2) areas of elevated activity identified during the surface scans.

Two (2) samples (L1-10214E-FSGS-008-SS and L1-10214E-FSGS-006-SB) were selected for HTD radionuclide analysis.

One (1) surface soil sample (L1-10214E-FQGS-008-SS) was selected randomly for QC sample analysis. One (1) additional QC split sample was obtained at investigational sample location L1-10214E-QIGS-001-SB.

7. SURVEY RESULTS

One hundred percent (100%) of the surface area of the survey unit was scanned for elevated radiation levels. Eighty (80) 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. Two (2) elevated measurement locations were identified by surface scan in rows 36 and 43 (see Section 9 for further discussion). Table 11 provides an overview 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
Row 1	2349	2443	None	None
Row 2	2115	2443	None	None
Row 3	2291	2443	None	None
Row 4	2074	2443	None	None
Row 5	2105	2443	None	None
Row 6	1981	2443	None	None
Row 7	2006	2443	None	None
Row 8	1920	2443	None	None
Row 9	2032	2443	None	None
Row 10	1899	2443	None	None
Row 11	1895	2443	None	None
Row 12	1900	2443	None	None
Row 13	2042	2463	None	None
Row 14	2089	2463	None	None
Row 15	1979	2463	None	None
Row 16	2135	2463	None	None
Row 17	2010	2463	None	None
Row 18	2086	2463	None	None
Row 19	2052	2463	None	None
Row 20	2223	2463	None	None
Row 21	2173	2463	None	None
Row 22	2204	2463	None	None
Row 23	2123	2463	None	None
Row 24	2143	2463	None	None
Row 25	2207	2463	None	None
Row 26	2167	2463	None	None
Row 27	2131	2463	None	None
Row 28	2087	2463	None	None
Row 29	2321	2641	None	None
Row 30	2387	2641	None	None
Row 31	2206	2641	None	None
Row 32	2303	2641	None	None
Row 33	2562	2641	None	None
Row 34	2485	2641	None	None
Row 35	2614	2641	None	None
Row 36	3003	2641	1	L1-10214E-FIGS-001-SS/SB
Row 37	2555	2641	None	None
Row 38	2610	2641	None	None
Row 39	2421	2641	None	None
Row 40	2505	2641	None	None

Table 11 (continued) - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[1] (cpm)	# of Scan Alarms	Investigation Samples
Row 41	2456	2641	None	None
Row 42	2589	2641	None	None
Row 43	2924	2641	1	L1-10214E-FIGS-002-SS/SB
Row 44	2475	2641	None	None
Row 45	2525	2641	None	None
Row 46	2682	2811	None	None
Row 47	2629	2811	None	None
Row 48	2674	2811	None	None
Row 49	2453	2811	None	None
Row 50	2748	2811	None	None
Row 51	2774	2811	None	None
Row 52	2653	2811	None	None
Row 53	2780	2811	None	None
Row 54	2805	2811	None	None
Row 55	2615	2811	None	None
Row 56	2494	2811	None	None
Row 57	2379	2811	None	None
Row 58	2423	2811	None	None
Row 59	2642	2811	None	None
Row 60	1355	1722	None	None
Row 61	1395	1722	None	None
Row 62	1296	1722	None	None
Row 63	1289	1690	None	None
Row 64	1288	1690	None	None
Row 65	1304	1690	None	None
Row 66	1215	1690	None	None
Row 67	1283	1690	None	None
Row 68	1241	1690	None	None
Row 69	1291	1690	None	None
Row 70	1248	1690	None	None
Row 71	1343	1690	None	None
Row 72	1337	1690	None	None
Row 73	1338	1690	None	None
Row 74	1575	1690	None	None
Row 75	1998	2342	None	None
Row 76	1916	2342	None	None
Row 77	1920	2342	None	None
Row 78	2055	2342	None	None

Table 11 (continued) - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level(1) (cpm)	# of Scan Alarms	Investigation Samples
Row 79	2243	2342	None	None
Row 80	2291	2342	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) systematic surface soil samples taken for non-parametric statistical testing, the two (2) biased surface soil samples (investigation) and the four (4) subsurface soil samples (two randomly selected samples and two investigation 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. For the systematic samples, the gamma spectroscopy results revealed two (2) samples with activity levels above MDC for Cs-137 and no samples with activity levels above MDC for Co-60 or Cs-134. 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)
L1-10214E-FSGS-001-SS	8.94E-03	3.26E-02	**3.87E-02**	1.61E+00	7.74E-05
L1-10214E-FSGS-002-SS	7.44E-03	0.00E+00	1.14E-02	1.34E+00	2.28E-05
L1-10214E-FSGS-003-SS	0.00E+00	0.00E+00	1.56E-02	0.00E+00	3.12E-05
L1-10214E-FSGS-004-SS	2.46E-02	1.16E-02	2.01E-02	4.44E+00	4.02E-05
L1-10214E-FSGS-005-SS	0.00E+00	1.13E-02	5.87E-02	0.00E+00	1.17E-04
L1-10214E-FSGS-006-SS	9.18E-03	4.86E-03	1.47E-03	1.66E+00	2.94E-06
L1-10214E-FSGS-007-SS	1.74E-02	2.89E-02	2.50E-02	3.14E+00	5.00E-05
L1-10214E-FSGS-008-SS	2.76E-02	1.52E-02	**5.32E-02**	4.98E+00	1.06E-04
L1-10214E-FSGS-009-SS	3.35E-02	1.73E-02	2.23E-02	6.05E+00	4.46E-05
L1-10214E-FSGS-010-SS	1.46E-02	1.61E-02	1.06E-02	2.63E+00	2.12E-05
L1-10214E-FSGS-011-SS	2.16E-03	0.00E+00	2.42E-02	3.90E-01	4.84E-05
L1-10214E-FSGS-012-SS	3.26E-03	3.35E-02	6.97E-03	5.88E-01	1.39E-05
L1-10214E-FSGS-013-SS	2.25E-02	1.04E-02	0.00E+00	4.06E+00	0.00E+00

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)
L1-10214E-FSGS-014-SS	0.00E+00	1.30E-02	6.01E-03	0.00E+00	1.20E-05
L1-10214E-FSGS-015-SS	0.00E+00	1.53E-02	0.00E+00	0.00E+00	0.00E+00
L1-10214E-FSGS-016-SS	2.76E-02	0.00E+00	1.26E-02	4.98E+00	2.52E-05
L1-10214E-FSGS-017-SS	5.60E-02	2.80E-02	4.12E-02	1.01E+01	8.24E-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 Investigation 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)
L1-10214E-FIGS-001-SS	2.26E-02	2.94E-02	0.00E+00	4.08E+00	0.00E+00
L1-10214E-FIGS-002-SS	3.32E-03	2.38E-02	**6.89E-02**	5.99E-01	1.38E-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.

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)
L1-10214E-FSGS-006-SB	0.00E+00	5.04E-02	**1.21E-01**	0.00E+00	2.42E-04
L1-10214E-FSGS-007-SB	7.40E-04	2.96E-02	4.69E-02	1.34E-01	9.38E-05
L1-10214E-FIGS-001-SB	0.00E+00	4.34E-02	3.35E-02	0.00E+00	6.70E-05
L1-10214E-FIGS-002-SB	2.24E-02	2.51E-02	1.95E-02	4.04E+00	3.90E-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.

The off-site laboratory, Eberline Analytical, processed the two (2) samples selected for HTD ROC analysis as specified in the survey design. Samples L1-10214E-FSGS-008-SS-A and L1-10214E-FSGS-006-SBA were selected. Only HTD radionuclides included as ROC (Ni-63 and Sr-90 for soils) were included in the analysis. All analyses met the required MDC. Only Cs-137 was positively detected in the samples at concentrations 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 # L1-10214E-FSGS-008-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	5.63E-02	6.26E-02	8.66E-02	No
Cs-134	1.70E-03	2.37E-02	9.37E-02	No
Cs-137	1.33E-01	6.95E-02	1.06E-01	Yes
Ni-63	-8.77E-01	1.85E+00	3.24E+00	No
Sr-90	4.93E-01	3.70E-01	8.80E-01	No

Sample # L1-10214E-FSGS-006-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	-1.68E-02	4.76E-02	4.91E-02	No
Cs-134	-3.17E-03	1.47E-02	6.12E-02	No
Cs-137	8.77E-02	5.44E-02	8.53E-02	Yes
Ni-63	-4.40E-01	1.87E+00	3.25E+00	No
Sr-90(1)	4.27E-02	3.29E-02	6.54E-02	No

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

The implementation of survey specific QC measures included the collection of one (1) systematic sample (L1-10214E-FQGS-008-SS) and one (1) biased sample (L1-10214E-QIGS-001-SB) for "split sample" analysis. The on-site laboratory analyzed the designated QC samples using the on-site gamma spectroscopy system. Gamma spectroscopy results are summarized in Table 16. The concentration for Ni-63 and Sr-90 are 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)
L1-10214E-FQGS-008-SS	5.25E-02	0.00E+00	2.73E-02	9.47E+00	5.46E-05
L1-10214E-QIGS-001-SB	0.00E+00	1.78E-02	5.11E-02	0.00E+00	1.02E-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 10214E are provided in Table 17. The results of the unity rule calculations for the ROC for the biased surface samples are provided in Table 18, the results for the subsurface samples are provided in Table 19, and the results for the QC samples are provided in Table 20.

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-10214E-FSGS-001-SS	8.19E-03	1.88E-02	1.07E-02	1.76E-03	2.50E-05	0.039
L1-10214E-FSGS-002-SS	6.82E-03	0.00E+00	3.14E-03	1.47E-03	7.37E-06	0.011
L1-10214E-FSGS-003-SS	0.00E+00	0.00E+00	4.30E-03	0.00E+00	1.01E-05	0.004
L1-10214E-FSGS-004-SS	2.25E-02	6.69E-03	5.54E-03	4.85E-03	1.30E-05	0.040
L1-10214E-FSGS-005-SS	0.00E+00	6.52E-03	1.62E-02	0.00E+00	3.79E-05	0.023
L1-10214E-FSGS-006-SS	8.41E-03	2.80E-03	4.05E-04	1.81E-03	9.50E-07	0.013
L1-10214E-FSGS-007-SS	1.59E-02	1.67E-02	6.89E-03	3.43E-03	1.62E-05	0.043
L1-10214E-FSGS-008-SS	2.53E-02	8.77E-03	1.47E-02	5.45E-03	3.44E-05	0.054
L1-10214E-FSGS-009-SS	3.07E-02	9.98E-03	6.14E-03	6.61E-03	1.44E-05	0.053
L1-10214E-FSGS-010-SS	1.34E-02	9.29E-03	2.92E-03	2.88E-03	6.85E-06	0.028
L1-10214E-FSGS-011-SS	1.98E-03	0.00E+00	6.67E-03	4.26E-04	1.56E-05	0.009
L1-10214E-FSGS-012-SS	2.99E-03	1.93E-02	1.92E-03	6.43E-04	4.50E-06	0.025
L1-10214E-FSGS-013-SS	2.06E-02	6.00E-03	0.00E+00	4.44E-03	0.00E+00	0.031
L1-10214E-FSGS-014-SS	0.00E+00	7.50E-03	1.66E-03	0.00E+00	3.88E-06	0.009
L1-10214E-FSGS-015-SS	0.00E+00	8.83E-03	0.00E+00	0.00E+00	0.00E+00	0.009
L1-10214E-FSGS-016-SS	2.53E-02	0.00E+00	3.47E-03	5.45E-03	8.14E-06	0.034
L1-10214E-FSGS-017-SS	5.13E-02	1.62E-02	1.13E-02	1.11E-02	2.66E-05	0.090

Systematic Measurements

Number of Systematic Measurements =	17
# of Systematic Measurements with OpSOF ≥ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	0
Max Individual Systematic Measurement OpSOF =	0.090
Mean Systematic Measurement OpSOF =	0.030

Table 18 - Sum of Fractions for Investigation 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	
L1-10214E-FIGS-001-SS	2.07E-02	1.70E-02	0.00E+00	4.46E-03	0.00E+00	0.042
L1-10214E-FIGS-002-SS	3.04E-03	1.37E-02	1.90E-02	6.55E-04	4.45E-05	0.036

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	
L1-10214E-FSGS-006-SB	0.00E+00	4.43E-02	6.10E-02	0.00E+00	5.69E-04	0.106
L1-10214E-FSGS-007-SB	8.40E-04	2.60E-02	2.36E-02	6.84E-04	2.21E-04	0.051
L1-10214E-FIGS-001-SB	0.00E+00	3.82E-02	1.69E-02	0.00E+00	1.58E-04	0.055
L1-10214E-FIGS-002-SB	2.54E-02	2.21E-02	9.83E-03	2.07E-02	9.18E-05	0.078

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface/Subsurface soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-10214E-FQGS-008-SS	4.81E-02	0.00E+00	7.52E-03	1.04E-02	1.76E-05	0.066
L1-10214E-QIGS-001-SB	0.00E+00	1.57E-02	2.58E-02	0.00E+00	2.40E-04	0.042

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	1.50E-02	9.18E-03	5.60E-02	0.00E+00	0.015	4.26	3.52E-03	8.80E-02
Cs-134	1.40E-02	1.30E-02	3.35E-02	0.00E+00	0.011	6.77	2.07E-03	5.17E-02
Cs-137	2.05E-02	1.56E-02	5.87E-02	0.00E+00	0.018	14.18	1.44E-03	3.61E-02
Ni-63	2.70E+00	1.66E+00	1.01E+01	0.00E+00	2.790	3572.1	7.57E-04	1.89E-02
Sr-90	4.09E-05	3.12E-05	1.17E-04	0.00E+00	0.000	12.09	3.39E-06	8.47E-05

The mean BcSOF for survey unit 10214E is 0.008 which equates to a dose of 0.195 mrem/year TEDE.

The mean 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, L1-10214E-FQGS-008-SS and L1-10214E-QIGS-001-SB, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in ZS-LT-01, *"Quality Assurance Project Plan (for Characterization and FSS)."* For sample #8 and 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 between standard and comparison results. Refer to Attachment 5 for data and QC analysis results.

9. INVESTIGATIONS AND RESULTS

Investigations were performed following scan alarms in rows 36 and 43 on December 7, 2019. Two (2) areas were identified: a 0.25 ft^2 area in row 36 and a 3 ft^2 area in row 43. The maximum count rates were 3,003 cpm and 2,924 cpm respectively (a map of the areas is included in Attachment 1). One (1) surface and one (1) subsurface soil sample were taken in each elevated area: L1-10214E-FIGS-001-SS, L1-10214E-FIGS-002-SS, L1-10214E-FIGS-001-SB and L1-10214E-FIGS-002-SB. Gamma spectroscopy results revealed one (1) sample with an activity level above MDC for Cs-137 and no samples with activity levels above MDC for Co-60 or Cs-134. The OpSOF for the investigation samples were all less than 1.0, with a maximum OpSOF of 0.078 for sample L1-10214E-FIGS-002-SB. No further action was necessary. The investigation is documented in an Attachment 13 (from ZS- LT-300-001-004), "Final Status Survey Investigation."

The gamma spectroscopy results are summarized in Table 13 for the surface soil samples and Table 14 for the subsurface samples. The OpSOF are summarized in Table 18 and Table 19 respectively.

10. REMEDIATION AND RESULTS

No remediation was performed in this survey unit.

11. CHANGES FROM THE SURVEY PLAN

There were no addendums to the FSS 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 adherence 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

The samples sent off-site to Eberline Analytical for HTD radionuclide analysis, L1-10214E-FSGS-008-SS-A and L1-10214E-FSGS-006-SB-A, are mislabeled on the Eberline Analytical Report as L2-10214E-FSGS-008-SS-A and L2-10214E-FSGS-006-SB-A.

14. CONCLUSION

Survey unit 10214E has met the DQOs of the FSS 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 0.008, which results in a dose contribution from soil in survey unit 10214E of 0.195 mrem/year 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 10214E is acceptable for unrestricted release.

15. REFERENCES

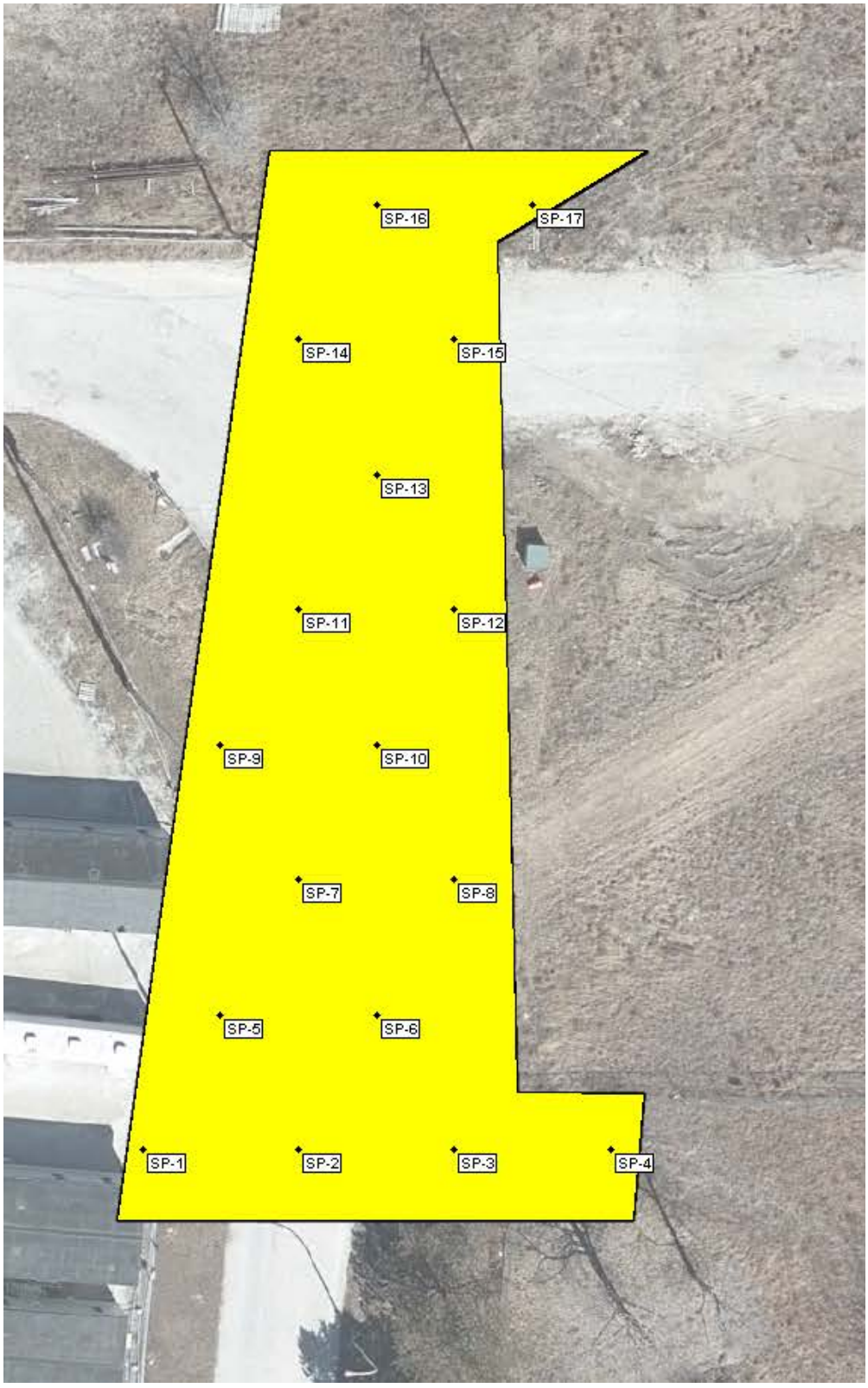
1. Zion*Solutions* procedure ZS-LT-300-001-005, "Final Status Survey Data Reporting"
2. Zion Station Restoration Project License Termination Plan
3. Zion*Solutions* procedure ZS-LT-300-001-001, "Final Status Survey Package Development"
4. NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation 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

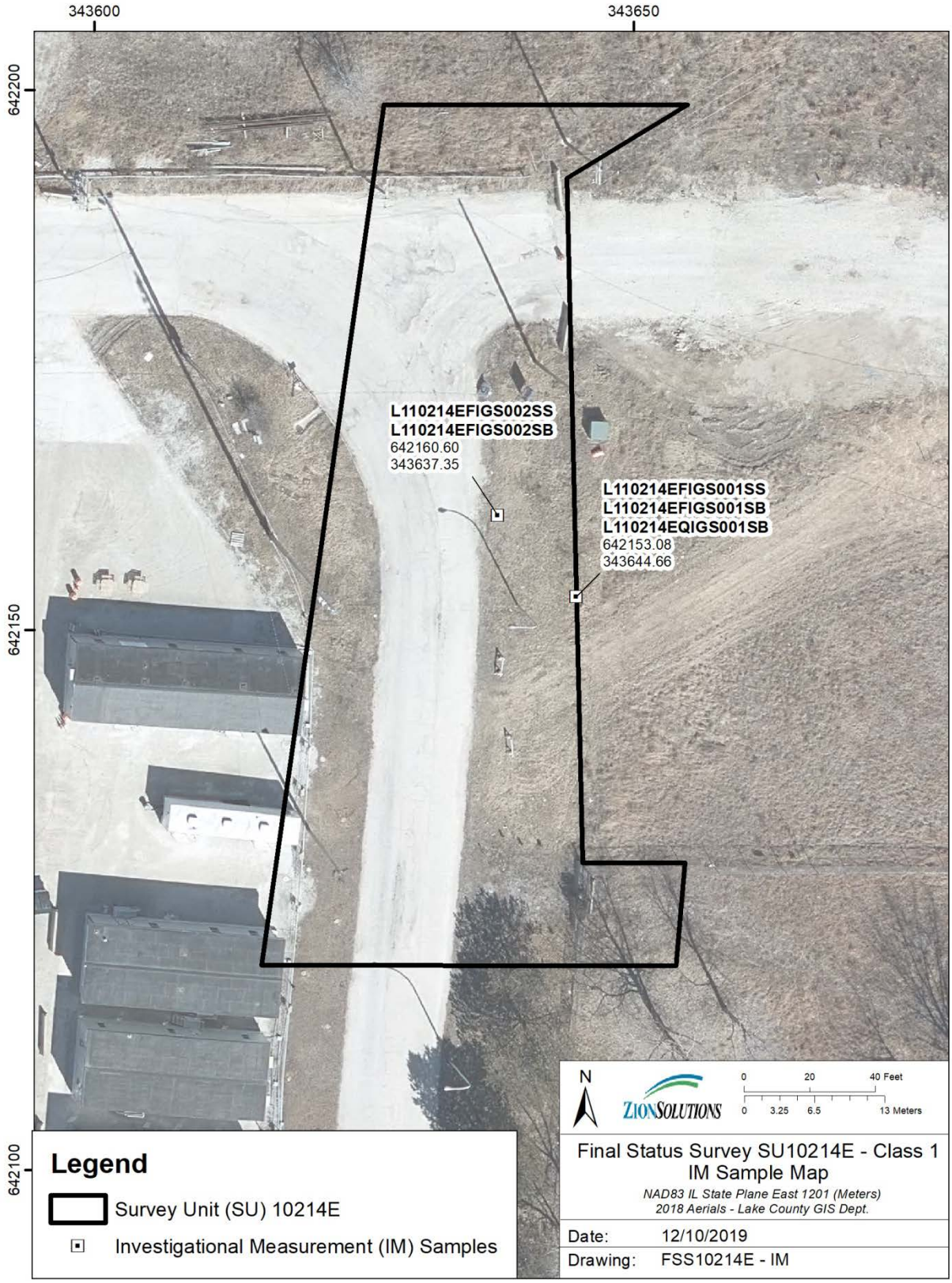
1. Attachment 1 - Figures and Map
2. Attachment 2 - Scan Data
3. Attachment 3 - Consultation Triggers for Residential and Commercial/Industrial Soil Contamination
4. Attachment 4 - Sign Test
5. Attachment 5 - QC Sample Assessment
6. Attachment 6 - Graphical Presentations
7. Attachment 7 - Sample Analytical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

ATTACHMENT 1
FIGURES AND MAP

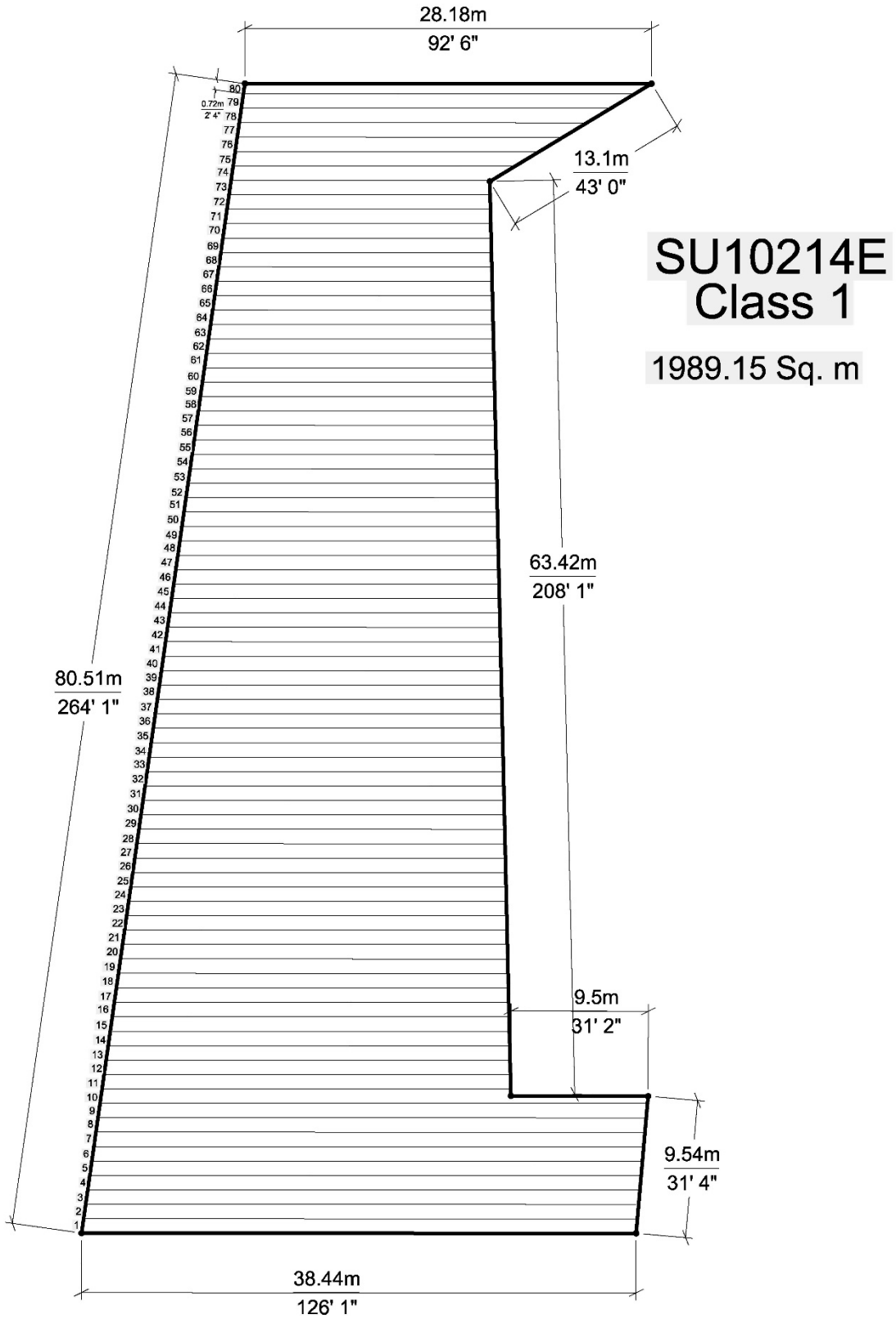
Survey Unit 10214E Final Status Survey Boundaries and Systematic Sample Points



Survey Unit 10214E Investigation Sample Points



Survey Unit 10214E Final Status Survey Scan Rows



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	PR321892	304708	10214E	GS001	12/7/2019 8:54	2349	1801	2443	No
44-10	PR321892	304708	10214E	GS001	12/7/2019 8:57	1811	1801	2443	No
44-10	PR321892	304708	10214E	GS001	12/7/2019 8:59	2118	1801	2443	No
44-10	PR321892	304708	10214E	GS002	12/7/2019 9:02	2055	1801	2443	No
44-10	PR321892	304708	10214E	GS002	12/7/2019 9:04	1854	1801	2443	No
44-10	PR321892	304708	10214E	GS002	12/7/2019 9:07	2115	1801	2443	No
44-10	PR321892	304708	10214E	GS003	12/7/2019 9:11	2291	1801	2443	No
44-10	PR321892	304708	10214E	GS003	12/7/2019 9:13	1892	1801	2443	No
44-10	PR321892	304708	10214E	GS003	12/7/2019 9:16	2050	1801	2443	No
44-10	PR321892	304708	10214E	GS004	12/7/2019 9:19	1897	1801	2443	No
44-10	PR321892	304708	10214E	GS004	12/7/2019 9:21	1884	1801	2443	No
44-10	PR321892	304708	10214E	GS004	12/7/2019 9:23	2074	1801	2443	No
44-10	PR321892	304708	10214E	GS005	12/7/2019 9:26	2105	1801	2443	No
44-10	PR321892	304708	10214E	GS005	12/7/2019 9:28	1932	1801	2443	No
44-10	PR321892	304708	10214E	GS005	12/7/2019 9:31	1903	1801	2443	No
44-10	PR321892	304708	10214E	GS006	12/7/2019 9:35	1928	1801	2443	No
44-10	PR321892	304708	10214E	GS006	12/7/2019 9:37	1842	1801	2443	No
44-10	PR321892	304708	10214E	GS006	12/7/2019 9:39	1981	1801	2443	No
44-10	PR321892	304708	10214E	GS007	12/7/2019 9:44	1904	1801	2443	No
44-10	PR321892	304708	10214E	GS007	12/7/2019 9:46	2006	1801	2443	No
44-10	PR321892	304708	10214E	GS007	12/7/2019 9:49	1818	1801	2443	No
44-10	PR321892	304708	10214E	GS008	12/7/2019 9:54	1920	1801	2443	No
44-10	PR321892	304708	10214E	GS008	12/7/2019 9:57	1857	1801	2443	No
44-10	PR321892	304708	10214E	GS008	12/7/2019 10:01	1861	1801	2443	No
44-10	PR321892	304708	10214E	GS009	12/7/2019 10:03	1859	1801	2443	No
44-10	PR321892	304708	10214E	GS009	12/7/2019 10:05	2032	1801	2443	No
44-10	PR321892	304708	10214E	GS009	12/7/2019 10:09	1857	1801	2443	No
44-10	PR321892	304708	10214E	GS010	12/7/2019 10:12	1858	1801	2443	No
44-10	PR321892	304708	10214E	GS010	12/7/2019 10:15	1899	1801	2443	No
44-10	PR321892	304708	10214E	GS010	12/7/2019 10:17	1855	1801	2443	No
44-10	PR321892	304708	10214E	GS011	12/7/2019 10:20	1832	1801	2443	No
44-10	PR321892	304708	10214E	GS011	12/7/2019 10:22	1895	1801	2443	No
44-10	PR321892	304708	10214E	GS011	12/7/2019 10:24	1862	1801	2443	No
44-10	PR321892	304708	10214E	GS012	12/7/2019 10:26	1829	1801	2443	No
44-10	PR321892	304708	10214E	GS012	12/7/2019 10:29	1844	1801	2443	No
44-10	PR321892	304708	10214E	GS012	12/7/2019 10:31	1900	1801	2443	No
44-10	PR321892	304708	10214E	GS001	12/7/2019 12:25	1578	1433	2006	No
44-10	PR321892	304708	10214E	GS002	12/7/2019 12:28	1546	1433	2006	No
44-10	PR321892	304708	10214E	GS003	12/7/2019 12:31	1550	1433	2006	No
44-10	PR321892	304708	10214E	GS004	12/7/2019 12:34	1584	1433	2006	No
44-10	PR321892	304708	10214E	GS005	12/7/2019 12:37	1582	1433	2006	No
44-10	PR321892	304708	10214E	GS006	12/7/2019 12:40	1559	1433	2006	No
44-10	PR321892	304708	10214E	GS007	12/7/2019 12:43	1555	1433	2006	No
44-10	PR321892	304708	10214E	GS008	12/7/2019 12:46	1570	1433	2006	No
44-10	PR321892	304708	10214E	GS009	12/7/2019 12:50	1607	1433	2006	No
44-10	PR321892	304708	10214E	GS010	12/7/2019 12:54	1778	1433	2006	No
44-10	ES0118	216173	10214E	GS013	12/7/2019 8:53	2031	1819	2463	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	ES0118	216173	10214E	GS013	12/7/2019 8:55	1827	1819	2463	No
44-10	ES0118	216173	10214E	GS013	12/7/2019 8:57	2042	1819	2463	No
44-10	ES0118	216173	10214E	GS014	12/7/2019 9:00	2089	1819	2463	No
44-10	ES0118	216173	10214E	GS014	12/7/2019 9:02	1848	1819	2463	No
44-10	ES0118	216173	10214E	GS014	12/7/2019 9:04	2044	1819	2463	No
44-10	ES0118	216173	10214E	GS015	12/7/2019 9:06	1968	1819	2463	No
44-10	ES0118	216173	10214E	GS015	12/7/2019 9:08	1979	1819	2463	No
44-10	ES0118	216173	10214E	GS015	12/7/2019 9:10	1931	1819	2463	No
44-10	ES0118	216173	10214E	GS016	12/7/2019 9:12	2135	1819	2463	No
44-10	ES0118	216173	10214E	GS016	12/7/2019 9:15	1827	1819	2463	No
44-10	ES0118	216173	10214E	GS016	12/7/2019 9:17	1949	1819	2463	No
44-10	ES0118	216173	10214E	GS017	12/7/2019 9:19	2010	1819	2463	No
44-10	ES0118	216173	10214E	GS017	12/7/2019 9:21	1889	1819	2463	No
44-10	ES0118	216173	10214E	GS017	12/7/2019 9:23	1937	1819	2463	No
44-10	ES0118	216173	10214E	GS018	12/7/2019 9:26	2086	1819	2463	No
44-10	ES0118	216173	10214E	GS018	12/7/2019 9:28	1885	1819	2463	No
44-10	ES0118	216173	10214E	GS018	12/7/2019 9:30	1992	1819	2463	No
44-10	ES0118	216173	10214E	GS019	12/7/2019 9:32	2052	1819	2463	No
44-10	ES0118	216173	10214E	GS019	12/7/2019 9:34	2049	1819	2463	No
44-10	ES0118	216173	10214E	GS019	12/7/2019 9:36	1879	1819	2463	No
44-10	ES0118	216173	10214E	GS020	12/7/2019 9:38	2223	1819	2463	No
44-10	ES0118	216173	10214E	GS020	12/7/2019 9:40	1999	1819	2463	No
44-10	ES0118	216173	10214E	GS020	12/7/2019 9:42	2089	1819	2463	No
44-10	ES0118	216173	10214E	GS021	12/7/2019 9:44	2173	1819	2463	No
44-10	ES0118	216173	10214E	GS021	12/7/2019 9:46	2171	1819	2463	No
44-10	ES0118	216173	10214E	GS021	12/7/2019 9:48	2074	1819	2463	No
44-10	ES0118	216173	10214E	GS022	12/7/2019 9:52	2204	1819	2463	No
44-10	ES0118	216173	10214E	GS022	12/7/2019 9:55	1966	1819	2463	No
44-10	ES0118	216173	10214E	GS022	12/7/2019 9:57	2133	1819	2463	No
44-10	ES0118	216173	10214E	GS023	12/7/2019 9:59	2115	1819	2463	No
44-10	ES0118	216173	10214E	GS023	12/7/2019 10:01	1992	1819	2463	No
44-10	ES0118	216173	10214E	GS023	12/7/2019 10:03	2123	1819	2463	No
44-10	ES0118	216173	10214E	GS024	12/7/2019 10:05	2064	1819	2463	No
44-10	ES0118	216173	10214E	GS024	12/7/2019 10:07	1972	1819	2463	No
44-10	ES0118	216173	10214E	GS024	12/7/2019 10:09	2143	1819	2463	No
44-10	ES0118	216173	10214E	GS025	12/7/2019 10:11	2182	1819	2463	No
44-10	ES0118	216173	10214E	GS025	12/7/2019 10:13	2207	1819	2463	No
44-10	ES0118	216173	10214E	GS025	12/7/2019 10:15	1894	1819	2463	No
44-10	ES0118	216173	10214E	GS026	12/7/2019 10:17	1943	1819	2463	No
44-10	ES0118	216173	10214E	GS026	12/7/2019 10:19	1957	1819	2463	No
44-10	ES0118	216173	10214E	GS026	12/7/2019 10:21	2167	1819	2463	No
44-10	ES0118	216173	10214E	GS027	12/7/2019 10:23	2104	1819	2463	No
44-10	ES0118	216173	10214E	GS027	12/7/2019 10:25	2111	1819	2463	No
44-10	ES0118	216173	10214E	GS027	12/7/2019 10:28	2131	1819	2463	No
44-10	ES0118	216173	10214E	GS028	12/7/2019 10:31	2066	1819	2463	No
44-10	ES0118	216173	10214E	GS028	12/7/2019 10:33	1963	1819	2463	No
44-10	ES0118	216173	10214E	GS028	12/7/2019 10:35	2087	1819	2463	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	PR311750	266656	10214E	GS029	12/7/2019 9:18	1995	1970	2641	No
44-10	PR311750	266656	10214E	GS029	12/7/2019 9:22	2188	1970	2641	No
44-10	PR311750	266656	10214E	GS029	12/7/2019 9:24	2321	1970	2641	No
44-10	PR311750	266656	10214E	GS030	12/7/2019 9:26	2387	1970	2641	No
44-10	PR311750	266656	10214E	GS030	12/7/2019 9:28	2134	1970	2641	No
44-10	PR311750	266656	10214E	GS030	12/7/2019 9:30	1967	1970	2641	No
44-10	PR311750	266656	10214E	GS031	12/7/2019 9:32	2140	1970	2641	No
44-10	PR311750	266656	10214E	GS031	12/7/2019 9:34	2054	1970	2641	No
44-10	PR311750	266656	10214E	GS031	12/7/2019 9:36	2206	1970	2641	No
44-10	PR311750	266656	10214E	GS032	12/7/2019 9:38	2303	1970	2641	No
44-10	PR311750	266656	10214E	GS032	12/7/2019 9:40	2266	1970	2641	No
44-10	PR311750	266656	10214E	GS032	12/7/2019 9:42	2292	1970	2641	No
44-10	PR311750	266656	10214E	GS033	12/7/2019 9:44	2363	1970	2641	No
44-10	PR311750	266656	10214E	GS033	12/7/2019 9:46	2042	1970	2641	No
44-10	PR311750	266656	10214E	GS033	12/7/2019 9:48	2562	1970	2641	No
44-10	PR311750	266656	10214E	GS034	12/7/2019 9:50	2469	1970	2641	No
44-10	PR311750	266656	10214E	GS034	12/7/2019 9:52	2330	1970	2641	No
44-10	PR311750	266656	10214E	GS034	12/7/2019 9:54	2485	1970	2641	No
44-10	PR311750	266656	10214E	GS035	12/7/2019 9:56	2549	1970	2641	No
44-10	PR311750	266656	10214E	GS035	12/7/2019 9:58	2139	1970	2641	No
44-10	PR311750	266656	10214E	GS035	12/7/2019 10:00	2614	1970	2641	No
44-10	PR311750	266656	10214E	GS036	12/7/2019 10:05	3003	1970	2641	Yes
44-10	PR311750	266656	10214E	GS036	12/7/2019 10:08	2369	1970	2641	No
44-10	PR311750	266656	10214E	GS036	12/7/2019 10:10	2209	1970	2641	No
44-10	PR311750	266656	10214E	GS036	12/7/2019 10:12	2527	1970	2641	No
44-10	PR311750	266656	10214E	GS037	12/7/2019 10:14	2555	1970	2641	No
44-10	PR311750	266656	10214E	GS037	12/7/2019 10:16	2166	1970	2641	No
44-10	PR311750	266656	10214E	GS037	12/7/2019 10:18	2530	1970	2641	No
44-10	PR311750	266656	10214E	GS038	12/7/2019 10:20	2610	1970	2641	No
44-10	PR311750	266656	10214E	GS038	12/7/2019 10:22	2103	1970	2641	No
44-10	PR311750	266656	10214E	GS038	12/7/2019 10:24	2329	1970	2641	No
44-10	PR311750	266656	10214E	GS039	12/7/2019 10:26	2359	1970	2641	No
44-10	PR311750	266656	10214E	GS039	12/7/2019 10:28	2117	1970	2641	No
44-10	PR311750	266656	10214E	GS039	12/7/2019 10:30	2421	1970	2641	No
44-10	PR311750	266656	10214E	GS040	12/7/2019 10:32	2102	1970	2641	No
44-10	PR311750	266656	10214E	GS040	12/7/2019 10:34	2109	1970	2641	No
44-10	PR311750	266656	10214E	GS040	12/7/2019 10:36	2505	1970	2641	No
44-10	PR311750	266656	10214E	GS041	12/7/2019 10:38	2369	1970	2641	No
44-10	PR311750	266656	10214E	GS041	12/7/2019 10:40	1991	1970	2641	No
44-10	PR311750	266656	10214E	GS041	12/7/2019 10:42	2456	1970	2641	No
44-10	PR311750	266656	10214E	GS042	12/7/2019 10:44	2559	1970	2641	No
44-10	PR311750	266656	10214E	GS042	12/7/2019 10:46	2252	1970	2641	No
44-10	PR311750	266656	10214E	GS042	12/7/2019 10:48	2589	1970	2641	No
44-10	PR311750	266656	10214E	GS043	12/7/2019 12:26	2493	1970	2641	No
44-10	PR311750	266656	10214E	GS043	12/7/2019 12:31	2924	1970	2641	Yes
44-10	PR311750	266656	10214E	GS043	12/7/2019 12:33	2608	1970	2641	No
44-10	PR311750	266656	10214E	GS043	12/7/2019 12:33	2411	1970	2641	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	PR311750	266656	10214E	GS044	12/7/2019 12:36	2475	1970	2641	No
44-10	PR311750	266656	10214E	GS044	12/7/2019 12:38	2474	1970	2641	No
44-10	PR311750	266656	10214E	GS044	12/7/2019 12:40	2426	1970	2641	No
44-10	PR311750	266656	10214E	GS045	12/7/2019 12:42	2525	1970	2641	No
44-10	PR311750	266656	10214E	GS045	12/7/2019 12:45	2460	1970	2641	No
44-10	PR311750	266656	10214E	GS045	12/7/2019 12:47	2300	1970	2641	No
44-10	PR363452	304726	10214E	GS046	12/7/2019 9:07	2618	2116	2811	No
44-10	PR363452	304726	10214E	GS046	12/7/2019 9:11	2682	2116	2811	No
44-10	PR363452	304726	10214E	GS046	12/7/2019 9:13	2621	2116	2811	No
44-10	PR363452	304726	10214E	GS047	12/7/2019 9:16	2501	2116	2811	No
44-10	PR363452	304726	10214E	GS047	12/7/2019 9:20	2629	2116	2811	No
44-10	PR363452	304726	10214E	GS047	12/7/2019 9:22	2397	2116	2811	No
44-10	PR363452	304726	10214E	GS048	12/7/2019 9:26	2674	2116	2811	No
44-10	PR363452	304726	10214E	GS048	12/7/2019 9:28	2341	2116	2811	No
44-10	PR363452	304726	10214E	GS048	12/7/2019 9:31	2460	2116	2811	No
44-10	PR363452	304726	10214E	GS049	12/7/2019 9:35	2360	2116	2811	No
44-10	PR363452	304726	10214E	GS049	12/7/2019 9:37	2453	2116	2811	No
44-10	PR363452	304726	10214E	GS049	12/7/2019 9:40	2446	2116	2811	No
44-10	PR363452	304726	10214E	GS050	12/7/2019 9:43	2530	2116	2811	No
44-10	PR363452	304726	10214E	GS050	12/7/2019 9:47	2748	2116	2811	No
44-10	PR363452	304726	10214E	GS050	12/7/2019 9:51	2474	2116	2811	No
44-10	PR363452	304726	10214E	GS051	12/7/2019 9:55	2774	2116	2811	No
44-10	PR363452	304726	10214E	GS051	12/7/2019 9:57	2743	2116	2811	No
44-10	PR363452	304726	10214E	GS052	12/7/2019 10:00	2653	2116	2811	No
44-10	PR363452	304726	10214E	GS052	12/7/2019 10:03	2544	2116	2811	No
44-10	PR363452	304726	10214E	GS053	12/7/2019 10:06	2731	2116	2811	No
44-10	PR363452	304726	10214E	GS053	12/7/2019 10:08	2780	2116	2811	No
44-10	PR363452	304726	10214E	GS054	12/7/2019 10:12	2805	2116	2811	No
44-10	PR363452	304726	10214E	GS054	12/7/2019 10:17	2335	2116	2811	No
44-10	PR363452	304726	10214E	GS055	12/7/2019 10:21	2395	2116	2811	No
44-10	PR363452	304726	10214E	GS055	12/7/2019 10:24	2615	2116	2811	No
44-10	PR363452	304726	10214E	GS056	12/7/2019 10:27	2494	2116	2811	No
44-10	PR363452	304726	10214E	GS056	12/7/2019 10:30	2259	2116	2811	No
44-10	PR363452	304726	10214E	GS057	12/7/2019 10:32	2377	2116	2811	No
44-10	PR363452	304726	10214E	GS057	12/7/2019 10:35	2379	2116	2811	No
44-10	PR363452	304726	10214E	GS058	12/7/2019 10:38	2322	2116	2811	No
44-10	PR363452	304726	10214E	GS058	12/7/2019 10:40	2423	2116	2811	No
44-10	PR363452	304726	10214E	GS059	12/7/2019 10:43	2642	2116	2811	No
44-10	PR363452	304726	10214E	GS059	12/7/2019 10:46	2539	2116	2811	No
44-10	PR363452	304726	10214E	GS051	12/7/2019 12:42	1386	1199	1722	No
44-10	PR363452	304726	10214E	GS052	12/7/2019 12:44	1339	1199	1722	No
44-10	PR363452	304726	10214E	GS053	12/7/2019 12:47	1417	1199	1722	No
44-10	PR363452	304726	10214E	GS054	12/7/2019 12:50	1254	1199	1722	No
44-10	PR363452	304726	10214E	GS055	12/7/2019 12:52	1301	1199	1722	No
44-10	PR363452	304726	10214E	GS056	12/7/2019 12:54	1282	1199	1722	No
44-10	PR363452	304726	10214E	GS057	12/7/2019 12:57	1340	1199	1722	No
44-10	PR363452	304726	10214E	GS058	12/7/2019 12:59	1180	1199	1722	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	PR363452	304726	10214E	GS059	12/7/2019 13:01	1226	1199	1722	No
44-10	PR363452	304726	10214E	GS060	12/7/2019 13:03	1296	1199	1722	No
44-10	PR363452	304726	10214E	GS060	12/7/2019 13:06	1355	1199	1722	No
44-10	PR363452	304726	10214E	GS061	12/7/2019 13:08	1249	1199	1722	No
44-10	PR363452	304726	10214E	GS061	12/7/2019 13:10	1395	1199	1722	No
44-10	PR363452	304726	10214E	GS062	12/7/2019 13:12	1296	1199	1722	No
44-10	PR363452	304726	10214E	GS062	12/7/2019 13:15	1289	1199	1722	No
44-10	PR321902	304711	10214E	GS063	12/7/2019 9:25	1253	1172	1690	No
44-10	PR321902	304711	10214E	GS063	12/7/2019 9:28	1289	1172	1690	No
44-10	PR321902	304711	10214E	GS064	12/7/2019 9:30	1288	1172	1690	No
44-10	PR321902	304711	10214E	GS064	12/7/2019 9:32	1219	1172	1690	No
44-10	PR321902	304711	10214E	GS065	12/7/2019 9:34	1240	1172	1690	No
44-10	PR321902	304711	10214E	GS065	12/7/2019 9:36	1304	1172	1690	No
44-10	PR321902	304711	10214E	GS066	12/7/2019 9:38	1194	1172	1690	No
44-10	PR321902	304711	10214E	GS066	12/7/2019 9:40	1215	1172	1690	No
44-10	PR321902	304711	10214E	GS067	12/7/2019 9:42	1283	1172	1690	No
44-10	PR321902	304711	10214E	GS067	12/7/2019 9:44	1183	1172	1690	No
44-10	PR321902	304711	10214E	GS068	12/7/2019 9:46	1228	1172	1690	No
44-10	PR321902	304711	10214E	GS068	12/7/2019 9:48	1241	1172	1690	No
44-10	PR321902	304711	10214E	GS069	12/7/2019 9:50	1291	1172	1690	No
44-10	PR321902	304711	10214E	GS069	12/7/2019 9:52	1201	1172	1690	No
44-10	PR321902	304711	10214E	GS070	12/7/2019 9:54	1211	1172	1690	No
44-10	PR321902	304711	10214E	GS070	12/7/2019 9:56	1248	1172	1690	No
44-10	PR321902	304711	10214E	GS071	12/7/2019 9:58	1292	1172	1690	No
44-10	PR321902	304711	10214E	GS071	12/7/2019 10:00	1343	1172	1690	No
44-10	PR321902	304711	10214E	GS072	12/7/2019 10:02	1337	1172	1690	No
44-10	PR321902	304711	10214E	GS072	12/7/2019 10:04	1308	1172	1690	No
44-10	PR321902	304711	10214E	GS073	12/7/2019 10:06	1267	1172	1690	No
44-10	PR321902	304711	10214E	GS073	12/7/2019 10:08	1338	1172	1690	No
44-10	PR321902	304711	10214E	GS074	12/7/2019 10:10	1575	1172	1690	No
44-10	PR321902	304711	10214E	GS074	12/7/2019 10:12	1561	1172	1690	No
44-10	PR321902	304711	10214E	GS075	12/7/2019 10:16	1868	1716	2342	No
44-10	PR321902	304711	10214E	GS075	12/7/2019 10:18	1773	1716	2342	No
44-10	PR321902	304711	10214E	GS075	12/7/2019 10:20	1998	1716	2342	No
44-10	PR321902	304711	10214E	GS076	12/7/2019 10:22	1916	1716	2342	No
44-10	PR321902	304711	10214E	GS076	12/7/2019 10:24	1903	1716	2342	No
44-10	PR321902	304711	10214E	GS076	12/7/2019 10:26	1829	1716	2342	No
44-10	PR321902	304711	10214E	GS077	12/7/2019 10:28	1862	1716	2342	No
44-10	PR321902	304711	10214E	GS077	12/7/2019 10:30	1905	1716	2342	No
44-10	PR321902	304711	10214E	GS077	12/7/2019 10:32	1920	1716	2342	No
44-10	PR321902	304711	10214E	GS078	12/7/2019 10:34	2055	1716	2342	No
44-10	PR321902	304711	10214E	GS078	12/7/2019 10:36	1920	1716	2342	No
44-10	PR321902	304711	10214E	GS078	12/7/2019 10:38	2044	1716	2342	No
44-10	PR321902	304711	10214E	GS078	12/7/2019 10:40	1892	1716	2342	No
44-10	PR321902	304711	10214E	GS079	12/7/2019 10:42	2015	1716	2342	No
44-10	PR321902	304711	10214E	GS079	12/7/2019 10:44	2243	1716	2342	No
44-10	PR321902	304711	10214E	GS079	12/7/2019 10:46	1795	1716	2342	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	PR321902	304711	10214E	GS080	12/7/2019 10:48	2165	1716	2342	No
44-10	PR321902	304711	10214E	GS080	12/7/2019 10:50	2110	1716	2342	No
44-10	PR321902	304711	10214E	GS080	12/7/2019 10:52	2291	1716	2342	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

Attachment 12
Sign Statistical Test

ZS-LT-300-001-004
Revision 7
Information Use

Survey Area: No. 10200 **Description:** Radiological Restricted Area Grounds
Survey Unit: No. 10214E **Description:** Construction Parking 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	8.19E-03	1.88E-02	1.07E-02	1.76E-03	2.50E-05	SOF	0.039	0.961	+
2	6.82E-03	0.00E+00	3.14E-03	1.47E-03	7.37E-06	SOF	0.011	0.989	+
3	0.00E+00	0.00E+00	4.30E-03	0.00E+00	1.01E-05	SOF	0.004	0.996	+
4	2.25E-02	6.69E-03	5.54E-03	4.85E-03	1.30E-05	SOF	0.040	0.960	+
5	0.00E+00	6.52E-03	1.62E-02	0.00E+00	3.79E-05	SOF	0.023	0.977	+
6	8.41E-03	2.80E-03	4.05E-04	1.81E-03	9.50E-07	SOF	0.013	0.987	+
7	1.59E-02	1.67E-02	6.89E-03	3.43E-03	1.62E-05	SOF	0.043	0.957	+
8	2.53E-02	8.77E-03	1.47E-02	5.45E-03	3.44E-05	SOF	0.054	0.946	+
9	3.07E-02	9.98E-03	6.14E-03	6.61E-03	1.44E-05	SOF	0.053	0.947	+
10	1.34E-02	9.29E-03	2.92E-03	2.88E-03	6.85E-06	SOF	0.028	0.972	+
11	1.98E-03	0.00E+00	6.67E-03	4.26E-04	1.56E-05	SOF	0.009	0.991	+
12	2.99E-03	1.93E-02	1.92E-03	6.43E-04	4.50E-06	SOF	0.025	0.975	+
13	2.06E-02	6.00E-03	0.00E+00	4.44E-03	0.00E+00	SOF	0.031	0.969	+
14	0.00E+00	7.50E-03	1.66E-03	0.00E+00	3.88E-06	SOF	0.009	0.991	+
15	0.00E+00	8.83E-03	0.00E+00	0.00E+00	0.00E+00	SOF	0.009	0.991	+
16	2.53E-02	0.00E+00	3.47E-03	5.45E-03	8.14E-06	SOF	0.034	0.966	+
17	5.13E-02	1.62E-02	1.13E-02	1.11E-02	2.66E-05	SOF	0.090	0.910	+

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

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

Prepared By (RE): R.S. Mandi (Print Name) / (Signature) 2-10-20 (Date)

Peer Reviewed By (RE): T Graham (Print Name) / (Signature) 2/10/2020 (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #:	10200	Survey Unit #:	10214E	Survey Unit Name:	Construction Parking Area
Sample Plan#:	L1-10214E-F				

Sample Description: Comparison of split samples collected from systematic surface soil sample location #8 and investigation subsurface soil sample location #1 and analyzed using gamma spectroscopy by on-site HPGe system. The standard/comparison samples were L1-10214E-FSGS-008-SS/L1-10214E-FQGS-008-SS, and L1-10214E-FIGS-001-SB/L1-10214E-QIGS-001-SB.

	STANDARD				COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
Systematic Sample #8								
K-40	8.27E+00	5.96E-01	13.88	0.6-1.66	6.83E+00	5.22E-01	1.21	Y
Investigation Sample #1								
K-40	6.03E+00	4.27E-01	14.12	0.6-1.66	6.28E+00	4.51E-01	0.96	Y

Comments/Corrective Actions:
The standard samples and QC samples 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.

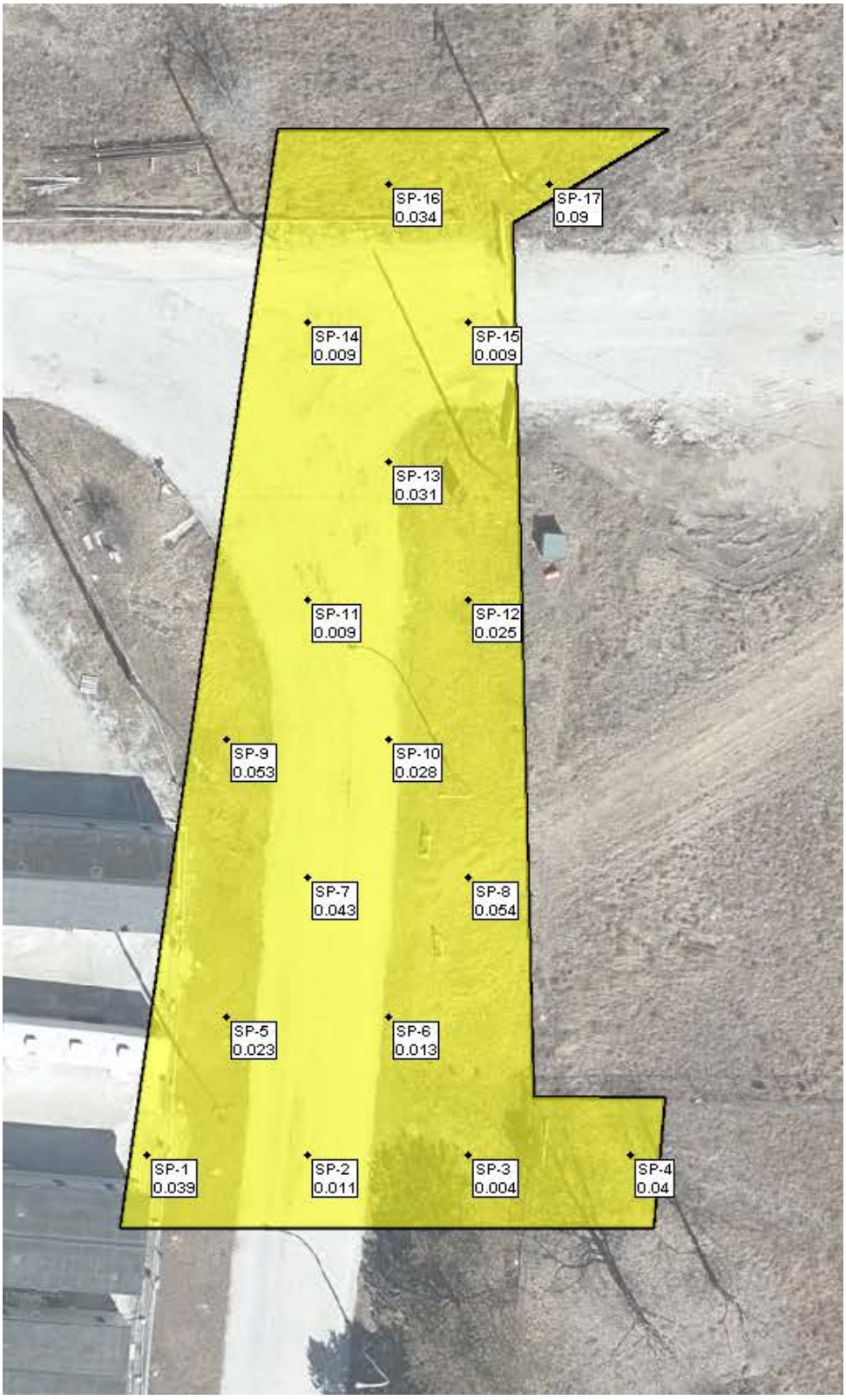
Table 4-1 from the QAPP is reproduced below to show acceptance criteria used to assess split samples.

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

Performed by:	Date:	Reveiwed by:	Date:
K.S. Mundis	2-10-20	J Grodam	2/10/2020

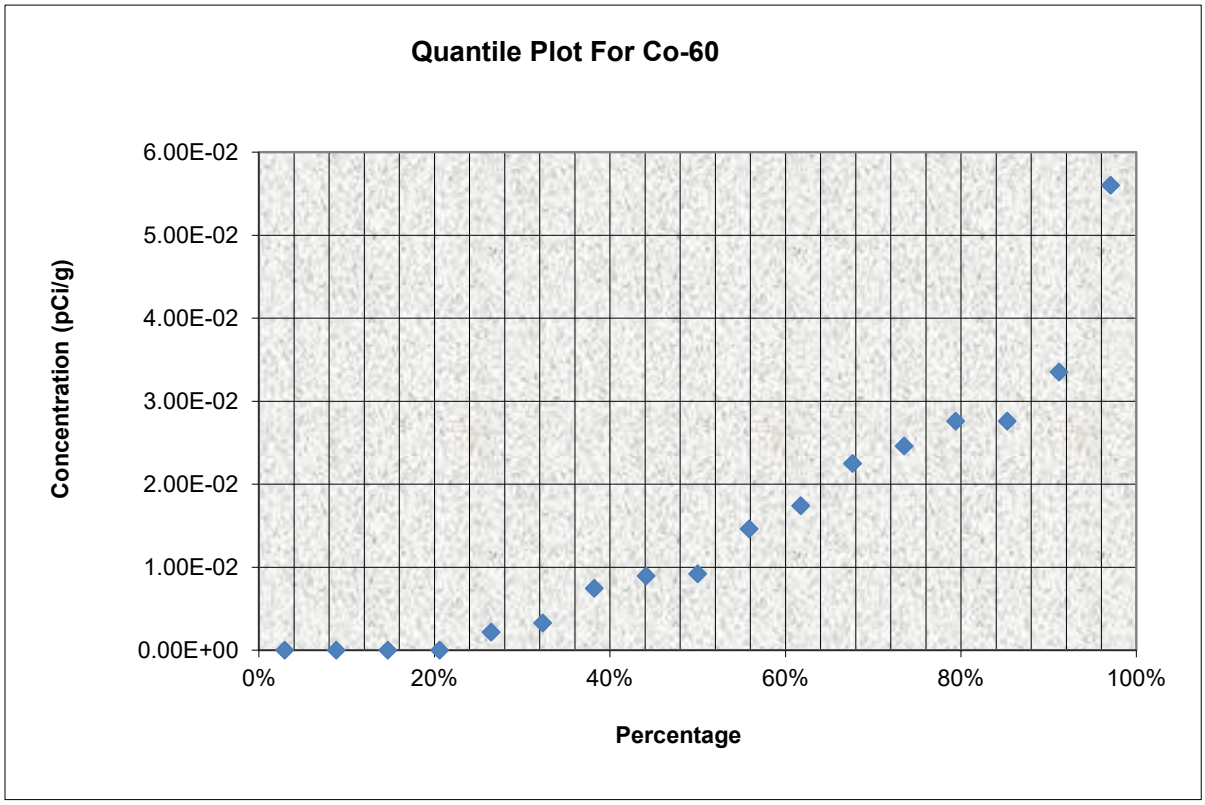
ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot



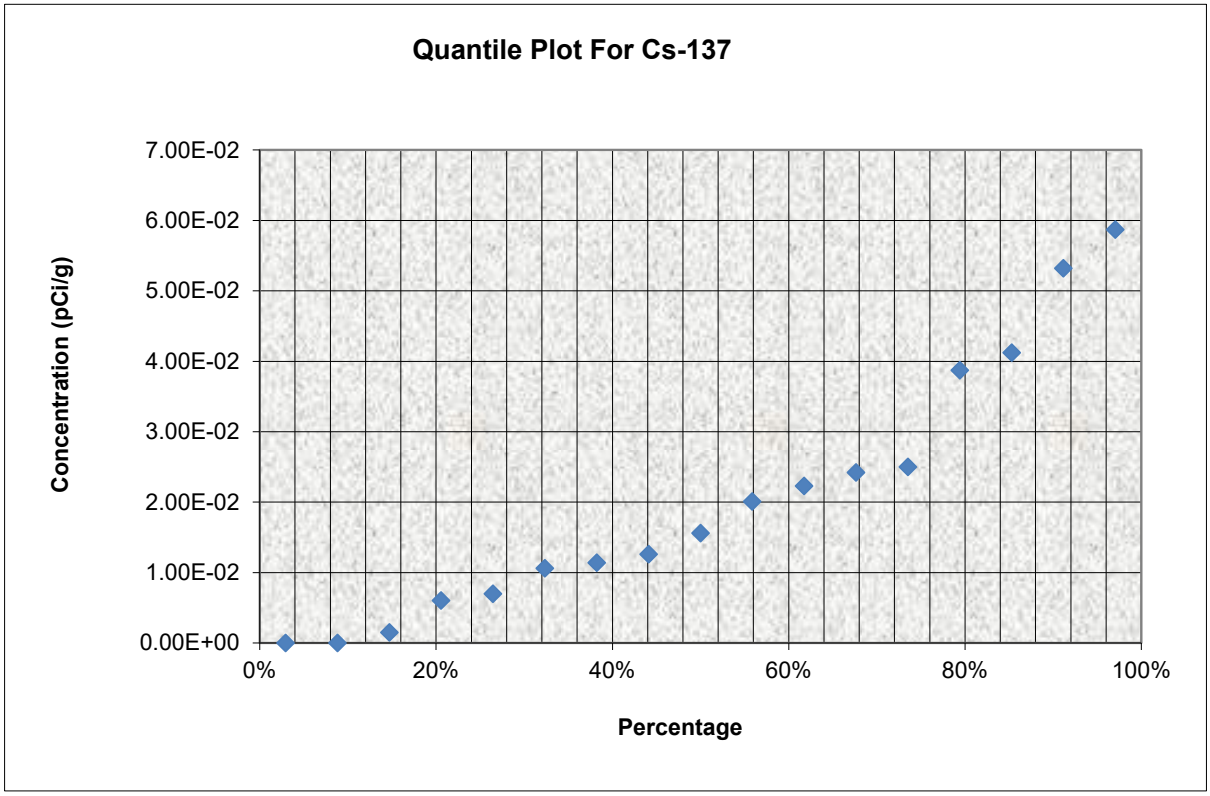
QUANTILE PLOT FOR Co-60

Survey Unit: 10214E
Survey Unit Name: Contractor Parking Area
Mean: 1.50E-02 pCi/g



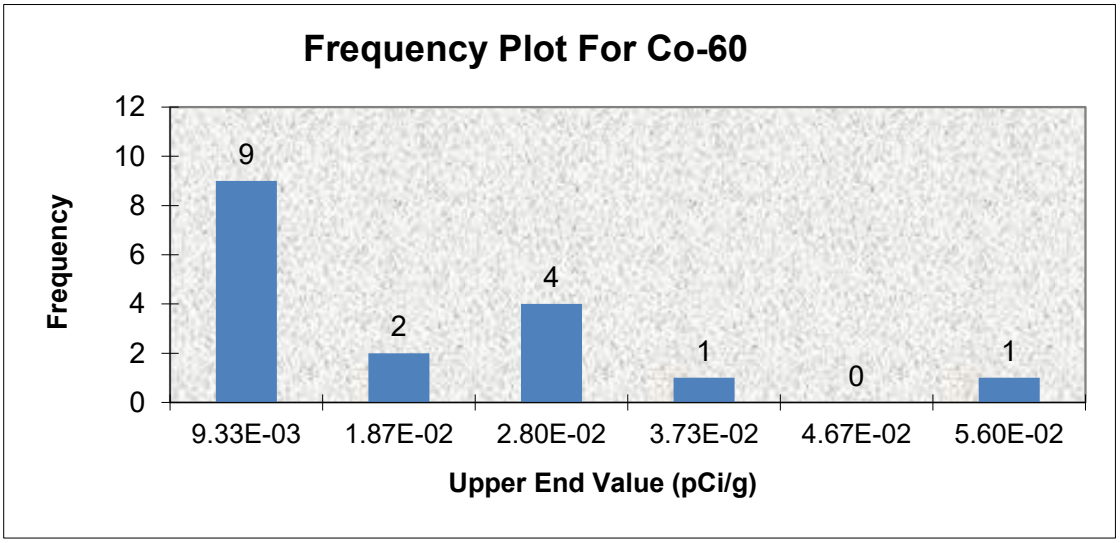
QUANTILE PLOT FOR Cs-137

Survey Unit: 10214E
Survey Unit Name: Contractor Parking Area
Mean: 2.05E-02 pCi/g



HISTOGRAM FOR Co-60

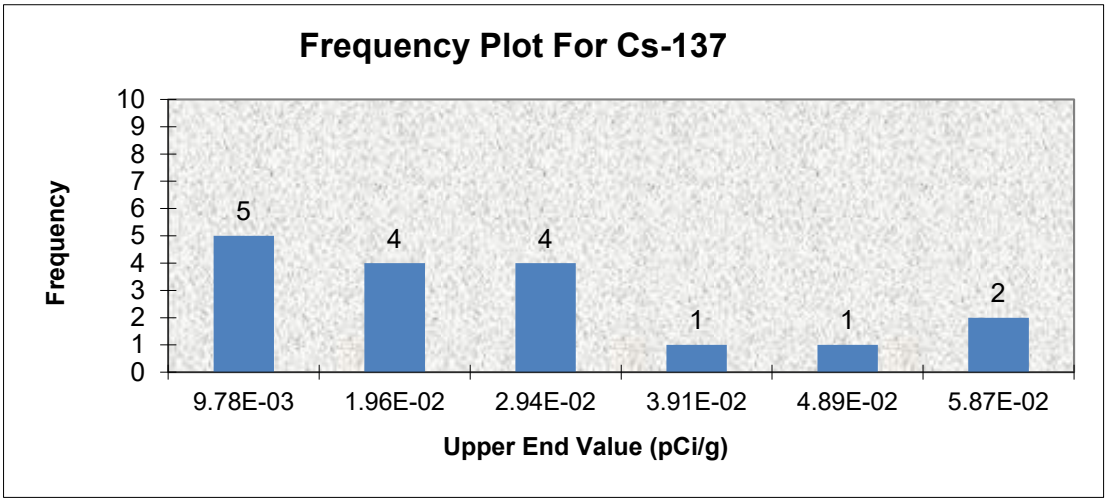
Survey Unit: 10214E
Survey Unit Name: Contractor Parking Area
Mean: 1.50E-02 pCi/g
Median: 9.18E-03 pCi/g
ST DEV: 0.015
Skew: 1.200



Upper Value	Observation Frequency	Observation %
9.33E-03	9	53%
1.87E-02	2	12%
2.80E-02	4	24%
3.73E-02	1	6%
4.67E-02	0	0%
5.60E-02	1	6%
TOTAL	17	100%

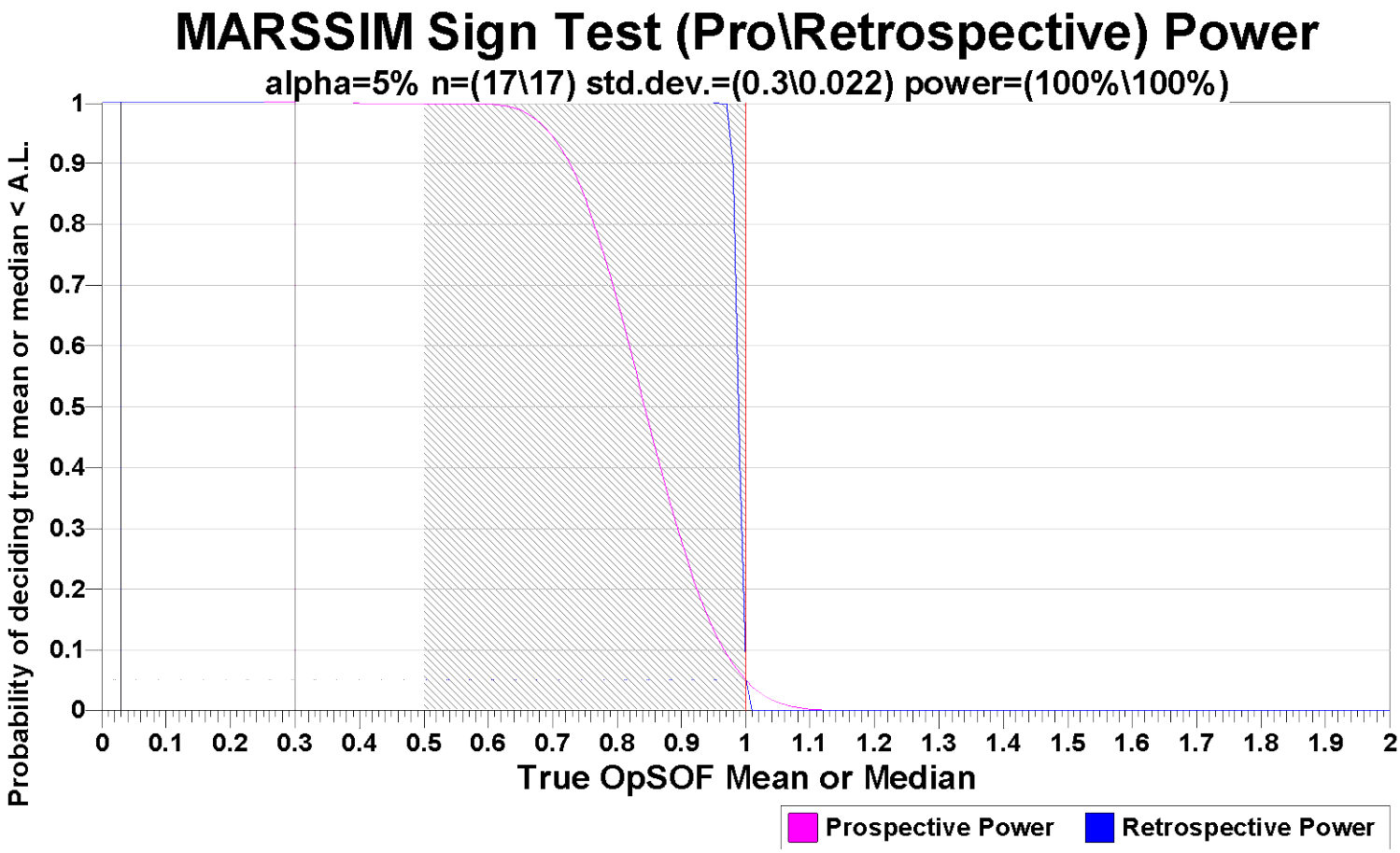
HISTOGRAM FOR Cs-137

Survey Unit: 10214E
Survey Unit Name: Contractor Parking Area
Mean: 2.05E-02 pCi/g
Median: 1.56E-02 pCi/g
ST DEV: 0.018
Skew: 0.900



Upper Value	Observation Frequency	Observation %
9.78E-03	5	29%
1.96E-02	4	24%
2.94E-02	4	24%
3.91E-02	1	6%
4.89E-02	1	6%
5.87E-02	2	12%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Unit 10214E



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 11-Dec-19-10001

L1-10214E-FSGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10001
Sample Description	: L1-10214E-FSGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.105E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:30:00PM
Acquisition Started	: 12/11/2019 8:28:39AM
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81957
Fill Height	: 1104.97 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 8:43:41AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10001

L1-10214E-FSGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.66	473 -	481	477.51	1.27E+02	17.85	8.66E+01	1.24
2	295.26	585 -	595	590.59	3.95E+01	13.49	5.95E+01	0.96
3	352.00	700 -	708	703.95	1.05E+02	13.12	3.15E+01	1.45
4	583.10	1162 -	1171	1165.81	6.39E+01	10.87	2.31E+01	1.33
5	609.20	1213 -	1223	1217.98	7.22E+01	10.28	1.38E+01	1.61
6	661.27	1318 -	1325	1322.07	2.50E+01	7.01	1.20E+01	1.44
7	910.76	1818 -	1825	1820.97	4.67E+01	8.33	1.13E+01	0.98
8	1460.70	2917 -	2929	2921.46	2.44E+02	16.61	1.20E+01	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	0.99	1460.82	*	10.66	5.16E+00	4.17E-01
Cs-137	0.97	661.66	*	85.10	3.87E-02	1.11E-02
Tl-208	0.99	583.19	*	85.00	9.12E-02	1.64E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.95E-01	3.15E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.98E-01	3.06E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 11-Dec-19-10001

L1-10214E-FSGS-001SS

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	1.62E-01	5.67E-02
		351.93	*	35.60	2.51E-01	3.74E-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	2.96E-01	5.44E-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 11-Dec-19-10001

L1-10214E-FSGS-001SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	5.16E+00	4.17E-01	
	Cs-137	0.976	3.87E-02	1.11E-02	
	Tl-208	0.999	9.12E-02	1.64E-02	
X	Bi-211	0.871			
	Pb-212	1.000	1.95E-01	3.15E-02	
	Bi-214	0.999	1.98E-01	3.06E-02	
	Pb-214	0.999	2.24E-01	3.12E-02	
	Ac-228	0.990	2.96E-01	5.44E-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 11-Dec-19-10001

L1-10214E-FSGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 8:43:41AM
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	8.65E-02	5.77E-02	5.77E-02
	BE-7	477.60		10.44	2.20E-01	3.55E-01	3.55E-01
+	K-40	1460.82	*	10.66	5.16E+00	4.66E-01	4.66E-01
	Mn-54	834.85		99.98	1.42E-02	4.29E-02	4.29E-02
	Co-60	1173.23		99.85	4.35E-03	5.44E-02	5.73E-02
		1332.49		99.98	8.94E-03		5.44E-02
	Nb-94	702.65		99.81	-1.08E-02	3.27E-02	3.27E-02
		871.09		99.89	9.07E-03		4.03E-02
	Ag-108m	79.13		6.60	5.02E-01	3.88E-02	1.18E+00
		433.94		90.50	1.39E-02		3.88E-02
		614.28		89.80	-2.78E-02		5.60E-02
		722.94		90.80	5.65E-03		4.63E-02
	Sb-125	176.31		6.84	-3.89E-02	1.06E-01	5.12E-01
		380.45		1.52	9.78E-01		2.27E+00
		427.87		29.60	-2.53E-02		1.06E-01
		463.36		10.49	3.12E-02		3.43E-01
		600.60		17.65	3.25E-02		1.88E-01
		606.71		4.98	-2.09E-01		1.22E+00
		635.95		11.22	2.74E-02		3.39E-01

Analysis Report for 11-Dec-19-10001

L1-10214E-FSGS-001SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-3.20E-01	1.06E-01	2.27E+00
	Ba-133	79.61		2.65	-2.57E-02	7.52E-02	2.73E+00
		81.00		32.90	-1.86E-01		1.90E-01
		276.40		7.16	-1.47E-01		4.18E-01
		302.85		18.34	6.78E-02		1.98E-01
		356.01		62.05	-5.88E-02		7.52E-02
		383.85		8.94	-6.38E-02		3.57E-01
	Cs-134	475.36		1.48	1.22E+00	5.10E-02	2.53E+00
		563.25		8.34	2.10E-01		4.72E-01
		569.33		15.37	-7.11E-02		2.49E-01
		604.72		97.62	-1.38E-02		5.10E-02
		795.86		85.46	3.26E-02		5.53E-02
		801.95		8.69	-1.31E-01		4.64E-01
		1038.61		0.99	-1.08E+00		4.09E+00
		1167.97		1.79	-4.76E-01		3.14E+00
		1365.19		3.02	-3.29E-01		1.38E+00
+	Cs-137	661.66	*	85.10	3.87E-02	3.03E-02	3.03E-02
	Eu-152	121.78		28.67	-2.97E-02	1.05E-01	1.05E-01
		244.70		7.61	-4.24E-01		4.32E-01
		295.94		0.45	-4.63E-01		9.00E+00
		344.28		26.60	-1.00E-01		1.21E-01
		367.79		0.86	8.19E-01		3.87E+00
		411.12		2.24	5.89E-01		1.64E+00
		443.96		2.83	2.99E-01		1.21E+00
		488.68		0.42	-6.63E+00		7.46E+00
		563.99		0.49	4.48E-01		7.83E+00
		586.26		0.46	-1.65E-01		1.38E+01
		678.62		0.47	-2.19E+00		7.36E+00
		688.67		0.86	2.86E-01		4.16E+00
		719.35		0.28	-5.09E+00		1.34E+01
		778.90		12.96	-9.67E-02		3.16E-01
		810.45		0.32	2.16E+00		1.17E+01
		867.37		4.26	-4.27E-01		8.41E-01
		919.33		0.43	-4.76E+00		1.03E+01
		964.08		14.65	-7.46E-02		3.33E-01
		1085.87		10.24	-1.03E-02		4.37E-01
		1089.74		1.73	-2.70E+00		2.59E+00
		1112.07		13.69	-1.53E-01		3.73E-01
		1212.95		1.43	1.59E+00		3.79E+00
		1249.94		0.19	2.53E+00		2.76E+01
		1299.14		1.63	1.40E+00		3.16E+00
		1408.01		21.07	6.76E-02		2.23E-01
		1457.64		0.50	-3.62E+01		3.62E+01
		1528.10		0.28	3.10E+00		1.49E+01
	Eu-154	123.07		40.40	-4.97E-03	7.76E-02	7.76E-02
		247.93		6.89	-1.06E-01		4.36E-01
		591.76		4.95	2.92E-01		8.03E-01
		692.42		1.78	-9.45E-01		1.90E+00
		723.30		20.06	3.14E-02		2.13E-01
		756.80		4.52	-2.51E-01		9.03E-01
		873.18		12.08	1.84E-01		3.59E-01

Analysis Report for 11-Dec-19-10001

L1-10214E-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.06E-03	7.76E-02	4.29E-01
	1004.76	18.01	-7.56E-03		2.20E-01
	1274.43	34.80	-2.32E-02		1.63E-01
	1596.48	1.80	-2.01E+00		1.83E+00
Eu-155	45.30	1.31	-7.29E-01	1.69E-01	1.05E+01
	60.01	1.22	-6.94E+00		1.12E+01
	86.55	30.70	-3.62E-02		1.69E-01
	105.31	21.10	2.89E-02		1.69E-01
Ra-226	186.21	3.64	7.99E-01	1.08E+00	1.08E+00
Pa-231	27.36	10.30	4.19E-01	1.07E+00	1.07E+00
	283.69	1.70	5.01E-01		1.95E+00
	300.07	2.47	-3.58E-01		1.35E+00
	302.65	2.20	5.65E-01		1.65E+00
	330.06	1.40	1.28E+00		2.49E+00
U-235	143.76	10.96	4.94E-02	6.84E-02	2.98E-01
	163.33	5.08	1.50E-02		6.81E-01
	185.71	57.20	4.49E-02		6.84E-02
	202.11	1.08	-1.92E-03		3.12E+00
	205.31	5.01	-3.51E-01		6.75E-01
Am-241	59.54	35.90	-2.20E-01	3.95E-01	3.95E-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 11-Dec-19-10002

L1-10214E-FSGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10002
Sample Description	: L1-10214E-FSGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.523E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:32:00PM
Acquisition Started	: 12/11/2019 8:29:24AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.0 seconds
Dead Time	: 0.11 %
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81958
Fill Height	: 1522.90 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 8:44:27AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10002

L1-10214E-FSGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.72	949 -	959	954.96	7.89E+01	12.19	2.91E+01	0.52
2	583.30	2327 -	2338	2332.40	3.03E+01	5.92	1.70E+00	0.44
3	609.29	2431 -	2443	2436.34	3.31E+01	7.34	7.88E+00	0.99
4	911.23	3637 -	3650	3643.86	3.40E+01	5.83	0.00E+00	0.78
5	1460.87	5833 -	5852	5843.30	1.04E+02	10.20	0.00E+00	0.51

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	2.60E+00	2.78E-01
Tl-208	0.99	583.19	*	85.00	5.06E-02	1.03E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.41E-01	2.46E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.07E-01	2.44E-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 11-Dec-19-10002

L1-10214E-FSGS-002SS

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		
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	2.54E-01	4.48E-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
K-40	1.000	2.60E+00	2.78E-01	
Tl-208	0.998	5.06E-02	1.03E-02	
Pb-212	0.999	1.41E-01	2.46E-02	
Bi-214	1.000	1.07E-01	2.44E-02	

Analysis Report for 11-Dec-19-10002

L1-10214E-FSGS-002SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
Ac-228	1.000	2.54E-01	4.48E-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 11-Dec-19-10002

L1-10214E-FSGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 8:44:27AM
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	3.91E-02	5.29E-02	5.29E-02
	BE-7	477.60		10.44	-5.30E-02	2.98E-01	2.98E-01
+	K-40	1460.82	*	10.66	2.60E+00	7.18E-02	7.18E-02
	Mn-54	834.85		99.98	4.99E-03	3.66E-02	3.66E-02
	Co-60	1173.23		99.85	2.45E-04	2.78E-02	4.75E-02
		1332.49		99.98	7.44E-03		2.78E-02
	Nb-94	702.65		99.81	8.79E-03	4.00E-02	4.10E-02
		871.09		99.89	1.82E-02		4.00E-02
	Ag-108m	79.13		6.60	4.50E-01	3.84E-02	1.48E+00
		433.94		90.50	-3.84E-03		3.84E-02
		614.28		89.80	-1.72E-03		5.38E-02
		722.94		90.80	-2.72E-03		4.31E-02
	Sb-125	176.31		6.84	1.43E-01	1.21E-01	4.98E-01
		380.45		1.52	1.24E+00		2.26E+00
		427.87		29.60	-6.78E-02		1.21E-01
		463.36		10.49	2.13E-01		3.84E-01
		600.60		17.65	1.23E-02		2.04E-01
		606.71		4.98	1.47E+00		1.15E+00
		635.95		11.22	6.97E-02		3.48E-01

Analysis Report for 11-Dec-19-10002

L1-10214E-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	3.33E-01	1.21E-01	2.30E+00
Ba-133	79.61	2.65	-3.91E-02	6.49E-02	3.54E+00
	81.00	32.90	-1.69E-02		2.53E-01
	276.40	7.16	2.73E-01		5.38E-01
	302.85	18.34	1.88E-02		1.89E-01
	356.01	62.05	-7.43E-02		6.49E-02
	383.85	8.94	-2.60E-01		3.57E-01
Cs-134	475.36	1.48	1.80E-02	4.00E-02	2.12E+00
	563.25	8.34	2.29E-01		4.31E-01
	569.33	15.37	-1.69E-01		2.21E-01
	604.72	97.62	-2.15E-02		5.23E-02
	795.86	85.46	-2.71E-02		4.00E-02
	801.95	8.69	-1.09E-01		3.66E-01
	1038.61	0.99	-3.25E+00		4.29E+00
	1167.97	1.79	9.15E-01		2.48E+00
	1365.19	3.02	5.03E-01		1.23E+00
Cs-137	661.66	85.10	1.14E-02	4.02E-02	4.02E-02
Eu-152	121.78	28.67	-6.84E-02	1.18E-01	1.18E-01
	244.70	7.61	1.87E-01		4.63E-01
	295.94	0.45	1.30E+00		7.34E+00
	344.28	26.60	2.02E-02		1.28E-01
	367.79	0.86	-1.99E+00		3.69E+00
	411.12	2.24	5.55E-01		1.47E+00
	443.96	2.83	-3.05E-01		1.10E+00
	488.68	0.42	-1.79E+00		6.60E+00
	563.99	0.49	1.34E+00		7.32E+00
	586.26	0.46	5.37E+00		1.03E+01
	678.62	0.47	-4.78E+00		6.51E+00
	688.67	0.86	2.78E+00		3.97E+00
	719.35	0.28	-1.03E+01		1.22E+01
	778.90	12.96	-2.71E-02		2.94E-01
	810.45	0.32	-8.85E+00		9.98E+00
	867.37	4.26	-1.18E-01		9.36E-01
	919.33	0.43	-1.48E+00		9.13E+00
	964.08	14.65	1.33E-01		3.67E-01
	1085.87	10.24	-4.87E-01		4.40E-01
	1089.74	1.73	2.82E-01		2.61E+00
	1112.07	13.69	-1.67E-01		2.35E-01
	1212.95	1.43	1.46E+00		3.40E+00
	1249.94	0.19	-4.34E+00		2.77E+01
	1299.14	1.63	1.95E+00		3.03E+00
	1408.01	21.07	8.79E-02		2.56E-01
	1457.64	0.50	4.64E+01		2.77E+01
	1528.10	0.28	-7.74E-01		1.43E+01
Eu-154	123.07	40.40	-3.02E-02	8.72E-02	8.72E-02
	247.93	6.89	-2.94E-01		4.64E-01
	591.76	4.95	-2.37E-01		6.40E-01
	692.42	1.78	-1.07E+00		1.69E+00
	723.30	20.06	2.76E-02		1.99E-01
	756.80	4.52	6.56E-02		7.31E-01
	873.18	12.08	-1.71E-01		3.22E-01

Analysis Report for 11-Dec-19-10002

L1-10214E-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	9.08E-02	8.72E-02	3.52E-01
	1004.76	18.01	1.37E-01		2.23E-01
	1274.43	34.80	-8.53E-02		1.35E-01
	1596.48	1.80	3.17E-01		1.53E+00
Eu-155	45.30	1.31	-2.05E+00	2.10E-01	2.61E+01
	60.01	1.22	-1.36E+01		2.44E+01
	86.55	30.70	9.83E-02		2.10E-01
	105.31	21.10	-2.63E-02		2.12E-01
Ra-226	186.21	3.64	9.94E-01	9.64E-01	9.64E-01
Pa-231	27.36	10.30	1.96E+00	1.36E+00	2.90E+00
	283.69	1.70	-1.29E+00		1.79E+00
	300.07	2.47	1.36E-01		1.36E+00
	302.65	2.20	6.53E-01		1.60E+00
	330.06	1.40	3.87E-01		2.42E+00
U-235	143.76	10.96	-1.58E-01	5.89E-02	3.31E-01
	163.33	5.08	-1.79E-01		6.44E-01
	185.71	57.20	-7.66E-03		5.89E-02
	202.11	1.08	1.35E-01		2.96E+00
	205.31	5.01	1.45E-01		6.85E-01
Am-241	59.54	35.90	-1.76E-01	9.03E-01	9.03E-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 11-Dec-19-10003

L1-10214E-FSGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10003
Sample Description	: L1-10214E-FSGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.324E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:34:00PM
Acquisition Started	: 12/11/2019 8:29:50AM
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81959
Fill Height	: 1323.85 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 8:44:53AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10003

L1-10214E-FSGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.79	948 -	960	954.72	8.74E+01	13.18	3.26E+01	0.75
2	351.84	1401 -	1413	1406.37	4.33E+01	10.11	2.07E+01	0.93
3	582.84	2324 -	2334	2329.47	1.15E+01	7.15	1.65E+01	0.59
4	608.85	2427 -	2440	2433.45	4.52E+01	8.34	8.80E+00	0.42
5	1460.35	5830 -	5850	5839.33	1.67E+02	14.10	9.35E+00	1.52

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	0.96	1460.82	*	10.66	3.92E+00	3.73E-01
Tl-208	0.98	583.19	*	85.00	1.80E-02	1.12E-02
Bi-211	0.91	351.07	*	13.02	3.09E-01	7.63E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.43E-01	2.45E-02
		300.09		3.30		
Bi-214	0.98	609.32	*	45.49	1.36E-01	2.64E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 11-Dec-19-10003

L1-10214E-FSGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.98	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	1.13E-01	2.79E-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	0.965	3.92E+00	3.73E-01	
	Tl-208	0.981	1.80E-02	1.12E-02	
?	Bi-211	0.910	3.09E-01	7.63E-02	
	Pb-212	0.997	1.43E-01	2.45E-02	
	Bi-214	0.986	1.36E-01	2.64E-02	
?	Pb-214	0.999	1.13E-01	2.79E-02	

Analysis Report for 11-Dec-19-10003

L1-10214E-FSGS-003SS

? = 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 11-Dec-19-10003

L1-10214E-FSGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 8:44:53AM
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	5.57E-02	5.78E-02	5.78E-02
	BE-7	477.60		10.44	-2.41E-02	3.59E-01	3.59E-01
+	K-40	1460.82	*	10.66	3.92E+00	5.19E-01	5.19E-01
	Mn-54	834.85		99.98	1.44E-02	4.50E-02	4.50E-02
	Co-60	1173.23		99.85	-9.67E-03	3.64E-02	5.11E-02
		1332.49		99.98	-2.60E-02		3.64E-02
	Nb-94	702.65		99.81	-2.38E-03	3.16E-02	3.16E-02
		871.09		99.89	-7.90E-03		3.87E-02
	Ag-108m	79.13		6.60	2.37E-01	2.97E-02	1.01E+00
		433.94		90.50	-3.52E-02		2.97E-02
		614.28		89.80	-5.59E-02		4.20E-02
		722.94		90.80	4.21E-03		4.14E-02
	Sb-125	176.31		6.84	-2.54E-01	1.13E-01	3.77E-01
		380.45		1.52	-8.21E-02		1.98E+00
		427.87		29.60	-2.52E-02		1.13E-01
		463.36		10.49	1.67E-01		3.29E-01
		600.60		17.65	3.93E-02		1.99E-01
		606.71		4.98	1.09E+00		1.17E+00
		635.95		11.22	2.60E-02		3.13E-01

Analysis Report for 11-Dec-19-10003

L1-10214E-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	5.80E-01	1.13E-01	2.28E+00
Ba-133	79.61	2.65	9.67E-01	6.00E-02	2.43E+00
	81.00	32.90	-2.02E-01		1.57E-01
	276.40	7.16	5.22E-02		4.13E-01
	302.85	18.34	7.52E-02		1.62E-01
	356.01	62.05	9.18E-04		6.00E-02
	383.85	8.94	6.82E-02		3.23E-01
Cs-134	475.36	1.48	6.24E-01	4.59E-02	2.53E+00
	563.25	8.34	-4.74E-01		4.11E-01
	569.33	15.37	4.69E-02		2.25E-01
	604.72	97.62	-2.06E-02		5.47E-02
	795.86	85.46	-1.32E-02		4.59E-02
	801.95	8.69	-2.80E-01		3.72E-01
	1038.61	0.99	-3.32E+00		3.90E+00
	1167.97	1.79	1.79E-01		3.21E+00
	1365.19	3.02	-1.90E-01		1.48E+00
Cs-137	661.66	85.10	1.56E-02	4.51E-02	4.51E-02
Eu-152	121.78	28.67	-8.68E-03	9.99E-02	9.99E-02
	244.70	7.61	2.21E-01		4.35E-01
	295.94	0.45	4.16E+00		7.88E+00
	344.28	26.60	-3.25E-02		1.16E-01
	367.79	0.86	1.29E-01		3.39E+00
	411.12	2.24	1.24E-01		1.40E+00
	443.96	2.83	-4.17E-01		1.18E+00
	488.68	0.42	3.50E-01		5.05E+00
	563.99	0.49	-1.82E+01		6.00E+00
	586.26	0.46	-2.64E+00		1.08E+01
	678.62	0.47	1.26E+00		7.28E+00
	688.67	0.86	-4.84E+00		3.62E+00
	719.35	0.28	-6.29E+00		1.15E+01
	778.90	12.96	-1.02E-01		2.91E-01
	810.45	0.32	-1.02E+00		1.08E+01
	867.37	4.26	-3.54E-01		9.30E-01
	919.33	0.43	3.63E-01		9.65E+00
	964.08	14.65	2.05E-01		3.80E-01
	1085.87	10.24	-1.91E-01		2.91E-01
	1089.74	1.73	-1.16E+00		1.94E+00
	1112.07	13.69	4.45E-03		3.43E-01
	1212.95	1.43	-9.53E-01		3.57E+00
	1249.94	0.19	-6.56E+00		2.31E+01
	1299.14	1.63	-1.06E-01		2.76E+00
	1408.01	21.07	-3.18E-02		2.09E-01
	1457.64	0.50	8.97E+01		3.38E+01
	1528.10	0.28	4.61E+00		1.25E+01
Eu-154	123.07	40.40	1.97E-03	7.06E-02	7.06E-02
	247.93	6.89	1.57E-01		3.95E-01
	591.76	4.95	2.56E-01		7.68E-01
	692.42	1.78	6.12E-01		1.91E+00
	723.30	20.06	2.76E-02		1.91E-01
	756.80	4.52	7.37E-02		8.38E-01
	873.18	12.08	2.01E-01		3.46E-01

Analysis Report for 11-Dec-19-10003

L1-10214E-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.38E-01	7.06E-02	3.94E-01
	1004.76	18.01	-2.12E-01		2.24E-01
	1274.43	34.80	-1.14E-02		1.22E-01
	1596.48	1.80	1.05E+00		2.33E+00
Eu-155	45.30	1.31	4.18E+00	1.55E-01	9.24E+00
	60.01	1.22	5.70E+00		1.04E+01
	86.55	30.70	7.10E-02		1.55E-01
	105.31	21.10	6.22E-03		1.55E-01
Ra-226	186.21	3.64	-2.70E-02	7.78E-01	7.78E-01
Pa-231	27.36	10.30	7.69E-01	1.15E+00	1.15E+00
	283.69	1.70	-7.68E-01		1.72E+00
	300.07	2.47	-1.10E+00		1.16E+00
	302.65	2.20	6.10E-01		1.34E+00
	330.06	1.40	6.82E-01		2.29E+00
U-235	143.76	10.96	-2.44E-01	5.15E-02	2.35E-01
	163.33	5.08	-2.70E-01		5.02E-01
	185.71	57.20	1.20E-02		5.15E-02
	202.11	1.08	7.19E-01		2.39E+00
	205.31	5.01	-3.72E-01		4.62E-01
Am-241	59.54	35.90	1.48E-03	3.57E-01	3.57E-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 11-Dec-19-10004

L1-10214E-FSGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10004
Sample Description	: L1-10214E-FSGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.366E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:36:00PM
Acquisition Started	: 12/11/2019 8:30:14AM
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81960
Fill Height	: 1366.00 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 8:45:17AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10004

L1-10214E-FSGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	74.76	296 -	304	300.36	2.44E+01	11.64	5.06E+01	0.72
2	238.58	947 -	962	954.78	1.15E+02	16.98	5.53E+01	1.00
3	249.80	996 -	1003	999.63	1.40E+01	6.49	1.40E+01	0.93
4	295.12	1173 -	1185	1180.72	5.28E+01	10.44	2.12E+01	1.63
5	351.72	1400 -	1414	1406.86	7.99E+01	11.98	2.21E+01	1.41
6	583.01	2325 -	2338	2331.35	3.96E+01	7.92	8.36E+00	0.38
7	609.32	2427 -	2443	2436.56	7.23E+01	10.01	8.69E+00	0.87
8	911.26	3636 -	3650	3644.10	3.75E+01	7.69	7.50E+00	1.38
9	1460.24	5830 -	5852	5841.34	2.27E+02	17.10	1.70E+01	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	0.94	1460.82	*	10.66	4.92E+00	4.27E-01
Tl-208	0.99	583.19	*	85.00	5.83E-02	1.22E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.84E-01	3.10E-02
		300.09		3.30		
Pb212-XR	1.00	74.82	*	10.28	4.31E-01	2.10E-01
		77.11		17.10		
		87.35		3.97		

Analysis Report for 11-Dec-19-10004

L1-10214E-FSGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	1.00	89.78		1.46		
Bi-214	1.00	609.32	*	45.49	2.05E-01	3.09E-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	2.25E-01	4.80E-02
		351.93	*	35.60	1.99E-01	3.39E-02
		785.96		1.06		
Pb214-XR	1.00	74.82	*	5.80	7.64E-01	3.74E-01
		77.11		9.70		
		87.35		2.24		
		89.78		0.82		
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	2.45E-01	5.12E-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 11-Dec-19-10004

L1-10214E-FSGS-004SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.948	4.92E+00	4.27E-01	
	Tl-208	0.995	5.83E-02	1.22E-02	
X	Bi-211	0.935			
	Pb-212	1.000	1.84E-01	3.10E-02	
?	Pb212-XR	1.000	4.31E-01	2.10E-01	
	Bi-214	1.000	2.05E-01	3.09E-02	
	Pb-214	0.995	2.08E-01	2.77E-02	
?	Pb214-XR	1.000	7.64E-01	3.74E-01	
	Ac-228	1.000	2.45E-01	5.12E-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 11-Dec-19-10004

L1-10214E-FSGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 8:45:17AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
3	249.80	1.55556E-02	46.34		

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	4.74E-02	5.36E-02	5.36E-02
	BE-7	477.60		10.44	9.07E-02	3.86E-01	3.86E-01
+	K-40	1460.82	*	10.66	4.92E+00	6.56E-01	6.56E-01
	Mn-54	834.85		99.98	-7.15E-03	3.78E-02	3.78E-02
	Co-60	1173.23		99.85	2.46E-02	5.25E-02	6.21E-02
		1332.49		99.98	1.42E-02		5.25E-02
	Nb-94	702.65		99.81	-2.01E-02	3.29E-02	4.25E-02
		871.09		99.89	-1.05E-02		3.29E-02
	Ag-108m	79.13		6.60	-1.12E+00	3.50E-02	1.28E+00
		433.94		90.50	1.13E-02		3.50E-02
		614.28		89.80	1.55E-02		6.79E-02
		722.94		90.80	3.29E-02		4.77E-02
	Sb-125	176.31		6.84	-2.36E-01	1.02E-01	4.69E-01
		380.45		1.52	-1.14E+00		2.15E+00
		427.87		29.60	-1.46E-02		1.02E-01
		463.36		10.49	4.11E-01		4.16E-01
		600.60		17.65	2.41E-01		2.61E-01
		606.71		4.98	1.76E+00		1.34E+00

Analysis Report for 11-Dec-19-10004

L1-10214E-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	635.95	11.22	-2.36E-01	1.02E-01	3.17E-01
	671.44	1.79	-2.71E-01		2.02E+00
Ba-133	79.61	2.65	-1.46E+00	6.95E-02	3.13E+00
	81.00	32.90	-3.43E-01		2.29E-01
	276.40	7.16	-3.06E-01		4.45E-01
	302.85	18.34	1.14E-02		1.62E-01
	356.01	62.05	-1.66E-02		6.95E-02
	383.85	8.94	7.39E-02		3.66E-01
Cs-134	475.36	1.48	6.57E-01	6.04E-02	2.51E+00
	563.25	8.34	-7.32E-02		4.58E-01
	569.33	15.37	6.69E-02		2.47E-01
	604.72	97.62	-2.83E-02		6.52E-02
	795.86	85.46	1.16E-02		6.04E-02
	801.95	8.69	-3.06E-01		4.94E-01
	1038.61	0.99	2.32E+00		4.30E+00
	1167.97	1.79	1.41E+00		3.36E+00
	1365.19	3.02	1.34E-01		1.26E+00
Cs-137	661.66	85.10	2.01E-02	5.99E-02	5.99E-02
Eu-152	121.78	28.67	6.94E-02	1.09E-01	1.30E-01
	244.70	7.61	-5.89E-02		4.82E-01
	295.94	0.45	1.14E+01		9.21E+00
	344.28	26.60	-1.32E-01		1.09E-01
	367.79	0.86	-3.39E-01		3.65E+00
	411.12	2.24	-3.32E-01		1.64E+00
	443.96	2.83	-6.53E-01		1.09E+00
	488.68	0.42	-4.47E+00		8.27E+00
	563.99	0.49	-3.67E+00		7.37E+00
	586.26	0.46	3.25E+00		1.08E+01
	678.62	0.47	-5.29E-01		8.15E+00
	688.67	0.86	-3.88E+00		4.52E+00
	719.35	0.28	2.67E+00		1.31E+01
	778.90	12.96	-2.19E-01		2.65E-01
	810.45	0.32	6.06E+00		1.37E+01
	867.37	4.26	-8.88E-01		8.18E-01
	919.33	0.43	-7.20E+00		9.41E+00
	964.08	14.65	2.95E-01		4.66E-01
	1085.87	10.24	-9.54E-02		4.95E-01
	1089.74	1.73	-5.89E-01		2.72E+00
	1112.07	13.69	-7.76E-01		3.55E-01
	1212.95	1.43	3.89E-01		4.56E+00
	1249.94	0.19	2.19E+01		2.99E+01
	1299.14	1.63	1.96E+00		2.80E+00
	1408.01	21.07	-1.43E-01		2.00E-01
	1457.64	0.50	1.16E+02		3.64E+01
	1528.10	0.28	-2.60E+00		1.32E+01
Eu-154	123.07	40.40	4.41E-02	9.16E-02	9.16E-02
	247.93	6.89	-2.38E-01		4.84E-01
	591.76	4.95	1.74E-01		7.55E-01
	692.42	1.78	-4.23E-01		2.04E+00
	723.30	20.06	1.49E-01		2.16E-01
	756.80	4.52	-4.24E-01		9.29E-01

Analysis Report for 11-Dec-19-10004

L1-10214E-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	-1.81E-02	9.16E-02	3.06E-01
	996.29	10.48	-7.66E-02		4.81E-01
	1004.76	18.01	-1.52E-01		2.58E-01
	1274.43	34.80	-7.37E-02		1.56E-01
	1596.48	1.80	-2.06E+00		2.14E+00
Eu-155	45.30	1.31	1.28E+01	1.74E-01	1.84E+01
	60.01	1.22	4.05E+00		2.13E+01
	86.55	30.70	-8.10E-02		2.12E-01
	105.31	21.10	-5.84E-02		1.74E-01
Ra-226	186.21	3.64	3.72E-01	9.69E-01	9.69E-01
Pa-231	27.36	10.30	1.26E+00	1.25E+00	2.41E+00
	283.69	1.70	9.28E-02		1.72E+00
	300.07	2.47	-1.91E+00		1.25E+00
	302.65	2.20	-5.45E-02		1.35E+00
	330.06	1.40	-1.07E+00		2.56E+00
U-235	143.76	10.96	-1.06E-01	6.16E-02	3.06E-01
	163.33	5.08	5.31E-02		6.35E-01
	185.71	57.20	-1.47E-03		6.16E-02
	202.11	1.08	1.09E+00		3.32E+00
	205.31	5.01	-6.20E-01		6.53E-01
Am-241	59.54	35.90	-2.83E-01	7.21E-01	7.21E-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 11-Dec-19-10005

L1-10214E-FSGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10005
Sample Description	: L1-10214E-FSGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 9.801E+02 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:38:00PM
Acquisition Started	: 12/11/2019 8:47:42AM
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81961
Fill Height	: 980.08 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:02:44AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10005

L1-10214E-FSGS-005SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.20	151 -	158	155.00	5.49E+01	18.64	1.43E+02	0.61
M	2	238.69	473 -	488	477.56	2.49E+02	40.17	6.58E+01	1.20
m	3	241.89	473 -	488	483.95	5.41E+01	11.67	5.86E+01	1.21
	4	295.22	587 -	595	590.50	7.35E+01	13.04	4.45E+01	1.27
	5	351.83	698 -	708	703.61	1.61E+02	15.16	2.89E+01	1.26
	6	583.22	1160 -	1171	1166.04	8.81E+01	12.71	2.89E+01	0.94
	7	609.20	1213 -	1223	1217.98	9.97E+01	13.19	3.13E+01	1.46
	8	911.25	1816 -	1828	1821.95	6.20E+01	10.20	1.60E+01	1.67
	9	1460.63	2915 -	2928	2921.31	3.51E+02	19.17	6.42E+00	2.15

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	7.87E+00	5.49E-01
Tl-208	1.00	583.19	*	85.00	1.33E-01	2.07E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	3.98E-01	7.20E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.92E-01	1.39E-01
		87.35		3.97		

Analysis Report for 11-Dec-19-10005

L1-10214E-FSGS-005SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.89E-01	4.20E-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	5.25E-01	1.21E-01
		295.22	*	18.42	3.16E-01	6.15E-02
		351.93	*	35.60	4.07E-01	5.03E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	6.92E-01	2.47E-01
		87.35		2.24		
		89.78		0.82		
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	4.16E-01	7.07E-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 11-Dec-19-10005

L1-10214E-FSGS-005SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.994	7.87E+00	5.49E-01	
	Tl-208	1.000	1.33E-01	2.07E-02	
X	Bi-211	0.911			
	Pb-212	1.000	3.98E-01	7.20E-02	
?	Pb212-XR	0.999	3.92E-01	1.39E-01	
	Bi-214	0.999	2.89E-01	4.20E-02	
	Pb-214	0.999	3.85E-01	3.71E-02	
?	Pb214-XR	0.999	6.92E-01	2.47E-01	
	Ac-228	1.000	4.16E-01	7.07E-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 11-Dec-19-10005

L1-10214E-FSGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:02:44AM
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	6.36E-02	5.78E-02	5.78E-02
	BE-7	477.60		10.44	2.15E-01	4.26E-01	4.26E-01
+	K-40	1460.82	*	10.66	7.87E+00	3.78E-01	3.78E-01
	Mn-54	834.85		99.98	-1.23E-02	5.30E-02	5.30E-02
	Co-60	1173.23		99.85	-2.51E-02	5.31E-02	5.80E-02
		1332.49		99.98	-5.29E-04		5.31E-02
	Nb-94	702.65		99.81	0.00E+00	4.61E-02	4.61E-02
		871.09		99.89	2.60E-02		5.04E-02
	Ag-108m	79.13		6.60	5.68E-02	3.96E-02	1.22E+00
		433.94		90.50	-6.63E-03		3.96E-02
		614.28		89.80	-2.06E-03		6.68E-02
		722.94		90.80	1.06E-02		5.41E-02
	Sb-125	176.31		6.84	-1.26E-01	1.34E-01	5.66E-01
		380.45		1.52	3.12E-01		2.53E+00
		427.87		29.60	7.36E-02		1.34E-01
		463.36		10.49	3.02E-01		4.24E-01
		600.60		17.65	-5.60E-02		2.25E-01
		606.71		4.98	6.60E-03		1.62E+00
		635.95		11.22	-6.60E-03		3.68E-01

Analysis Report for 11-Dec-19-10005

L1-10214E-FSGS-005SS

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	1.34E-01	2.33E+00
Ba-133	79.61	2.65	5.69E-02	8.67E-02	2.93E+00
	81.00	32.90	-1.57E-01		1.94E-01
	276.40	7.16	5.11E-02		5.44E-01
	302.85	18.34	1.04E-01		2.00E-01
	356.01	62.05	-6.41E-02		8.67E-02
	383.85	8.94	8.64E-02		4.39E-01
Cs-134	475.36	1.48	1.32E+00	5.92E-02	2.99E+00
	563.25	8.34	1.66E-01		4.92E-01
	569.33	15.37	2.46E-02		2.63E-01
	604.72	97.62	-6.20E-03		7.09E-02
	795.86	85.46	1.13E-02		5.92E-02
	801.95	8.69	-1.44E-02		5.64E-01
	1038.61	0.99	1.45E-01		5.22E+00
	1167.97	1.79	7.41E-01		3.47E+00
	1365.19	3.02	4.17E-01		1.57E+00
Cs-137	661.66	85.10	5.87E-02	6.91E-02	6.91E-02
Eu-152	121.78	28.67	2.77E-02	1.29E-01	1.29E-01
	244.70	7.61	-1.06E-01		5.48E-01
	295.94	0.45	7.18E+00		1.03E+01
	344.28	26.60	-1.23E-01		1.44E-01
	367.79	0.86	-2.70E-01		4.48E+00
	411.12	2.24	1.19E+00		1.79E+00
	443.96	2.83	-2.89E-01		1.43E+00
	488.68	0.42	-4.19E+00		8.10E+00
	563.99	0.49	2.70E+00		8.46E+00
	586.26	0.46	-2.73E+00		1.60E+01
	678.62	0.47	-6.01E-01		8.63E+00
	688.67	0.86	2.68E+00		5.60E+00
	719.35	0.28	2.58E+00		1.45E+01
	778.90	12.96	-1.28E-01		2.92E-01
	810.45	0.32	-1.42E+01		1.18E+01
	867.37	4.26	-7.24E-01		1.05E+00
	919.33	0.43	-4.80E+00		1.19E+01
	964.08	14.65	2.13E-01		5.14E-01
	1085.87	10.24	-7.77E-02		5.37E-01
	1089.74	1.73	-6.85E-01		3.19E+00
	1112.07	13.69	-2.09E-01		3.59E-01
	1212.95	1.43	8.50E-01		4.93E+00
	1249.94	0.19	2.16E+00		3.44E+01
	1299.14	1.63	2.80E+00		3.75E+00
	1408.01	21.07	1.08E-01		2.44E-01
	1457.64	0.50	-8.28E+00		4.48E+01
	1528.10	0.28	-4.63E+00		1.65E+01
Eu-154	123.07	40.40	3.22E-02	9.12E-02	9.12E-02
	247.93	6.89	-1.36E-02		5.12E-01
	591.76	4.95	-2.38E-01		8.77E-01
	692.42	1.78	3.76E-01		2.81E+00
	723.30	20.06	1.18E-01		2.53E-01
	756.80	4.52	-2.49E-01		9.69E-01
	873.18	12.08	1.26E-01		4.05E-01

Analysis Report for 11-Dec-19-10005

L1-10214E-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.71E-02	9.12E-02	4.80E-01
	1004.76	18.01	-9.77E-02		2.86E-01
	1274.43	34.80	-1.47E-01		1.67E-01
	1596.48	1.80	-2.42E+00		2.35E+00
Eu-155	45.30	1.31	4.17E-01	1.85E-01	1.27E+01
	60.01	1.22	-2.27E+00		1.36E+01
	86.55	30.70	3.50E-02		1.94E-01
	105.31	21.10	-3.72E-02		1.85E-01
Ra-226	186.21	3.64	1.44E+00	1.28E+00	1.28E+00
Pa-231	27.36	10.30	8.35E-01	1.28E+00	1.28E+00
	283.69	1.70	7.71E-01		2.08E+00
	300.07	2.47	-4.10E-01		1.49E+00
	302.65	2.20	8.70E-01		1.67E+00
	330.06	1.40	-7.85E-03		2.91E+00
U-235	143.76	10.96	-1.17E-01	8.12E-02	3.14E-01
	163.33	5.08	-3.18E-01		7.31E-01
	185.71	57.20	8.82E-02		8.12E-02
	202.11	1.08	4.27E-01		3.66E+00
	205.31	5.01	-3.61E-01		7.87E-01
Am-241	59.54	35.90	-7.89E-02	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 11-Dec-19-10006

L1-10214E-FSGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10006
Sample Description	: L1-10214E-FSGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.205E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:40:00PM
Acquisition Started	: 12/11/2019 8:48:10AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.1 seconds
Dead Time	: 0.12 %
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81962
Fill Height	: 1204.95 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:03:13AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10006

L1-10214E-FSGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.70	946 -	960	954.89	9.38E+01	16.07	5.72E+01	0.83
2	352.02	1402 -	1414	1407.82	4.00E+01	9.76	2.10E+01	0.92
3	609.19	2430 -	2442	2435.93	3.10E+01	8.08	1.30E+01	0.63
4	911.25	3639 -	3649	3643.98	1.45E+01	6.09	9.49E+00	0.32
5	1460.75	5832 -	5854	5842.85	1.86E+02	13.64	0.00E+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	5.05E+00	4.31E-01
Bi-211	0.86	351.07	*	13.02	3.27E-01	8.41E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.78E-01	3.38E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.07E-01	2.87E-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 11-Dec-19-10006

L1-10214E-FSGS-006SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	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	1.20E-01	3.07E-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	1.17E-01	4.94E-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 11-Dec-19-10006

L1-10214E-FSGS-006SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	5.05E+00	4.31E-01	
?	Bi-211	0.865	3.27E-01	8.41E-02	
	Pb-212	0.999	1.78E-01	3.38E-02	
	Bi-214	0.999	1.07E-01	2.87E-02	
?	Pb-214	0.999	1.20E-01	3.07E-02	
	Ac-228	1.000	1.17E-01	4.94E-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 11-Dec-19-10006

L1-10214E-FSGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:03:13AM
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	5.55E-02	6.01E-02	6.01E-02
	BE-7	477.60		10.44	4.30E-01	4.77E-01	4.77E-01
+	K-40	1460.82	*	10.66	5.05E+00	7.82E-02	7.82E-02
	Mn-54	834.85		99.98	6.21E-03	5.17E-02	5.17E-02
	Co-60	1173.23		99.85	9.18E-03	4.20E-02	6.41E-02
		1332.49		99.98	-4.59E-02		4.20E-02
	Nb-94	702.65		99.81	2.93E-03	4.42E-02	4.42E-02
		871.09		99.89	1.56E-02		4.79E-02
	Ag-108m	79.13		6.60	2.13E-01	4.11E-02	1.66E+00
		433.94		90.50	6.42E-05		4.11E-02
		614.28		89.80	-5.15E-02		5.92E-02
		722.94		90.80	1.55E-02		5.77E-02
	Sb-125	176.31		6.84	9.72E-03	1.13E-01	5.15E-01
		380.45		1.52	7.54E-01		2.36E+00
		427.87		29.60	-3.03E-03		1.13E-01
		463.36		10.49	2.55E-01		4.21E-01
		600.60		17.65	-2.21E-02		2.00E-01
		606.71		4.98	1.30E+00		1.27E+00
		635.95		11.22	1.66E-01		4.22E-01

Analysis Report for 11-Dec-19-10006

L1-10214E-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.13E+00	1.13E-01	2.44E+00
Ba-133	79.61	2.65	-8.64E-01	7.40E-02	3.93E+00
	81.00	32.90	-4.34E-02		2.91E-01
	276.40	7.16	4.42E-01		5.51E-01
	302.85	18.34	7.96E-02		2.06E-01
	356.01	62.05	-1.67E-02		7.40E-02
	383.85	8.94	1.14E-01		4.32E-01
Cs-134	475.36	1.48	2.36E+00	5.15E-02	3.36E+00
	563.25	8.34	-9.71E-02		4.16E-01
	569.33	15.37	4.66E-02		2.58E-01
	604.72	97.62	-1.79E-02		5.91E-02
	795.86	85.46	4.86E-03		5.15E-02
	801.95	8.69	-7.23E-01		3.78E-01
	1038.61	0.99	-3.15E+00		5.08E+00
	1167.97	1.79	1.67E+00		3.12E+00
	1365.19	3.02	-1.10E+00		1.42E+00
Cs-137	661.66	85.10	1.47E-03	5.71E-02	5.71E-02
Eu-152	121.78	28.67	2.98E-02	1.31E-01	1.48E-01
	244.70	7.61	4.02E-02		5.41E-01
	295.94	0.45	5.24E+00		9.79E+00
	344.28	26.60	4.94E-03		1.31E-01
	367.79	0.86	-3.13E-01		3.89E+00
	411.12	2.24	-2.25E-01		1.73E+00
	443.96	2.83	1.26E-01		1.20E+00
	488.68	0.42	-4.15E-01		8.47E+00
	563.99	0.49	4.00E-03		7.23E+00
	586.26	0.46	1.20E+01		1.20E+01
	678.62	0.47	-1.74E+00		9.31E+00
	688.67	0.86	3.30E+00		4.96E+00
	719.35	0.28	5.54E+00		1.51E+01
	778.90	12.96	-3.45E-02		3.50E-01
	810.45	0.32	3.79E+00		1.16E+01
	867.37	4.26	7.56E-01		1.20E+00
	919.33	0.43	-2.70E+00		8.83E+00
	964.08	14.65	3.19E-01		4.74E-01
	1085.87	10.24	1.20E-01		5.19E-01
	1089.74	1.73	-1.50E+00		3.16E+00
	1112.07	13.69	-9.87E-02		3.40E-01
	1212.95	1.43	-4.95E+00		4.41E+00
	1249.94	0.19	-1.84E+01		2.66E+01
	1299.14	1.63	1.30E+00		3.29E+00
	1408.01	21.07	-5.14E-02		2.41E-01
	1457.64	0.50	1.05E+02		3.94E+01
	1528.10	0.28	-1.60E+00		8.17E+00
Eu-154	123.07	40.40	3.52E-02	1.04E-01	1.04E-01
	247.93	6.89	1.17E-01		5.71E-01
	591.76	4.95	4.90E-01		7.75E-01
	692.42	1.78	-1.23E+00		2.25E+00
	723.30	20.06	1.16E-01		2.65E-01
	756.80	4.52	3.14E-01		1.05E+00
	873.18	12.08	2.19E-01		4.06E-01

Analysis Report for 11-Dec-19-10006

L1-10214E-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.80E-01	1.04E-01	5.03E-01
	1004.76	18.01	1.21E-01		2.65E-01
	1274.43	34.80	6.09E-02		1.57E-01
	1596.48	1.80	6.92E-01		2.16E+00
Eu-155	45.30	1.31	1.61E+01	2.25E-01	2.77E+01
	60.01	1.22	-1.66E+00		2.64E+01
	86.55	30.70	-1.12E-01		2.25E-01
	105.31	21.10	6.59E-02		2.50E-01
Ra-226	186.21	3.64	6.58E-01	1.13E+00	1.13E+00
Pa-231	27.36	10.30	1.31E+00	1.56E+00	2.83E+00
	283.69	1.70	-2.29E-01		2.25E+00
	300.07	2.47	-1.64E+00		1.56E+00
	302.65	2.20	1.07E+00		1.76E+00
	330.06	1.40	1.52E+00		2.99E+00
U-235	143.76	10.96	-2.86E-01	7.16E-02	3.47E-01
	163.33	5.08	-2.06E-01		7.76E-01
	185.71	57.20	6.70E-02		7.16E-02
	202.11	1.08	-1.04E+00		3.61E+00
	205.31	5.01	-1.10E+00		7.05E-01
Am-241	59.54	35.90	-8.01E-02	9.45E-01	9.45E-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 11-Dec-19-10007

L1-10214E-FSGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10007
Sample Description	: L1-10214E-FSGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.696E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:42:00PM
Acquisition Started	: 12/11/2019 8:48:39AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.2 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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81963
Fill Height	: 1695.89 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:03:41AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10007

L1-10214E-FSGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.64	946 -	961	954.13	8.84E+01	15.66	5.06E+01	1.30
2	1460.34	5829 -	5847	5839.30	1.15E+02	11.08	2.40E+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	0.96	1460.82	*	10.66	2.50E+00	2.65E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.38E-01	2.69E-02
		300.09		3.30		

* = 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 11-Dec-19-10007

L1-10214E-FSGS-007SS

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.963	2.50E+00	2.65E-01	
Pb-212	1.000	1.38E-01	2.69E-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 11-Dec-19-10007

L1-10214E-FSGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:03:41AM
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	4.66E-02	4.69E-02	4.69E-02
	BE-7	477.60		10.44	-2.47E-01	2.20E-01	2.20E-01
+	K-40	1460.82	*	10.66	2.50E+00	2.75E-01	2.75E-01
	Mn-54	834.85		99.98	1.39E-02	3.88E-02	3.88E-02
	Co-60	1173.23		99.85	2.69E-04	3.57E-02	4.03E-02
		1332.49		99.98	1.74E-02		3.57E-02
	Nb-94	702.65		99.81	-4.01E-03	2.67E-02	2.67E-02
		871.09		99.89	-3.80E-02		2.96E-02
	Ag-108m	79.13		6.60	3.83E-01	3.08E-02	9.14E-01
		433.94		90.50	1.91E-02		3.08E-02
		614.28		89.80	-3.07E-02		4.08E-02
		722.94		90.80	-4.41E-02		3.61E-02
	Sb-125	176.31		6.84	3.79E-02	8.30E-02	3.58E-01
		380.45		1.52	1.73E+00		2.04E+00
		427.87		29.60	5.28E-02		8.30E-02
		463.36		10.49	4.83E-02		3.01E-01
		600.60		17.65	5.37E-02		1.64E-01
		606.71		4.98	3.10E-01		8.87E-01
		635.95		11.22	2.25E-01		2.81E-01

Analysis Report for 11-Dec-19-10007

L1-10214E-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.08E-02	8.30E-02	1.87E+00
Ba-133	79.61	2.65	1.24E+00	4.80E-02	2.23E+00
	81.00	32.90	-1.76E-01		1.43E-01
	276.40	7.16	-1.72E-01		3.40E-01
	302.85	18.34	-6.59E-02		1.55E-01
	356.01	62.05	-5.06E-02		4.80E-02
	383.85	8.94	-5.22E-02		2.86E-01
Cs-134	475.36	1.48	5.94E-01	3.89E-02	1.79E+00
	563.25	8.34	-3.18E-01		4.14E-01
	569.33	15.37	1.33E-02		1.77E-01
	604.72	97.62	-2.18E-02		3.89E-02
	795.86	85.46	2.89E-02		3.98E-02
	801.95	8.69	2.39E-01		4.04E-01
	1038.61	0.99	4.49E-01		4.11E+00
	1167.97	1.79	6.95E-01		2.58E+00
	1365.19	3.02	-1.28E-01		1.38E+00
Cs-137	661.66	85.10	2.50E-02	3.90E-02	3.90E-02
Eu-152	121.78	28.67	-3.31E-02	9.00E-02	9.00E-02
	244.70	7.61	-3.49E-02		3.80E-01
	295.94	0.45	2.52E-01		6.79E+00
	344.28	26.60	-1.09E-02		9.20E-02
	367.79	0.86	1.19E+00		3.16E+00
	411.12	2.24	6.00E-01		1.35E+00
	443.96	2.83	-7.52E-02		1.11E+00
	488.68	0.42	3.04E+00		7.08E+00
	563.99	0.49	-5.52E+00		6.69E+00
	586.26	0.46	9.11E+00		9.57E+00
	678.62	0.47	-6.24E-01		6.48E+00
	688.67	0.86	1.43E+00		3.79E+00
	719.35	0.28	-2.87E-02		1.20E+01
	778.90	12.96	3.23E-02		2.37E-01
	810.45	0.32	-9.53E+00		9.48E+00
	867.37	4.26	-4.12E-01		7.98E-01
	919.33	0.43	-9.03E+00		8.28E+00
	964.08	14.65	6.59E-02		3.39E-01
	1085.87	10.24	1.04E-01		3.74E-01
	1089.74	1.73	-1.92E-01		1.99E+00
	1112.07	13.69	3.52E-03		2.75E-01
	1212.95	1.43	3.93E-01		3.07E+00
	1249.94	0.19	-1.83E-01		1.90E+01
	1299.14	1.63	-7.55E-01		2.04E+00
	1408.01	21.07	2.98E-02		1.85E-01
	1457.64	0.50	5.54E+01		2.56E+01
	1528.10	0.28	-1.32E+00		1.16E+01
Eu-154	123.07	40.40	-8.58E-04	6.18E-02	6.18E-02
	247.93	6.89	1.85E-01		3.79E-01
	591.76	4.95	6.02E-02		5.63E-01
	692.42	1.78	-6.81E-02		1.84E+00
	723.30	20.06	3.61E-03		1.79E-01
	756.80	4.52	-1.26E-01		5.43E-01
	873.18	12.08	-6.50E-02		2.74E-01

Analysis Report for 11-Dec-19-10007

L1-10214E-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.75E-01	6.18E-02	3.22E-01
	1004.76	18.01	7.05E-02		2.09E-01
	1274.43	34.80	-5.80E-02		1.09E-01
	1596.48	1.80	-6.93E-02		1.34E+00
Eu-155	45.30	1.31	9.46E-01	1.33E-01	8.43E+00
	60.01	1.22	1.34E+00		9.25E+00
	86.55	30.70	4.79E-02		1.33E-01
	105.31	21.10	-6.93E-02		1.42E-01
Ra-226	186.21	3.64	-1.72E-01	6.78E-01	6.78E-01
Pa-231	27.36	10.30	8.07E-01	1.04E+00	1.04E+00
	283.69	1.70	-5.49E-02		1.44E+00
	300.07	2.47	-6.59E-01		1.15E+00
	302.65	2.20	-3.23E-01		1.28E+00
	330.06	1.40	9.78E-02		2.09E+00
U-235	143.76	10.96	-1.65E-02	4.37E-02	2.45E-01
	163.33	5.08	2.41E-01		4.81E-01
	185.71	57.20	1.05E-02		4.37E-02
	202.11	1.08	-1.03E+00		2.33E+00
	205.31	5.01	-3.17E-02		5.03E-01
Am-241	59.54	35.90	-1.49E-01	3.10E-01	3.10E-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 11-Dec-19-10008

L1-10214E-FSGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10008
Sample Description	: L1-10214E-FSGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.111E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:44:00PM
Acquisition Started	: 12/11/2019 8:50:03AM
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	: 0.04 %
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81964
Fill Height	: 1111.07 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:05:05AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

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Analysis Report for 11-Dec-19-10008

L1-10214E-FSGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.03	739 -	750	744.83	4.47E+01	13.56	5.53E+01	0.52
2	238.55	949 -	962	954.66	1.81E+02	21.13	9.33E+01	1.07
3	295.08	1173 -	1186	1180.54	6.22E+01	12.01	2.98E+01	0.65
4	338.20	1348 -	1358	1352.83	4.69E+01	10.57	2.71E+01	0.54
5	351.73	1400 -	1414	1406.92	1.03E+02	13.83	3.04E+01	1.44
6	510.70	2036 -	2047	2042.31	3.75E+01	10.11	2.55E+01	0.98
7	582.83	2324 -	2338	2330.65	6.71E+01	11.14	1.99E+01	1.25
8	609.25	2428 -	2445	2436.27	9.29E+01	12.15	1.71E+01	0.84
9	661.43	2639 -	2652	2644.90	3.10E+01	7.12	7.00E+00	1.44
10	910.89	3635 -	3651	3642.61	5.09E+01	9.07	1.01E+01	1.08
11	968.49	3866 -	3880	3873.04	2.43E+01	8.17	1.47E+01	0.25
12	1460.19	5827 -	5852	5841.13	3.53E+02	20.29	1.35E+01	2.01

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	4.65E-02	1.29E-02
K-40	0.93	1460.82	*	10.66	8.27E+00	5.96E-01
Cs-137	0.99	661.66	*	85.10	5.32E-02	1.26E-02
Tl-208	0.98	583.19	*	85.00	1.06E-01	1.87E-02
Pb-212	0.99	115.18		0.60		

Analysis Report for 11-Dec-19-10008

L1-10214E-FSGS-008SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	238.63	*	43.60	3.07E-01	4.36E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.82E-01	4.06E-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	2.82E-01	5.89E-02
		351.93	*	35.60	2.73E-01	4.28E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	8.08E-01	2.54E-01
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.83E-01	9.18E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.58E-01	6.56E-02
		964.77		4.99		
		968.97	*	15.80	2.90E-01	9.84E-02
		1588.20		3.22		
U-235	0.98	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	5.14E-02	1.62E-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 11-Dec-19-10008

L1-10214E-FSGS-008SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.986	4.65E-02	1.29E-02	
	K-40	0.938	8.27E+00	5.96E-01	
	Cs-137	0.992	5.32E-02	1.26E-02	
	Tl-208	0.980	1.06E-01	1.87E-02	
X	Bi-211	0.933			
	Pb-212	0.999	3.07E-01	4.36E-02	
	Bi-214	1.000	2.82E-01	4.06E-02	
	Pb-214	0.995	2.76E-01	3.46E-02	
?	Ra-226	0.995	8.08E-01	2.54E-01	
	Ac-228	0.988	3.49E-01	4.69E-02	
?	U-235	0.989	5.14E-02	1.62E-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 11-Dec-19-10008

L1-10214E-FSGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:05:05AM
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	4.65E-02	3.75E-02	3.75E-02
	BE-7	477.60		10.44	2.64E-01	4.54E-01	4.54E-01
+	K-40	1460.82	*	10.66	8.27E+00	6.80E-01	6.80E-01
	Mn-54	834.85		99.98	6.55E-02	6.63E-02	6.63E-02
	Co-60	1173.23		99.85	2.76E-02	6.04E-02	6.44E-02
		1332.49		99.98	5.30E-03		6.04E-02
	Nb-94	702.65		99.81	1.05E-02	4.76E-02	4.76E-02
		871.09		99.89	6.93E-05		5.70E-02
	Ag-108m	79.13		6.60	8.23E-01	4.89E-02	1.76E+00
		433.94		90.50	1.73E-02		4.89E-02
		614.28		89.80	-6.57E-03		8.77E-02
		722.94		90.80	6.57E-02		6.88E-02
	Sb-125	176.31		6.84	3.27E-01	1.25E-01	5.80E-01
		380.45		1.52	-1.18E+00		2.64E+00
		427.87		29.60	-1.68E-01		1.25E-01
		463.36		10.49	3.82E-01		4.52E-01
		600.60		17.65	4.52E-03		2.80E-01
		606.71		4.98	3.11E+00		1.62E+00
		635.95		11.22	-1.93E-01		4.26E-01

Analysis Report for 11-Dec-19-10008

L1-10214E-FSGS-008SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	3.83E-01	1.25E-01	2.67E+00
	Ba-133	79.61		2.65	4.21E-01	8.49E-02	4.19E+00
		81.00		32.90	-4.38E-01		2.71E-01
		276.40		7.16	1.32E-01		6.00E-01
		302.85		18.34	-4.37E-02		2.10E-01
		356.01		62.05	-2.69E-02		8.49E-02
		383.85		8.94	1.54E-01		4.51E-01
	Cs-134	475.36		1.48	8.80E-03	7.05E-02	3.02E+00
		563.25		8.34	1.65E-01		5.57E-01
		569.33		15.37	1.83E-01		3.07E-01
		604.72		97.62	-8.45E-03		7.83E-02
		795.86		85.46	1.52E-02		7.05E-02
		801.95		8.69	5.97E-01		6.70E-01
		1038.61		0.99	1.40E+00		6.00E+00
		1167.97		1.79	2.58E+00		3.83E+00
		1365.19		3.02	-1.30E+00		1.54E+00
+	Cs-137	661.66	*	85.10	5.32E-02	3.08E-02	3.08E-02
	Eu-152	121.78		28.67	-4.78E-02	1.49E-01	1.49E-01
		244.70		7.61	-3.35E-01		5.95E-01
		295.94		0.45	1.30E+01		1.16E+01
		344.28		26.60	3.31E-03		1.50E-01
		367.79		0.86	-1.07E-01		4.68E+00
		411.12		2.24	4.17E-01		1.99E+00
		443.96		2.83	7.48E-01		1.55E+00
		488.68		0.42	1.79E+00		1.02E+01
		563.99		0.49	-1.94E+00		9.27E+00
		586.26		0.46	-4.83E+00		1.51E+01
		678.62		0.47	2.28E+00		1.06E+01
		688.67		0.86	-1.44E+00		6.30E+00
		719.35		0.28	-7.39E+00		1.80E+01
		778.90		12.96	-2.53E-01		4.36E-01
		810.45		0.32	-3.26E+00		1.50E+01
		867.37		4.26	-1.05E+00		1.32E+00
		919.33		0.43	-2.26E+01		1.08E+01
		964.08		14.65	1.30E-01		5.56E-01
		1085.87		10.24	2.78E-01		5.44E-01
		1089.74		1.73	9.01E-01		2.99E+00
		1112.07		13.69	-7.44E-01		4.47E-01
		1212.95		1.43	2.07E+00		5.16E+00
		1249.94		0.19	7.16E+00		3.29E+01
		1299.14		1.63	-2.48E+00		3.44E+00
		1408.01		21.07	5.20E-02		2.68E-01
		1457.64		0.50	1.86E+02		4.75E+01
		1528.10		0.28	1.10E+01		1.79E+01
	Eu-154	123.07		40.40	1.94E-02	1.08E-01	1.08E-01
		247.93		6.89	1.74E-01		5.97E-01
		591.76		4.95	-5.93E-01		9.09E-01
		692.42		1.78	9.49E-01		2.91E+00
		723.30		20.06	2.97E-01		3.12E-01
		756.80		4.52	2.65E-02		1.12E+00
		873.18		12.08	4.75E-01		4.78E-01

Analysis Report for 11-Dec-19-10008

L1-10214E-FSGS-008SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-7.34E-02	1.08E-01	5.35E-01
		1004.76		18.01	1.51E-01		3.27E-01
		1274.43		34.80	2.93E-02		1.95E-01
		1596.48		1.80	-3.95E+00		3.01E+00
	Eu-155	45.30		1.31	-1.58E+01	2.32E-01	2.08E+01
		60.01		1.22	-9.06E+00		2.38E+01
		86.55		30.70	4.41E-02		2.56E-01
		105.31		21.10	7.83E-02		2.32E-01
+	Ra-226	186.21	*	3.64	8.08E-01	7.76E-01	7.76E-01
	Pa-231	27.36		10.30	1.26E+00	1.71E+00	2.54E+00
		283.69		1.70	-2.21E+00		2.22E+00
		300.07		2.47	-4.86E-01		1.71E+00
		302.65		2.20	-1.49E-01		1.77E+00
		330.06		1.40	5.31E-02		3.11E+00
+	U-235	143.76		10.96	2.50E-01	4.94E-02	3.94E-01
		163.33		5.08	-4.20E-02		7.18E-01
		185.71	*	57.20	5.14E-02		4.94E-02
		202.11		1.08	1.78E+00		3.90E+00
		205.31		5.01	-9.49E-01		7.96E-01
	Am-241	59.54		35.90	-9.75E-02	8.38E-01	8.38E-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 11-Dec-19-10009

L1-10214E-FQGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10009
Sample Description	: L1-10214E-FQGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 9.945E+02 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:44:00PM
Acquisition Started	: 12/11/2019 9:07:01AM
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81968
Fill Height	: 994.51 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:22:04AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10009

L1-10214E-FQGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	209.23	833 -	841	837.51	2.38E+01	9.32	2.92E+01	0.69
2	238.59	947 -	961	954.84	1.51E+02	19.71	8.22E+01	1.09
3	294.99	1173 -	1186	1180.18	6.77E+01	12.58	3.23E+01	1.07
4	338.02	1346 -	1358	1352.13	4.89E+01	10.26	2.11E+01	0.62
5	351.73	1399 -	1417	1406.90	1.34E+02	14.98	2.72E+01	0.95
6	583.01	2325 -	2338	2331.36	7.72E+01	10.73	1.38E+01	1.30
7	609.17	2427 -	2444	2435.93	8.99E+01	11.22	1.11E+01	0.40
8	661.71	2641 -	2651	2646.03	1.51E+01	6.62	1.19E+01	0.43
9	910.71	3635 -	3649	3641.89	4.43E+01	8.57	9.68E+00	0.75
10	968.66	3867 -	3880	3873.72	2.85E+01	7.58	1.05E+01	1.48
11	1460.33	5829 -	5852	5841.68	2.76E+02	17.32	6.00E+00	2.04

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	0.96	1460.82	*	10.66	6.83E+00	5.22E-01
Cs-137	0.99	661.66	*	85.10	2.73E-02	1.20E-02
Tl-208	0.99	583.19	*	85.00	1.28E-01	1.93E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.68E-01	4.11E-02
		300.09		3.30		

Analysis Report for 11-Dec-19-10009

L1-10214E-FQGS-008SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	609.32	*	45.49	2.86E-01	3.97E-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	3.20E-01	6.49E-02
		351.93	*	35.60	3.72E-01	5.13E-02
		785.96		1.06		
Ac-228	0.98	129.07		2.42		
		209.25	*	3.89	4.44E-01	1.77E-01
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	4.18E-01	9.41E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.27E-01	6.49E-02
		964.77		4.99		
		968.97	*	15.80	3.58E-01	9.66E-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 11-Dec-19-10009

L1-10214E-FQGS-008SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.962	6.83E+00	5.22E-01	
	Cs-137	0.999	2.73E-02	1.20E-02	
	Tl-208	0.995	1.28E-01	1.93E-02	
X	Bi-211	0.933			
	Pb-212	1.000	2.68E-01	4.11E-02	
	Bi-214	0.998	2.86E-01	3.97E-02	
	Pb-214	0.994	3.52E-01	4.02E-02	
	Ac-228	0.984	3.63E-01	4.52E-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 11-Dec-19-10009

L1-10214E-FQGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:22:04AM
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	7.22E-02	6.12E-02	6.12E-02
	BE-7	477.60		10.44	-8.02E-02	4.94E-01	4.94E-01
+	K-40	1460.82	*	10.66	6.83E+00	4.83E-01	4.83E-01
	Mn-54	834.85		99.98	-7.65E-03	5.76E-02	5.76E-02
	Co-60	1173.23		99.85	5.25E-02	6.38E-02	7.07E-02
		1332.49		99.98	2.63E-02		6.38E-02
	Nb-94	702.65		99.81	2.95E-02	4.96E-02	5.00E-02
		871.09		99.89	-9.99E-03		4.96E-02
	Ag-108m	79.13		6.60	-4.59E-01	4.71E-02	1.83E+00
		433.94		90.50	-3.46E-02		4.71E-02
		614.28		89.80	-8.12E-03		8.52E-02
		722.94		90.80	2.08E-02		6.66E-02
	Sb-125	176.31		6.84	4.44E-01	1.45E-01	5.97E-01
		380.45		1.52	-5.41E-01		2.68E+00
		427.87		29.60	-1.15E-01		1.45E-01
		463.36		10.49	5.50E-02		4.90E-01
		600.60		17.65	-5.09E-02		2.85E-01
		606.71		4.98	2.37E+00		1.64E+00
		635.95		11.22	2.69E-01		4.32E-01

Analysis Report for 11-Dec-19-10009

L1-10214E-FQGS-008SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	7.41E-01	1.45E-01	2.77E+00
	Ba-133	79.61		2.65	2.56E+00	9.74E-02	4.45E+00
		81.00		32.90	-9.18E-01		2.87E-01
		276.40		7.16	-1.04E-01		5.89E-01
		302.85		18.34	1.11E-01		2.09E-01
		356.01		62.05	3.35E-02		9.74E-02
		383.85		8.94	-5.11E-01		4.50E-01
	Cs-134	475.36		1.48	-3.17E-01	6.91E-02	3.29E+00
		563.25		8.34	6.38E-02		5.35E-01
		569.33		15.37	2.05E-01		3.25E-01
		604.72		97.62	-2.23E-02		8.10E-02
		795.86		85.46	-5.60E-03		6.91E-02
		801.95		8.69	-3.31E-01		6.36E-01
		1038.61		0.99	3.42E+00		6.04E+00
		1167.97		1.79	-7.51E-01		3.88E+00
		1365.19		3.02	1.46E-01		1.84E+00
+	Cs-137	661.66	*	85.10	2.73E-02	3.79E-02	3.79E-02
	Eu-152	121.78		28.67	4.38E-03	1.48E-01	1.48E-01
		244.70		7.61	3.54E-01		6.09E-01
		295.94		0.45	1.32E+01		1.21E+01
		344.28		26.60	-5.35E-02		1.51E-01
		367.79		0.86	-3.39E+00		4.72E+00
		411.12		2.24	1.57E+00		2.07E+00
		443.96		2.83	-9.39E-01		1.39E+00
		488.68		0.42	1.79E-01		9.97E+00
		563.99		0.49	-2.08E+00		9.09E+00
		586.26		0.46	1.93E+01		1.66E+01
		678.62		0.47	1.49E+00		1.07E+01
		688.67		0.86	2.03E+00		5.73E+00
		719.35		0.28	8.34E+00		2.14E+01
		778.90		12.96	-2.81E-01		3.61E-01
		810.45		0.32	-1.03E+01		1.69E+01
		867.37		4.26	-3.63E-01		1.24E+00
		919.33		0.43	2.09E+00		1.16E+01
		964.08		14.65	2.58E-01		5.93E-01
		1085.87		10.24	-7.76E-03		5.82E-01
		1089.74		1.73	-1.12E+00		3.28E+00
		1112.07		13.69	-2.86E-01		4.71E-01
		1212.95		1.43	1.28E+00		5.50E+00
		1249.94		0.19	1.23E+01		3.90E+01
		1299.14		1.63	4.02E+00		4.14E+00
		1408.01		21.07	-1.56E-01		2.10E-01
		1457.64		0.50	1.40E+02		4.47E+01
		1528.10		0.28	-1.44E+01		1.67E+01
	Eu-154	123.07		40.40	-2.60E-02	1.05E-01	1.05E-01
		247.93		6.89	-1.10E-03		5.44E-01
		591.76		4.95	3.39E-01		1.03E+00
		692.42		1.78	-1.04E+00		2.55E+00
		723.30		20.06	9.48E-02		3.01E-01
		756.80		4.52	3.08E-01		1.13E+00
		873.18		12.08	-7.65E-03		4.04E-01

Analysis Report for 11-Dec-19-10009

L1-10214E-FQGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.53E-01	1.05E-01	5.88E-01
	1004.76	18.01	2.83E-02		3.20E-01
	1274.43	34.80	-4.02E-02		1.78E-01
	1596.48	1.80	6.29E-01		1.96E+00
Eu-155	45.30	1.31	1.13E+00	2.48E-01	2.26E+01
	60.01	1.22	-1.15E+01		2.28E+01
	86.55	30.70	3.14E-03		2.78E-01
	105.31	21.10	-6.34E-02		2.48E-01
Ra-226	186.21	3.64	5.32E-01	1.21E+00	1.21E+00
Pa-231	27.36	10.30	3.53E-01	1.65E+00	2.20E+00
	283.69	1.70	-2.96E+00		2.22E+00
	300.07	2.47	-3.72E-01		1.65E+00
	302.65	2.20	1.27E+00		1.74E+00
	330.06	1.40	-8.60E-01		2.93E+00
U-235	143.76	10.96	2.88E-01	7.71E-02	3.86E-01
	163.33	5.08	1.90E-01		8.27E-01
	185.71	57.20	2.83E-02		7.71E-02
	202.11	1.08	1.33E+00		3.65E+00
	205.31	5.01	-2.24E-01		7.37E-01
Am-241	59.54	35.90	-2.76E-01	8.13E-01	8.13E-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 11-Dec-19-10010

L1-10214E-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10010
Sample Description	: L1-10214E-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.123E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:46:00PM
Acquisition Started	: 12/11/2019 9:05:40AM
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81965
Fill Height	: 1123.29 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:20:42AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10010

L1-10214E-FSGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	473 -	481	477.47	1.32E+02	20.64	1.36E+02	1.12
2	351.86	698 -	708	703.66	1.13E+02	14.60	4.16E+01	1.27
3	583.18	1162 -	1171	1165.97	4.49E+01	10.58	2.91E+01	1.21
4	609.36	1212 -	1221	1218.29	7.60E+01	10.79	1.80E+01	1.13
5	661.47	1319 -	1328	1322.48	1.45E+01	8.04	2.15E+01	0.98
6	846.85	1688 -	1697	1693.15	1.35E+01	5.51	7.50E+00	0.76
7	911.11	1817 -	1826	1821.67	5.90E+01	9.64	1.50E+01	1.79
8	1460.76	2914 -	2929	2921.58	3.47E+02	19.24	7.73E+00	1.95

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	7.29E+00	5.13E-01
Cs-137	0.99	661.66	*	85.10	2.23E-02	1.25E-02
Tl-208	1.00	583.19	*	85.00	6.37E-02	1.55E-02
Bi-211	0.90	351.07	*	13.02	7.40E-01	1.12E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.00E-01	3.53E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.07E-01	3.19E-02
		768.36		4.89		

Analysis Report for 11-Dec-19-10010

L1-10214E-FSGS-009SS

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	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.71E-01	4.10E-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	3.72E-01	6.28E-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 11-Dec-19-10010

L1-10214E-FSGS-009SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	7.29E+00	5.13E-01	
	Cs-137	0.995	2.23E-02	1.25E-02	
	Tl-208	1.000	6.37E-02	1.55E-02	
?	Bi-211	0.905	7.40E-01	1.12E-01	
	Pb-212	1.000	2.00E-01	3.53E-02	
	Bi-214	1.000	2.07E-01	3.19E-02	
?	Pb-214	0.513	2.71E-01	4.10E-02	
	Ac-228	1.000	3.72E-01	6.28E-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 11-Dec-19-10010

L1-10214E-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:20:42AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
6	846.85	1.50000E-02	40.84		

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	6.04E-02	5.58E-02	5.58E-02
	BE-7	477.60		10.44	2.39E-01	3.57E-01	3.57E-01
+	K-40	1460.82	*	10.66	7.29E+00	4.00E-01	4.00E-01
	Mn-54	834.85		99.98	1.52E-02	4.86E-02	4.86E-02
	Co-60	1173.23		99.85	6.72E-03	5.61E-02	5.77E-02
		1332.49		99.98	3.35E-02		5.61E-02
	Nb-94	702.65		99.81	8.21E-03	3.66E-02	3.67E-02
		871.09		99.89	-9.07E-03		3.66E-02
	Ag-108m	79.13		6.60	1.17E-01	3.85E-02	1.17E+00
		433.94		90.50	-1.16E-03		3.85E-02
		614.28		89.80	-1.29E-01		5.77E-02
		722.94		90.80	-3.90E-03		5.43E-02
	Sb-125	176.31		6.84	-1.58E-02	1.14E-01	4.95E-01
		380.45		1.52	-1.17E-01		2.32E+00
		427.87		29.60	2.53E-03		1.14E-01
		463.36		10.49	1.34E-01		3.77E-01
		600.60		17.65	8.95E-03		2.18E-01
		606.71		4.98	1.85E+00		1.33E+00

Analysis Report for 11-Dec-19-10010

L1-10214E-FSGS-009SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	635.95		11.22	1.35E-01	1.14E-01	3.46E-01
		671.44		1.79	-6.65E-01		1.99E+00
	Ba-133	79.61		2.65	7.63E-01	7.41E-02	2.84E+00
		81.00		32.90	-1.98E-01		1.93E-01
		276.40		7.16	-5.84E-03		4.65E-01
		302.85		18.34	-1.45E-02		1.79E-01
		356.01		62.05	-2.97E-02		7.41E-02
		383.85		8.94	3.17E-02		3.99E-01
	Cs-134	475.36		1.48	-6.30E-01	5.29E-02	2.25E+00
		563.25		8.34	-1.42E-01		4.30E-01
		569.33		15.37	-7.10E-04		2.50E-01
		604.72		97.62	-1.12E-02		5.96E-02
		795.86		85.46	1.73E-02		5.29E-02
		801.95		8.69	-1.91E-01		4.18E-01
		1038.61		0.99	-1.07E+00		4.36E+00
		1167.97		1.79	7.48E-01		3.12E+00
		1365.19		3.02	7.39E-01		1.68E+00
+	Cs-137	661.66	*	85.10	2.23E-02	4.14E-02	4.14E-02
	Eu-152	121.78		28.67	-2.60E-02	1.19E-01	1.19E-01
		244.70		7.61	-2.10E-01		4.80E-01
		295.94		0.45	9.59E+00		1.02E+01
		344.28		26.60	-1.79E-01		1.27E-01
		367.79		0.86	-1.88E+00		3.46E+00
		411.12		2.24	3.48E-01		1.66E+00
		443.96		2.83	-1.05E+00		9.98E-01
		488.68		0.42	-1.21E+00		8.34E+00
		563.99		0.49	-1.24E+00		7.59E+00
		586.26		0.46	-6.49E-01		1.26E+01
		678.62		0.47	1.01E+00		7.73E+00
		688.67		0.86	-1.12E+00		4.14E+00
		719.35		0.28	5.51E+00		1.55E+01
		778.90		12.96	3.11E-02		3.19E-01
		810.45		0.32	-6.53E+00		1.06E+01
		867.37		4.26	3.09E-01		9.36E-01
		919.33		0.43	-6.02E+00		9.50E+00
		964.08		14.65	-1.48E-01		3.87E-01
		1085.87		10.24	-2.89E-01		4.70E-01
		1089.74		1.73	5.24E-01		2.84E+00
		1112.07		13.69	1.29E-01		4.55E-01
		1212.95		1.43	5.89E-01		4.01E+00
		1249.94		0.19	-5.87E+00		2.89E+01
		1299.14		1.63	1.29E+00		3.63E+00
		1408.01		21.07	1.65E-01		2.28E-01
		1457.64		0.50	-1.36E+00		4.16E+01
		1528.10		0.28	1.44E+00		1.35E+01
	Eu-154	123.07		40.40	-1.08E-02	8.48E-02	8.48E-02
		247.93		6.89	-1.93E-02		4.66E-01
		591.76		4.95	1.63E-02		7.58E-01
		692.42		1.78	-2.66E-01		2.01E+00
		723.30		20.06	1.70E-02		2.51E-01
		756.80		4.52	6.10E-01		1.12E+00

Analysis Report for 11-Dec-19-10010

L1-10214E-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	6.57E-02	8.48E-02	3.11E-01
	996.29	10.48	-1.02E-01		4.09E-01
	1004.76	18.01	2.13E-02		2.72E-01
	1274.43	34.80	-6.71E-02		1.48E-01
	1596.48	1.80	-1.25E+00		1.95E+00
Eu-155	45.30	1.31	-2.81E+00	1.74E-01	1.17E+01
	60.01	1.22	-8.61E+00		1.15E+01
	86.55	30.70	4.75E-03		1.85E-01
	105.31	21.10	-2.40E-02		1.74E-01
Ra-226	186.21	3.64	9.44E-01	1.11E+00	1.11E+00
Pa-231	27.36	10.30	4.21E-01	1.05E+00	1.05E+00
	283.69	1.70	-9.97E-01		1.77E+00
	300.07	2.47	-1.96E+00		1.39E+00
	302.65	2.20	-1.21E-01		1.49E+00
	330.06	1.40	1.99E-01		2.62E+00
U-235	143.76	10.96	-5.63E-02	7.04E-02	3.05E-01
	163.33	5.08	3.39E-01		7.61E-01
	185.71	57.20	6.08E-02		7.04E-02
	202.11	1.08	7.77E-01		3.38E+00
	205.31	5.01	-3.73E-02		7.10E-01
Am-241	59.54	35.90	-3.03E-01	4.05E-01	4.05E-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 11-Dec-19-10011

L1-10214E-FSGS-010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10011
Sample Description	: L1-10214E-FSGS-010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.655E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:48:00PM
Acquisition Started	: 12/11/2019 9:06:18AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.9 seconds
Dead Time	: 0.10 %
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81966
Fill Height	: 1654.73 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:21:22AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10011

L1-10214E-FSGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	948 -	960	954.70	7.97E+01	13.87	4.23E+01	1.08
2	351.89	1402 -	1413	1407.28	2.00E+01	7.60	1.50E+01	0.92
3	609.43	2432 -	2443	2436.88	3.01E+01	6.75	5.90E+00	0.52
4	911.30	3639 -	3650	3644.14	1.85E+01	5.69	5.54E+00	0.61
5	1460.77	5834 -	5853	5842.91	1.11E+02	10.88	2.30E+00	1.42

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	2.70E+00	2.90E-01
Bi-211	0.89	351.07	*	13.02	1.51E-01	5.85E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.41E-01	2.70E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	9.50E-02	2.21E-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 11-Dec-19-10011

L1-10214E-FSGS-010SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	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		
		351.93	*	35.60	5.51E-02	2.14E-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	1.35E-01	4.20E-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

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

Analysis Report for 11-Dec-19-10011

L1-10214E-FSGS-010SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	2.70E+00	2.90E-01	
?	Bi-211	0.899	1.51E-01	5.85E-02	
	Pb-212	1.000	1.41E-01	2.70E-02	
	Bi-214	0.999	9.50E-02	2.21E-02	
?	Pb-214	1.000	5.51E-02	2.14E-02	
	Ac-228	1.000	1.35E-01	4.20E-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 11-Dec-19-10011

L1-10214E-FSGS-010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:21:22AM
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	4.57E-02	5.11E-02	5.11E-02
	BE-7	477.60		10.44	-4.74E-02	3.68E-01	3.68E-01
+	K-40	1460.82	*	10.66	2.70E+00	2.99E-01	2.99E-01
	Mn-54	834.85		99.98	-3.57E-02	3.81E-02	3.81E-02
	Co-60	1173.23		99.85	1.67E-03	3.55E-02	4.50E-02
		1332.49		99.98	1.46E-02		3.55E-02
	Nb-94	702.65		99.81	-9.27E-03	3.40E-02	3.40E-02
		871.09		99.89	2.01E-02		4.03E-02
	Ag-108m	79.13		6.60	6.95E-01	3.61E-02	1.46E+00
		433.94		90.50	-1.26E-02		3.61E-02
		614.28		89.80	-5.11E-03		5.09E-02
		722.94		90.80	4.08E-02		4.59E-02
	Sb-125	176.31		6.84	1.08E-01	1.21E-01	4.49E-01
		380.45		1.52	-2.76E-01		2.27E+00
		427.87		29.60	2.20E-02		1.21E-01
		463.36		10.49	-3.17E-02		3.64E-01
		600.60		17.65	-1.92E-01		2.00E-01
		606.71		4.98	7.41E-01		1.11E+00
		635.95		11.22	-9.92E-02		3.14E-01

Analysis Report for 11-Dec-19-10011

L1-10214E-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.65E+00	1.21E-01	1.48E+00
Ba-133	79.61	2.65	1.82E+00	5.82E-02	3.49E+00
	81.00	32.90	-2.34E-01		2.31E-01
	276.40	7.16	1.24E-01		4.49E-01
	302.85	18.34	6.67E-02		1.64E-01
	356.01	62.05	1.42E-02		5.82E-02
	383.85	8.94	5.30E-02		3.97E-01
Cs-134	475.36	1.48	-1.59E-01	4.56E-02	2.46E+00
	563.25	8.34	2.81E-01		4.39E-01
	569.33	15.37	-2.47E-01		1.86E-01
	604.72	97.62	-1.35E-02		5.49E-02
	795.86	85.46	1.61E-02		4.56E-02
	801.95	8.69	-4.10E-01		3.74E-01
	1038.61	0.99	-5.01E-01		4.59E+00
	1167.97	1.79	-1.43E+00		2.51E+00
	1365.19	3.02	-8.33E-01		1.41E+00
Cs-137	661.66	85.10	1.06E-02	3.72E-02	3.72E-02
Eu-152	121.78	28.67	2.89E-02	1.15E-01	1.38E-01
	244.70	7.61	-1.39E-01		4.64E-01
	295.94	0.45	3.44E-01		8.28E+00
	344.28	26.60	2.45E-03		1.15E-01
	367.79	0.86	6.44E-01		3.77E+00
	411.12	2.24	2.80E-01		1.29E+00
	443.96	2.83	-1.57E-01		1.12E+00
	488.68	0.42	-4.28E+00		6.31E+00
	563.99	0.49	-2.61E+00		7.04E+00
	586.26	0.46	4.26E+00		1.13E+01
	678.62	0.47	-5.37E-01		7.60E+00
	688.67	0.86	3.58E+00		4.79E+00
	719.35	0.28	-1.94E+00		1.27E+01
	778.90	12.96	2.92E-02		2.96E-01
	810.45	0.32	-6.95E+00		1.09E+01
	867.37	4.26	-1.47E+00		9.17E-01
	919.33	0.43	-1.06E+00		9.23E+00
	964.08	14.65	2.21E-01		3.96E-01
	1085.87	10.24	1.71E-01		4.31E-01
	1089.74	1.73	6.66E-01		2.22E+00
	1112.07	13.69	8.25E-02		3.56E-01
	1212.95	1.43	2.36E-01		2.88E+00
	1249.94	0.19	-1.36E+00		2.56E+01
	1299.14	1.63	-1.14E+00		2.00E+00
	1408.01	21.07	-1.70E-02		1.76E-01
	1457.64	0.50	6.00E+01		2.86E+01
	1528.10	0.28	1.91E+00		9.23E+00
Eu-154	123.07	40.40	-7.43E-03	9.38E-02	9.38E-02
	247.93	6.89	-3.53E-01		4.72E-01
	591.76	4.95	2.16E-01		7.78E-01
	692.42	1.78	1.39E+00		2.14E+00
	723.30	20.06	1.38E-01		2.04E-01
	756.80	4.52	7.72E-01		9.14E-01
	873.18	12.08	1.78E-01		3.43E-01

Analysis Report for 11-Dec-19-10011

L1-10214E-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.23E-01	9.38E-02	3.30E-01
	1004.76	18.01	-8.26E-02		2.10E-01
	1274.43	34.80	-1.32E-02		1.49E-01
	1596.48	1.80	4.99E-01		2.55E+00
Eu-155	45.30	1.31	1.37E+01	2.23E-01	2.60E+01
	60.01	1.22	8.54E+00		2.68E+01
	86.55	30.70	1.22E-01		2.33E-01
	105.31	21.10	-6.42E-02		2.23E-01
Ra-226	186.21	3.64	3.59E-01	9.33E-01	9.33E-01
Pa-231	27.36	10.30	2.06E+00	1.25E+00	2.83E+00
	283.69	1.70	2.30E-01		1.94E+00
	300.07	2.47	-3.51E-02		1.25E+00
	302.65	2.20	2.56E-01		1.36E+00
	330.06	1.40	-8.66E-02		2.26E+00
U-235	143.76	10.96	1.69E-02	5.90E-02	3.33E-01
	163.33	5.08	2.52E-01		6.71E-01
	185.71	57.20	1.80E-02		5.90E-02
	202.11	1.08	-6.61E-02		3.02E+00
	205.31	5.01	-8.98E-01		6.21E-01
Am-241	59.54	35.90	-1.60E-01	9.15E-01	9.15E-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 11-Dec-19-10012

L1-10214E-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10012
Sample Description	: L1-10214E-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.736E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:50:00PM
Acquisition Started	: 12/11/2019 9:06:36AM
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81967
Fill Height	: 1736.06 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:21:39AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10012

L1-10214E-FSGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.85	948 -	961	954.96	7.40E+01	13.77	4.20E+01	0.85
2	352.11	1401 -	1413	1407.46	3.97E+01	7.89	8.28E+00	0.44
3	1460.04	5829 -	5848	5838.08	1.24E+02	11.90	5.00E+00	1.10

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	2.69E+00	2.83E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.15E-01	2.34E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	9.78E-02	2.09E-02
		785.96		1.06		

Analysis Report for 11-Dec-19-10012

L1-10214E-FSGS-011SS

* = 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	0.906	2.69E+00	2.83E-01	
Pb-212	0.993	1.15E-01	2.34E-02	
Pb-214	0.997	9.78E-02	2.09E-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 11-Dec-19-10012

L1-10214E-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:21:39AM
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	3.88E-02	4.60E-02	4.60E-02
	BE-7	477.60		10.44	-2.63E-03	2.87E-01	2.87E-01
+	K-40	1460.82	*	10.66	2.69E+00	3.71E-01	3.71E-01
	Mn-54	834.85		99.98	1.90E-02	3.60E-02	3.60E-02
	Co-60	1173.23		99.85	-4.05E-02	3.36E-02	4.27E-02
		1332.49		99.98	2.16E-03		3.36E-02
	Nb-94	702.65		99.81	1.98E-03	3.40E-02	3.44E-02
		871.09		99.89	1.38E-02		3.40E-02
	Ag-108m	79.13		6.60	9.32E-01	3.37E-02	9.27E-01
		433.94		90.50	-7.28E-03		3.37E-02
		614.28		89.80	-4.27E-02		4.31E-02
		722.94		90.80	2.18E-02		4.18E-02
	Sb-125	176.31		6.84	-2.15E-01	9.91E-02	3.12E-01
		380.45		1.52	-1.19E-01		1.64E+00
		427.87		29.60	4.25E-02		9.91E-02
		463.36		10.49	-8.30E-02		2.67E-01
		600.60		17.65	-1.08E-01		1.83E-01
		606.71		4.98	1.08E+00		1.01E+00
		635.95		11.22	1.30E-01		2.21E-01

Analysis Report for 11-Dec-19-10012

L1-10214E-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.08E+00	9.91E-02	1.54E+00
Ba-133	79.61	2.65	1.77E+00	5.09E-02	2.22E+00
	81.00	32.90	-2.91E-01		1.22E-01
	276.40	7.16	-3.46E-02		3.43E-01
	302.85	18.34	6.31E-02		1.52E-01
	356.01	62.05	-2.34E-02		5.09E-02
	383.85	8.94	1.85E-01		2.85E-01
Cs-134	475.36	1.48	4.36E-01	4.17E-02	2.10E+00
	563.25	8.34	-3.27E-01		4.06E-01
	569.33	15.37	-5.38E-02		1.98E-01
	604.72	97.62	-1.52E-02		4.64E-02
	795.86	85.46	-3.12E-02		4.17E-02
	801.95	8.69	-8.44E-02		4.03E-01
	1038.61	0.99	-8.70E-01		3.05E+00
	1167.97	1.79	-1.43E+00		2.44E+00
	1365.19	3.02	7.06E-02		1.20E+00
Cs-137	661.66	85.10	2.42E-02	4.13E-02	4.13E-02
Eu-152	121.78	28.67	-7.70E-03	8.99E-02	8.99E-02
	244.70	7.61	-1.34E-01		3.43E-01
	295.94	0.45	-1.69E+00		6.71E+00
	344.28	26.60	-1.29E-02		9.60E-02
	367.79	0.86	-2.15E+00		2.77E+00
	411.12	2.24	9.70E-02		1.28E+00
	443.96	2.83	1.02E-01		9.80E-01
	488.68	0.42	2.69E+00		6.25E+00
	563.99	0.49	-1.02E+01		5.90E+00
	586.26	0.46	9.72E+00		9.53E+00
	678.62	0.47	1.72E+00		6.27E+00
	688.67	0.86	-4.13E+00		3.58E+00
	719.35	0.28	1.80E+00		1.22E+01
	778.90	12.96	5.55E-02		2.50E-01
	810.45	0.32	4.42E+00		1.04E+01
	867.37	4.26	2.62E-01		7.44E-01
	919.33	0.43	3.46E+00		9.63E+00
	964.08	14.65	2.11E-02		3.09E-01
	1085.87	10.24	1.40E-01		3.96E-01
	1089.74	1.73	-1.84E-01		2.28E+00
	1112.07	13.69	-5.90E-02		2.83E-01
	1212.95	1.43	5.34E-01		3.14E+00
	1249.94	0.19	-1.69E+01		1.89E+01
	1299.14	1.63	8.07E-01		2.96E+00
	1408.01	21.07	-4.06E-02		1.45E-01
	1457.64	0.50	5.97E+01		2.68E+01
	1528.10	0.28	5.95E+00		1.32E+01
Eu-154	123.07	40.40	2.47E-02	6.82E-02	6.82E-02
	247.93	6.89	-1.17E-01		3.43E-01
	591.76	4.95	4.87E-01		6.71E-01
	692.42	1.78	-1.02E+00		1.74E+00
	723.30	20.06	1.37E-01		1.93E-01
	756.80	4.52	5.44E-01		7.99E-01
	873.18	12.08	6.42E-02		2.98E-01

Analysis Report for 11-Dec-19-10012

L1-10214E-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	6.86E-02	6.82E-02	3.08E-01
	1004.76	18.01	6.35E-02		1.87E-01
	1274.43	34.80	7.17E-02		1.36E-01
	1596.48	1.80	2.33E-01		2.27E+00
Eu-155	45.30	1.31	-5.60E+00	1.30E-01	9.10E+00
	60.01	1.22	3.60E+00		1.03E+01
	86.55	30.70	7.56E-03		1.30E-01
	105.31	21.10	2.12E-03		1.39E-01
Ra-226	186.21	3.64	1.85E-01	7.37E-01	7.37E-01
Pa-231	27.36	10.30	3.91E-02	9.17E-01	9.17E-01
	283.69	1.70	-8.35E-01		1.42E+00
	300.07	2.47	-1.06E+00		1.12E+00
	302.65	2.20	4.57E-01		1.28E+00
	330.06	1.40	-9.12E-01		1.95E+00
U-235	143.76	10.96	-1.39E-01	4.66E-02	2.20E-01
	163.33	5.08	1.80E-01		4.40E-01
	185.71	57.20	2.27E-02		4.66E-02
	202.11	1.08	1.59E-01		2.29E+00
	205.31	5.01	-1.39E-01		5.17E-01
Am-241	59.54	35.90	8.31E-03	3.57E-01	3.57E-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 11-Dec-19-10013

L1-10214E-FSGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10013
Sample Description	: L1-10214E-FSGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.108E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:52:00PM
Acquisition Started	: 12/11/2019 9:26:35AM
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81974
Fill Height	: 1107.68 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:41:38AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10013

L1-10214E-FSGS-012SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.66	473 -	481	477.51	1.45E+02	20.23	1.20E+02	1.34
2	295.28	585 -	595	590.62	6.04E+01	14.31	6.06E+01	1.24
3	351.95	699 -	708	703.84	1.02E+02	13.68	3.76E+01	1.27
4	583.20	1162 -	1171	1166.00	8.19E+01	10.76	1.51E+01	1.73
5	609.37	1214 -	1224	1218.31	9.59E+01	11.57	1.61E+01	1.53
6	911.31	1816 -	1828	1822.06	5.49E+01	9.11	1.01E+01	0.74
7	1460.70	2914 -	2929	2921.46	3.04E+02	17.44	0.00E+00	1.96
8	1764.42	3525 -	3533	3529.70	1.59E+01	4.27	1.09E+00	1.23

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	6.42E+00	4.62E-01
Tl-208	1.00	583.19	*	85.00	1.17E-01	1.69E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.22E-01	3.57E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.63E-01	3.54E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 11-Dec-19-10013

L1-10214E-FSGS-012SS

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	2.71E-01	7.35E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.47E-01	6.17E-02
		351.93	*	35.60	2.46E-01	3.83E-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	3.48E-01	5.96E-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 11-Dec-19-10013

L1-10214E-FSGS-012SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	6.42E+00	4.62E-01	
	Tl-208	1.000	1.17E-01	1.69E-02	
X	Bi-211	0.885			
	Pb-212	1.000	2.22E-01	3.57E-02	
	Bi-214	1.000	2.64E-01	3.19E-02	
	Pb-214	1.000	2.46E-01	3.25E-02	
	Ac-228	0.999	3.48E-01	5.96E-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 11-Dec-19-10013

L1-10214E-FSGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:41:38AM
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	8.09E-02	5.80E-02	5.80E-02
	BE-7	477.60		10.44	1.35E-01	3.44E-01	3.44E-01
+	K-40	1460.82	*	10.66	6.42E+00	6.08E-02	6.08E-02
	Mn-54	834.85		99.98	3.73E-03	4.50E-02	4.50E-02
	Co-60	1173.23		99.85	-2.99E-02	3.49E-02	3.49E-02
		1332.49		99.98	3.26E-03		4.51E-02
	Nb-94	702.65		99.81	2.07E-02	3.95E-02	3.95E-02
		871.09		99.89	8.07E-03		4.02E-02
	Ag-108m	79.13		6.60	7.96E-01	4.27E-02	1.23E+00
		433.94		90.50	1.95E-02		4.27E-02
		614.28		89.80	-1.53E-02		6.20E-02
		722.94		90.80	-1.87E-02		4.88E-02
	Sb-125	176.31		6.84	-2.70E-01	1.16E-01	5.03E-01
		380.45		1.52	-6.07E-01		2.11E+00
		427.87		29.60	-7.01E-02		1.16E-01
		463.36		10.49	2.32E-01		3.98E-01
		600.60		17.65	-1.09E-01		2.10E-01
		606.71		4.98	-6.23E-01		1.41E+00
		635.95		11.22	-4.72E-02		3.48E-01

Analysis Report for 11-Dec-19-10013

L1-10214E-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.06E-02	1.16E-01	2.10E+00
Ba-133	79.61	2.65	4.99E-01	7.85E-02	2.85E+00
	81.00	32.90	-3.28E-01		1.78E-01
	276.40	7.16	5.54E-04		4.44E-01
	302.85	18.34	1.76E-02		1.72E-01
	356.01	62.05	-2.03E-02		7.85E-02
	383.85	8.94	8.83E-03		3.78E-01
Cs-134	475.36	1.48	3.15E-01	5.96E-02	2.37E+00
	563.25	8.34	-7.10E-03		4.82E-01
	569.33	15.37	1.33E-02		2.63E-01
	604.72	97.62	-4.44E-02		5.96E-02
	795.86	85.46	3.35E-02		6.12E-02
	801.95	8.69	-8.06E-02		5.03E-01
	1038.61	0.99	-1.97E+00		5.09E+00
	1167.97	1.79	1.50E+00		2.89E+00
	1365.19	3.02	1.88E-02		1.57E+00
Cs-137	661.66	85.10	6.97E-03	5.43E-02	5.43E-02
Eu-152	121.78	28.67	1.59E-02	1.17E-01	1.17E-01
	244.70	7.61	-1.69E-01		5.16E-01
	295.94	0.45	1.68E-02		9.90E+00
	344.28	26.60	-5.51E-02		1.23E-01
	367.79	0.86	-4.60E-01		3.93E+00
	411.12	2.24	7.24E-01		1.78E+00
	443.96	2.83	3.01E-01		1.15E+00
	488.68	0.42	-8.47E-01		8.77E+00
	563.99	0.49	1.30E+00		8.37E+00
	586.26	0.46	-3.76E+00		1.41E+01
	678.62	0.47	1.78E+00		8.28E+00
	688.67	0.86	-1.67E+00		4.24E+00
	719.35	0.28	4.01E+00		1.54E+01
	778.90	12.96	-1.89E-01		2.57E-01
	810.45	0.32	5.34E-01		1.19E+01
	867.37	4.26	4.82E-02		9.96E-01
	919.33	0.43	1.65E+00		1.03E+01
	964.08	14.65	4.92E-02		4.23E-01
	1085.87	10.24	1.80E-01		5.06E-01
	1089.74	1.73	-2.60E-01		2.96E+00
	1112.07	13.69	-6.16E-02		3.31E-01
	1212.95	1.43	-4.26E+00		3.65E+00
	1249.94	0.19	2.11E+01		3.54E+01
	1299.14	1.63	-6.35E-02		3.16E+00
	1408.01	21.07	-1.34E-01		2.10E-01
	1457.64	0.50	-1.90E+00		3.88E+01
	1528.10	0.28	6.80E+00		1.55E+01
Eu-154	123.07	40.40	1.35E-02	8.29E-02	8.29E-02
	247.93	6.89	1.44E-01		5.20E-01
	591.76	4.95	1.29E-01		7.92E-01
	692.42	1.78	1.03E+00		2.20E+00
	723.30	20.06	2.62E-02		2.34E-01
	756.80	4.52	3.13E-01		8.72E-01
	873.18	12.08	-1.56E-01		3.12E-01

Analysis Report for 11-Dec-19-10013

L1-10214E-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.05E-01	8.29E-02	5.24E-01
	1004.76	18.01	-1.29E-02		2.69E-01
	1274.43	34.80	-4.22E-02		1.36E-01
	1596.48	1.80	2.35E-01		2.21E+00
Eu-155	45.30	1.31	5.53E+00	1.87E-01	1.23E+01
	60.01	1.22	5.53E-01		1.28E+01
	86.55	30.70	6.77E-02		1.87E-01
	105.31	21.10	8.14E-02		1.95E-01
Ra-226	186.21	3.64	1.07E+00	1.13E+00	1.13E+00
Pa-231	27.36	10.30	1.35E-01	1.05E+00	1.05E+00
	283.69	1.70	8.33E-01		1.99E+00
	300.07	2.47	2.41E-02		1.36E+00
	302.65	2.20	1.47E-01		1.44E+00
	330.06	1.40	7.82E-03		2.70E+00
U-235	143.76	10.96	-5.01E-02	7.11E-02	2.88E-01
	163.33	5.08	-2.29E-01		6.67E-01
	185.71	57.20	5.37E-02		7.11E-02
	202.11	1.08	-1.32E+00		3.13E+00
	205.31	5.01	-5.18E-01		6.82E-01
Am-241	59.54	35.90	1.13E-01	4.49E-01	4.49E-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 11-Dec-19-10014

L1-10214E-FSGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10014
Sample Description	: L1-10214E-FSGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.618E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:54:00PM
Acquisition Started	: 12/11/2019 9:27:07AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.9 seconds
Dead Time	: 0.10 %
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81975
Fill Height	: 1618.08 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:42:11AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10014

L1-10214E-FSGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.64	947 -	960	954.67	6.52E+01	13.04	3.78E+01	1.23
2	338.36	1349 -	1357	1353.23	2.07E+01	6.84	1.13E+01	0.81
3	351.72	1402 -	1413	1406.61	4.58E+01	8.90	1.32E+01	1.49
4	583.18	2326 -	2338	2331.92	3.80E+01	8.06	1.00E+01	1.36
5	911.13	3639 -	3649	3643.49	2.34E+01	5.68	3.58E+00	0.77
6	1460.85	5834 -	5853	5843.22	1.26E+02	11.55	2.30E+00	1.73

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	3.08E+00	3.13E-01
Tl-208	1.00	583.19	*	85.00	6.26E-02	1.38E-02
Bi-211	0.93	351.07	*	13.02	3.46E-01	7.29E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.15E-01	2.49E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.27E-01	2.66E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		

Analysis Report for 11-Dec-19-10014

L1-10214E-FSGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Ac-228	1.00	209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.76E-01	5.99E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.72E-01	4.23E-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
	K-40	1.000	3.08E+00	3.13E-01	
	Tl-208	1.000	6.26E-02	1.38E-02	
?	Bi-211	0.935	3.46E-01	7.29E-02	
	Pb-212	1.000	1.15E-01	2.49E-02	
?	Pb-214	0.996	1.27E-01	2.66E-02	
	Ac-228	1.000	1.73E-01	3.46E-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 11-Dec-19-10014

L1-10214E-FSGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:42:11AM
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	5.37E-02	5.14E-02	5.14E-02
	BE-7	477.60		10.44	-2.59E-02	3.12E-01	3.12E-01
+	K-40	1460.82	*	10.66	3.08E+00	3.01E-01	3.01E-01
	Mn-54	834.85		99.98	-8.04E-03	3.94E-02	3.94E-02
	Co-60	1173.23		99.85	2.25E-02	4.05E-02	4.05E-02
		1332.49		99.98	9.09E-03		4.58E-02
	Nb-94	702.65		99.81	-2.21E-02	3.70E-02	3.70E-02
		871.09		99.89	1.78E-02		3.94E-02
	Ag-108m	79.13		6.60	6.79E-01	3.20E-02	1.58E+00
		433.94		90.50	-1.53E-02		3.20E-02
		614.28		89.80	-5.95E-02		4.34E-02
		722.94		90.80	-4.30E-02		4.71E-02
	Sb-125	176.31		6.84	-3.28E-02	1.01E-01	4.56E-01
		380.45		1.52	-5.58E-01		2.03E+00
		427.87		29.60	5.83E-02		1.01E-01
		463.36		10.49	-3.77E-02		3.06E-01
		600.60		17.65	-1.18E-03		2.14E-01
		606.71		4.98	1.22E+00		1.10E+00
		635.95		11.22	6.54E-02		3.22E-01

Analysis Report for 11-Dec-19-10014

L1-10214E-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.11E-01	1.01E-01	2.14E+00
Ba-133	79.61	2.65	7.63E-01	5.73E-02	3.80E+00
	81.00	32.90	-1.48E-01		2.57E-01
	276.40	7.16	-2.41E-02		4.26E-01
	302.85	18.34	1.58E-02		1.79E-01
	356.01	62.05	-1.41E-02		5.73E-02
	383.85	8.94	-2.38E-01		3.10E-01
Cs-134	475.36	1.48	-2.83E-01	4.08E-02	2.29E+00
	563.25	8.34	-9.03E-02		3.81E-01
	569.33	15.37	-2.09E-01		2.13E-01
	604.72	97.62	1.04E-02		5.21E-02
	795.86	85.46	5.56E-03		4.08E-02
	801.95	8.69	-7.42E-02		3.90E-01
	1038.61	0.99	2.72E+00		4.22E+00
	1167.97	1.79	2.00E+00		2.76E+00
	1365.19	3.02	-7.69E-01		1.21E+00
Cs-137	661.66	85.10	-1.24E-02	4.64E-02	4.64E-02
Eu-152	121.78	28.67	-8.39E-02	1.20E-01	1.24E-01
	244.70	7.61	-2.93E-02		4.43E-01
	295.94	0.45	4.60E+00		8.06E+00
	344.28	26.60	-8.14E-03		1.20E-01
	367.79	0.86	-1.72E+00		3.17E+00
	411.12	2.24	6.15E-02		1.34E+00
	443.96	2.83	-2.72E-01		1.16E+00
	488.68	0.42	3.25E+00		7.79E+00
	563.99	0.49	-3.10E+00		6.31E+00
	586.26	0.46	-4.89E+00		1.20E+01
	678.62	0.47	3.05E+00		6.85E+00
	688.67	0.86	2.42E+00		4.73E+00
	719.35	0.28	-1.24E+01		1.38E+01
	778.90	12.96	-1.97E-02		2.65E-01
	810.45	0.32	4.09E-01		1.02E+01
	867.37	4.26	5.20E-01		1.02E+00
	919.33	0.43	7.13E+00		9.83E+00
	964.08	14.65	1.13E-01		3.34E-01
	1085.87	10.24	-7.24E-02		4.20E-01
	1089.74	1.73	1.54E-01		2.49E+00
	1112.07	13.69	1.29E-01		3.29E-01
	1212.95	1.43	-8.12E-01		3.35E+00
	1249.94	0.19	7.73E+00		2.94E+01
	1299.14	1.63	-7.38E-01		2.30E+00
	1408.01	21.07	-1.83E-01		1.88E-01
	1457.64	0.50	6.25E+01		2.99E+01
	1528.10	0.28	6.72E+00		1.50E+01
Eu-154	123.07	40.40	-2.72E-02	9.16E-02	9.16E-02
	247.93	6.89	-1.88E-01		4.02E-01
	591.76	4.95	-1.10E-02		6.13E-01
	692.42	1.78	3.96E-01		2.38E+00
	723.30	20.06	-7.21E-03		2.28E-01
	756.80	4.52	9.29E-02		8.79E-01
	873.18	12.08	8.95E-02		3.07E-01

Analysis Report for 11-Dec-19-10014

L1-10214E-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-8.60E-02	9.16E-02	3.47E-01
	1004.76	18.01	-1.04E-01		1.85E-01
	1274.43	34.80	5.78E-02		1.46E-01
	1596.48	1.80	-2.81E-01		2.12E+00
Eu-155	45.30	1.31	-6.38E+00	2.29E-01	2.70E+01
	60.01	1.22	-2.66E+00		2.52E+01
	86.55	30.70	1.00E-01		2.29E-01
	105.31	21.10	3.39E-02		2.41E-01
Ra-226	186.21	3.64	-2.53E-01	9.17E-01	9.17E-01
Pa-231	27.36	10.30	1.29E+00	1.31E+00	2.61E+00
	283.69	1.70	-2.37E-02		1.86E+00
	300.07	2.47	-4.69E-01		1.31E+00
	302.65	2.20	4.21E-01		1.50E+00
	330.06	1.40	-8.25E-01		2.36E+00
U-235	143.76	10.96	1.37E-01	5.83E-02	3.47E-01
	163.33	5.08	-1.75E-01		6.42E-01
	185.71	57.20	-5.22E-04		5.83E-02
	202.11	1.08	-8.56E-01		3.00E+00
	205.31	5.01	4.23E-02		6.85E-01
Am-241	59.54	35.90	7.30E-02	9.00E-01	9.00E-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 11-Dec-19-10015

L1-10214E-FSGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10015
Sample Description	: L1-10214E-FSGS-014SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.732E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:56:00PM
Acquisition Started	: 12/11/2019 9:27:41AM
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81976
Fill Height	: 1732.18 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:42:43AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10015

L1-10214E-FSGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.71	947 -	959	954.41	8.34E+01	10.99	1.46E+01	0.78
2	351.81	1401 -	1412	1406.26	4.09E+01	8.00	9.08E+00	0.80
3	511.08	2038 -	2047	2042.70	1.34E+01	8.33	2.46E+01	0.55
4	911.28	3635 -	3649	3642.59	3.15E+01	6.45	3.50E+00	1.39
5	1460.12	5829 -	5849	5838.40	1.15E+02	11.96	7.72E+00	1.11

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	1.55E-02	9.66E-03
K-40	0.92	1460.82	*	10.66	2.50E+00	2.81E-01
Bi-211	0.91	351.07	*	13.02	2.75E-01	5.82E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.30E-01	2.01E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.01E-01	2.13E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		

Analysis Report for 11-Dec-19-10015

L1-10214E-FSGS-014SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Ac-228	1.00	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	2.06E-01	4.30E-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
	An Pk	0.999	1.55E-02	9.66E-03	
	K-40	0.923	2.50E+00	2.81E-01	
?	Bi-211	0.916	2.75E-01	5.82E-02	
	Pb-212	0.999	1.30E-01	2.01E-02	
?	Pb-214	0.999	1.01E-01	2.13E-02	
	Ac-228	1.000	2.06E-01	4.30E-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 11-Dec-19-10015

L1-10214E-FSGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:42:43AM
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	1.55E-02	3.26E-02	3.26E-02
	BE-7	477.60		10.44	4.89E-03	2.62E-01	2.62E-01
+	K-40	1460.82	*	10.66	2.50E+00	4.50E-01	4.50E-01
	Mn-54	834.85		99.98	4.81E-03	3.78E-02	3.78E-02
	Co-60	1173.23		99.85	-2.95E-02	3.55E-02	4.14E-02
		1332.49		99.98	-2.08E-02		3.55E-02
	Nb-94	702.65		99.81	1.24E-02	2.82E-02	2.95E-02
		871.09		99.89	-4.62E-02		2.82E-02
	Ag-108m	79.13		6.60	-3.07E-01	2.73E-02	8.40E-01
		433.94		90.50	-7.03E-03		2.73E-02
		614.28		89.80	-5.03E-02		3.86E-02
		722.94		90.80	3.42E-02		4.26E-02
	Sb-125	176.31		6.84	9.26E-02	7.71E-02	3.49E-01
		380.45		1.52	-2.65E-01		1.76E+00
		427.87		29.60	-1.70E-03		7.71E-02
		463.36		10.49	3.28E-01		3.49E-01
		600.60		17.65	-6.88E-02		1.87E-01
		606.71		4.98	4.54E-01		9.02E-01
		635.95		11.22	9.56E-02		2.45E-01

Analysis Report for 11-Dec-19-10015

L1-10214E-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-4.42E-02	7.71E-02	1.55E+00
Ba-133	79.61	2.65	3.96E-01	4.89E-02	2.08E+00
	81.00	32.90	-1.14E-01		1.45E-01
	276.40	7.16	1.90E-02		3.62E-01
	302.85	18.34	-6.26E-03		1.22E-01
	356.01	62.05	-4.34E-02		4.89E-02
	383.85	8.94	-2.09E-02		3.09E-01
Cs-134	475.36	1.48	-1.18E+00	4.07E-02	1.58E+00
	563.25	8.34	-4.54E-01		4.39E-01
	569.33	15.37	2.15E-03		2.18E-01
	604.72	97.62	-1.54E-02		4.40E-02
	795.86	85.46	1.30E-02		4.07E-02
	801.95	8.69	1.88E-01		3.81E-01
	1038.61	0.99	-3.06E-01		3.98E+00
	1167.97	1.79	-1.78E-01		2.63E+00
	1365.19	3.02	-9.90E-02		1.14E+00
Cs-137	661.66	85.10	6.01E-03	3.22E-02	3.22E-02
Eu-152	121.78	28.67	-1.61E-03	8.12E-02	8.12E-02
	244.70	7.61	2.59E-02		3.30E-01
	295.94	0.45	1.87E+00		6.48E+00
	344.28	26.60	-3.96E-02		1.01E-01
	367.79	0.86	2.44E+00		3.28E+00
	411.12	2.24	-3.01E-01		1.11E+00
	443.96	2.83	7.76E-02		8.89E-01
	488.68	0.42	9.62E-01		6.54E+00
	563.99	0.49	-1.10E+01		6.90E+00
	586.26	0.46	-3.36E+00		7.81E+00
	678.62	0.47	-1.94E+00		6.09E+00
	688.67	0.86	-1.46E+00		4.12E+00
	719.35	0.28	9.01E-01		1.00E+01
	778.90	12.96	-3.00E-02		2.43E-01
	810.45	0.32	-2.29E+00		9.10E+00
	867.37	4.26	1.81E-01		8.19E-01
	919.33	0.43	7.12E+00		9.19E+00
	964.08	14.65	5.49E-02		3.21E-01
	1085.87	10.24	-1.41E-01		3.84E-01
	1089.74	1.73	1.97E+00		2.54E+00
	1112.07	13.69	7.30E-02		2.63E-01
	1212.95	1.43	-3.95E-01		2.68E+00
	1249.94	0.19	-3.52E+00		2.14E+01
	1299.14	1.63	8.95E-01		2.64E+00
	1408.01	21.07	5.54E-02		2.01E-01
	1457.64	0.50	5.84E+01		2.62E+01
	1528.10	0.28	4.25E+00		1.16E+01
Eu-154	123.07	40.40	-2.50E-02	5.53E-02	5.53E-02
	247.93	6.89	0.00E+00		3.07E-01
	591.76	4.95	2.94E-01		5.76E-01
	692.42	1.78	-6.38E-02		1.96E+00
	723.30	20.06	1.53E-01		1.93E-01
	756.80	4.52	-2.31E-01		5.93E-01
	873.18	12.08	-1.01E-01		2.90E-01

Analysis Report for 11-Dec-19-10015

L1-10214E-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	9.17E-02	5.53E-02	3.08E-01
	1004.76	18.01	-2.83E-02		2.08E-01
	1274.43	34.80	5.17E-02		1.26E-01
	1596.48	1.80	-1.45E+00		1.33E+00
Eu-155	45.30	1.31	-5.26E+00	1.44E-01	8.85E+00
	60.01	1.22	-3.03E+00		8.95E+00
	86.55	30.70	8.36E-02		1.50E-01
	105.31	21.10	8.88E-02		1.44E-01
Ra-226	186.21	3.64	-1.32E-01	6.46E-01	6.46E-01
Pa-231	27.36	10.30	7.20E-01	9.72E-01	9.96E-01
	283.69	1.70	1.44E-01		1.68E+00
	300.07	2.47	-7.39E-01		9.72E-01
	302.65	2.20	1.97E-01		1.00E+00
	330.06	1.40	-2.40E-01		1.95E+00
U-235	143.76	10.96	-2.40E-02	4.17E-02	2.31E-01
	163.33	5.08	-1.83E-01		4.48E-01
	185.71	57.20	1.41E-03		4.17E-02
	202.11	1.08	-1.07E+00		2.06E+00
	205.31	5.01	-2.26E-01		4.78E-01
Am-241	59.54	35.90	-1.34E-01	3.15E-01	3.15E-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 11-Dec-19-10016

L1-10214E-FSGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10016
Sample Description	: L1-10214E-FSGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.712E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 12:58:00PM
Acquisition Started	: 12/11/2019 9:28:12AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.2 seconds
Dead Time	: 0.02 %
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81977
Fill Height	: 1712.34 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:43:15AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10016

L1-10214E-FSGS-015SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.39	947 -	961	954.05	7.99E+01	12.67	2.81E+01	0.91
2	351.80	1402 -	1413	1407.21	3.90E+01	8.89	1.60E+01	1.08
3	968.90	3869 -	3880	3874.68	1.94E+01	5.59	4.60E+00	0.61
4	1460.31	5831 -	5849	5841.60	1.31E+02	13.06	1.17E+01	1.19

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	0.95	1460.82	*	10.66	2.67E+00	2.90E-01
Bi-211	0.91	351.07	*	13.02	2.55E-01	6.15E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.23E-01	2.19E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	9.32E-02	2.25E-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		

Analysis Report for 11-Dec-19-10016

L1-10214E-FSGS-015SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Ac-228	0.57	338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97	*	15.80	2.03E-01	5.92E-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

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.959	2.67E+00	2.90E-01	
?	Bi-211	0.918	2.55E-01	6.15E-02	
	Pb-212	0.992	1.23E-01	2.19E-02	
?	Pb-214	0.998	9.32E-02	2.25E-02	
	Ac-228	0.570	2.03E-01	5.92E-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 11-Dec-19-10016

L1-10214E-FSGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:43:15AM
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	1.84E-02	4.38E-02	4.38E-02
	BE-7	477.60		10.44	2.58E-01	3.43E-01	3.43E-01
+	K-40	1460.82	*	10.66	2.67E+00	4.90E-01	4.90E-01
	Mn-54	834.85		99.98	-2.48E-02	3.40E-02	3.40E-02
	Co-60	1173.23		99.85	-7.10E-02	2.76E-02	4.01E-02
		1332.49		99.98	-3.83E-02		2.76E-02
	Nb-94	702.65		99.81	2.10E-02	3.58E-02	3.68E-02
		871.09		99.89	-5.75E-02		3.58E-02
	Ag-108m	79.13		6.60	-9.15E-01	2.63E-02	1.17E+00
		433.94		90.50	-1.20E-02		2.63E-02
		614.28		89.80	1.53E-02		4.60E-02
		722.94		90.80	2.80E-02		4.71E-02
	Sb-125	176.31		6.84	-1.46E-01	9.70E-02	4.04E-01
		380.45		1.52	1.22E+00		1.85E+00
		427.87		29.60	5.60E-02		9.70E-02
		463.36		10.49	-5.32E-02		2.37E-01
		600.60		17.65	1.50E-02		2.12E-01
		606.71		4.98	9.44E-01		9.43E-01
		635.95		11.22	-1.58E-01		2.73E-01

Analysis Report for 11-Dec-19-10016

L1-10214E-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.79E+00	9.70E-02	1.85E+00
Ba-133	79.61	2.65	1.12E+00	5.53E-02	2.92E+00
	81.00	32.90	-7.11E-02		2.05E-01
	276.40	7.16	8.46E-03		4.69E-01
	302.85	18.34	-1.06E-02		1.56E-01
	356.01	62.05	-2.76E-02		5.53E-02
	383.85	8.94	-7.68E-02		2.85E-01
Cs-134	475.36	1.48	1.51E+00	4.41E-02	2.37E+00
	563.25	8.34	2.28E-01		3.54E-01
	569.33	15.37	-1.14E-01		1.89E-01
	604.72	97.62	1.53E-02		4.59E-02
	795.86	85.46	-8.51E-04		4.41E-02
	801.95	8.69	4.21E-03		3.28E-01
	1038.61	0.99	-3.25E+00		3.64E+00
	1167.97	1.79	2.16E-01		2.17E+00
	1365.19	3.02	-1.61E+00		9.31E-01
Cs-137	661.66	85.10	-1.40E-02	3.52E-02	3.52E-02
Eu-152	121.78	28.67	-1.97E-02	1.06E-01	1.06E-01
	244.70	7.61	5.80E-02		3.83E-01
	295.94	0.45	3.76E+00		7.49E+00
	344.28	26.60	7.30E-02		1.11E-01
	367.79	0.86	9.59E-01		3.26E+00
	411.12	2.24	-5.79E-02		1.25E+00
	443.96	2.83	6.67E-01		8.35E-01
	488.68	0.42	6.93E+00		7.88E+00
	563.99	0.49	1.44E-01		5.89E+00
	586.26	0.46	1.20E+01		1.07E+01
	678.62	0.47	-3.82E+00		6.77E+00
	688.67	0.86	4.12E+00		4.69E+00
	719.35	0.28	7.69E+00		1.36E+01
	778.90	12.96	9.39E-02		2.86E-01
	810.45	0.32	-4.47E+00		7.91E+00
	867.37	4.26	-3.29E-01		8.58E-01
	919.33	0.43	9.34E-02		7.54E+00
	964.08	14.65	-4.88E-02		3.70E-01
	1085.87	10.24	1.84E-01		3.94E-01
	1089.74	1.73	1.24E+00		2.39E+00
	1112.07	13.69	-2.61E-01		2.83E-01
	1212.95	1.43	-2.23E+00		2.79E+00
	1249.94	0.19	2.57E-01		2.14E+01
	1299.14	1.63	-3.99E-01		2.31E+00
	1408.01	21.07	1.00E-01		1.81E-01
	1457.64	0.50	6.54E+01		2.67E+01
	1528.10	0.28	1.90E+00		1.24E+01
Eu-154	123.07	40.40	-1.58E-02	7.53E-02	7.53E-02
	247.93	6.89	-1.14E-01		3.80E-01
	591.76	4.95	2.66E-01		6.74E-01
	692.42	1.78	4.86E-01		2.15E+00
	723.30	20.06	8.92E-02		2.13E-01
	756.80	4.52	-2.85E-01		7.41E-01
	873.18	12.08	9.90E-02		3.11E-01

Analysis Report for 11-Dec-19-10016

L1-10214E-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.46E-01	7.53E-02	3.45E-01
	1004.76	18.01	6.82E-02		2.29E-01
	1274.43	34.80	-6.71E-02		1.02E-01
	1596.48	1.80	3.19E-01		2.42E+00
Eu-155	45.30	1.31	9.46E+00	1.75E-01	1.64E+01
	60.01	1.22	-7.17E+00		1.72E+01
	86.55	30.70	3.23E-02		1.85E-01
	105.31	21.10	1.74E-02		1.75E-01
Ra-226	186.21	3.64	5.69E-01	8.08E-01	8.08E-01
Pa-231	27.36	10.30	2.08E+00	1.24E+00	2.14E+00
	283.69	1.70	-1.63E+00		1.67E+00
	300.07	2.47	-2.83E-01		1.24E+00
	302.65	2.20	6.40E-01		1.32E+00
	330.06	1.40	-5.20E-01		1.85E+00
U-235	143.76	10.96	-7.85E-02	5.19E-02	2.72E-01
	163.33	5.08	-3.93E-01		5.36E-01
	185.71	57.20	2.96E-02		5.19E-02
	202.11	1.08	7.88E-01		2.55E+00
	205.31	5.01	-5.37E-01		5.36E-01
Am-241	59.54	35.90	5.94E-02	6.16E-01	6.16E-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 11-Dec-19-10017

L1-10214E-FSGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10017
Sample Description	: L1-10214E-FSGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.456E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 1:00:00PM
Acquisition Started	: 12/11/2019 9:42:16AM
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81978
Fill Height	: 1456.36 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:57:19AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10017

L1-10214E-FSGS-016SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.98	368 -	376	372.27	4.57E+01	15.05	8.13E+01	0.72
2	238.65	473 -	481	477.49	1.06E+02	18.99	1.17E+02	1.15
3	294.94	585 -	594	589.94	7.75E+01	14.02	5.25E+01	1.08
4	351.97	698 -	708	703.88	1.24E+02	15.25	4.54E+01	0.95
5	438.00	872 -	880	875.79	1.40E+01	7.24	1.80E+01	0.92
6	583.22	1162 -	1171	1166.05	6.17E+01	9.83	1.53E+01	1.44
7	609.26	1213 -	1223	1218.09	7.71E+01	11.09	1.89E+01	1.50
8	1460.69	2914 -	2928	2921.44	3.04E+02	17.59	1.88E+00	1.95
9	1764.02	3525 -	3533	3528.89	1.35E+01	4.81	4.50E+00	1.51

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	5.80E+00	4.19E-01
Tl-208	1.00	583.19	*	85.00	8.04E-02	1.37E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.50E-01	2.95E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.93E-01	3.02E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 11-Dec-19-10017

L1-10214E-FSGS-016SS

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	2.07E-01	7.41E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.93E-01	5.79E-02
		351.93	*	35.60	2.74E-01	4.02E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	6.84E-01	2.32E-01
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.36E-02	1.48E-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	0.997	5.80E+00	4.19E-01	
Tl-208	1.000	8.04E-02	1.37E-02	

Analysis Report for 11-Dec-19-10017

L1-10214E-FSGS-016SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
X	Bi-211	0.880			
	Pb-212	1.000	1.50E-01	2.95E-02	
	Bi-214	0.995	1.95E-01	2.79E-02	
	Pb-214	0.996	2.80E-01	3.30E-02	
?	Ra-226	0.992	6.84E-01	2.32E-01	
?	U-235	0.992	4.36E-02	1.48E-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 11-Dec-19-10017

L1-10214E-FSGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:57:19AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
5	438.00	1.55556E-02	51.70	D-Esc	

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	6.28E-02	5.42E-02	5.42E-02
	BE-7	477.60		10.44	-1.46E-01	3.02E-01	3.02E-01
+	K-40	1460.82	*	10.66	5.80E+00	2.05E-01	2.05E-01
	Mn-54	834.85		99.98	-4.98E-04	3.71E-02	3.71E-02
	Co-60	1173.23		99.85	2.76E-02	4.72E-02	5.33E-02
		1332.49		99.98	1.61E-02		4.72E-02
	Nb-94	702.65		99.81	4.66E-03	3.66E-02	3.66E-02
		871.09		99.89	3.10E-02		4.14E-02
	Ag-108m	79.13		6.60	1.30E+00	2.85E-02	1.23E+00
		433.94		90.50	-1.54E-02		2.85E-02
		614.28		89.80	-2.60E-02		5.23E-02
		722.94		90.80	-2.56E-02		4.16E-02
	Sb-125	176.31		6.84	-5.10E-02	1.04E-01	4.85E-01
		380.45		1.52	1.06E+00		1.90E+00
		427.87		29.60	-1.26E-02		1.04E-01
		463.36		10.49	2.48E-01		3.49E-01
		600.60		17.65	3.50E-02		2.08E-01
		606.71		4.98	1.99E-03		1.25E+00

Analysis Report for 11-Dec-19-10017

L1-10214E-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	635.95	11.22	-8.37E-02	1.04E-01	3.05E-01
	671.44	1.79	1.06E-01		2.10E+00
Ba-133	79.61	2.65	1.36E+00	7.66E-02	2.81E+00
	81.00	32.90	-3.00E-01		1.69E-01
	276.40	7.16	1.91E-02		4.36E-01
	302.85	18.34	3.86E-02		1.79E-01
	356.01	62.05	-3.44E-02		7.66E-02
	383.85	8.94	-4.08E-02		2.77E-01
Cs-134	475.36	1.48	-1.07E+00	4.28E-02	2.08E+00
	563.25	8.34	1.75E-01		4.17E-01
	569.33	15.37	4.15E-02		2.22E-01
	604.72	97.62	-3.76E-03		5.51E-02
	795.86	85.46	-2.07E-04		4.28E-02
	801.95	8.69	-1.77E-01		3.99E-01
	1038.61	0.99	-6.54E-01		3.89E+00
	1167.97	1.79	2.40E+00		3.08E+00
	1365.19	3.02	9.22E-01		1.49E+00
Cs-137	661.66	85.10	1.26E-02	4.91E-02	4.91E-02
Eu-152	121.78	28.67	2.36E-03	1.06E-01	1.14E-01
	244.70	7.61	7.62E-02		4.80E-01
	295.94	0.45	-9.34E-01		9.59E+00
	344.28	26.60	-1.24E-01		1.06E-01
	367.79	0.86	-9.65E-01		3.20E+00
	411.12	2.24	3.43E-01		1.39E+00
	443.96	2.83	-5.75E-02		1.09E+00
	488.68	0.42	-1.59E+00		7.80E+00
	563.99	0.49	7.05E-01		6.90E+00
	586.26	0.46	-5.30E+00		1.16E+01
	678.62	0.47	-2.86E+00		6.45E+00
	688.67	0.86	-1.08E+00		3.58E+00
	719.35	0.28	2.85E-01		1.11E+01
	778.90	12.96	5.38E-03		2.78E-01
	810.45	0.32	-2.87E+00		1.04E+01
	867.37	4.26	-2.57E-01		8.74E-01
	919.33	0.43	-6.75E+00		8.51E+00
	964.08	14.65	8.09E-02		3.34E-01
	1085.87	10.24	-1.11E-01		4.12E-01
	1089.74	1.73	-8.33E-01		2.40E+00
	1112.07	13.69	-1.44E-01		3.37E-01
	1212.95	1.43	-1.63E+00		4.11E+00
	1249.94	0.19	5.63E+00		2.45E+01
	1299.14	1.63	-5.01E-01		2.92E+00
	1408.01	21.07	-2.97E-02		1.76E-01
	1457.64	0.50	-1.82E+00		3.51E+01
	1528.10	0.28	2.54E+00		1.01E+01
Eu-154	123.07	40.40	-4.16E-02	7.78E-02	7.78E-02
	247.93	6.89	-3.06E-01		4.21E-01
	591.76	4.95	-1.21E-01		6.39E-01
	692.42	1.78	-6.21E-01		1.77E+00
	723.30	20.06	-1.04E-01		1.91E-01
	756.80	4.52	-6.37E-01		7.53E-01

Analysis Report for 11-Dec-19-10017

L1-10214E-FSGS-016SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	873.18		12.08	-7.42E-02	7.78E-02	3.03E-01
		996.29		10.48	8.74E-02		3.97E-01
		1004.76		18.01	2.12E-02		2.19E-01
		1274.43		34.80	-8.32E-02		1.29E-01
		1596.48		1.80	-1.75E+00		1.64E+00
	Eu-155	45.30		1.31	-2.72E-01	1.67E-01	1.09E+01
		60.01		1.22	3.43E+00		1.23E+01
		86.55		30.70	5.46E-02		1.79E-01
		105.31		21.10	-2.92E-02		1.67E-01
+	Ra-226	186.21	*	3.64	6.84E-01	7.27E-01	7.27E-01
	Pa-231	27.36		10.30	2.85E-01	9.87E-01	9.87E-01
		283.69		1.70	-2.99E-01		1.77E+00
		300.07		2.47	-2.45E-01		1.37E+00
		302.65		2.20	3.21E-01		1.49E+00
		330.06		1.40	-7.88E-01		2.10E+00
+	U-235	143.76		10.96	-1.14E-03	4.62E-02	2.68E-01
		163.33		5.08	-9.85E-02		6.68E-01
		185.71	*	57.20	4.36E-02		4.62E-02
		202.11		1.08	-1.39E+00		3.04E+00
		205.31		5.01	-1.66E-01		6.58E-01
	Am-241	59.54		35.90	1.27E-01	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 11-Dec-19-10018

L1-10214E-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 11-Dec-19-10018
Sample Description	: L1-10214E-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.542E+03 grams
Facility	: Default
Sample Taken On	: 12/10/2019 1:02:00PM
Acquisition Started	: 12/11/2019 9:42:47AM
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	: 12/11/2019
Efficiency Calibration Description	:
Sample Number	: 81979
Fill Height	: 1542.34 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/11/2019 9:57:50AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/11/19 - 1100

T Graham

Analysis Report for 11-Dec-19-10018

L1-10214E-FSGS-017SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.19	737 -	749	745.05	3.73E+01	13.96	5.97E+01	0.40
2	238.67	949 -	961	954.76	1.35E+02	18.92	7.95E+01	1.02
3	295.15	1175 -	1185	1180.52	3.87E+01	11.72	4.13E+01	0.95
4	338.31	1348 -	1357	1353.02	2.85E+01	8.24	1.75E+01	1.00
5	352.01	1398 -	1414	1407.78	9.65E+01	14.79	3.85E+01	1.04
6	609.41	2428 -	2443	2436.81	6.77E+01	11.12	1.83E+01	0.95
7	911.10	3636 -	3652	3643.37	5.50E+01	7.42	0.00E+00	0.63
8	964.95	3853 -	3864	3858.78	1.75E+01	5.38	4.53E+00	0.83
9	1460.73	5835 -	5854	5842.73	2.42E+02	16.34	8.12E+00	1.92

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	6.02E+00	4.83E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.42E-01	3.90E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.17E-01	3.80E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 11-Dec-19-10018

L1-10214E-FSGS-017SS

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	1.84E-01	5.77E-02
		351.93	*	35.60	2.70E-01	4.66E-02
		785.96		1.06		
Ra-226	1.00	186.21	*	3.64	7.13E-01	2.73E-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	2.45E-01	7.35E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	4.09E-01	5.79E-02
		964.77	*	4.99	6.98E-01	2.17E-01
		968.97		15.80		
		1588.20		3.22		
U-235	0.97	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.54E-02	1.74E-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 11-Dec-19-10018

L1-10214E-FSGS-017SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	6.02E+00	4.83E-01	
X	Bi-211	0.868			
	Pb-212	1.000	2.42E-01	3.90E-02	
	Bi-214	0.999	2.17E-01	3.80E-02	
	Pb-214	0.999	2.36E-01	3.63E-02	
?	Ra-226	1.000	7.13E-01	2.73E-01	
	Ac-228	0.999	3.61E-01	4.45E-02	
?	U-235	0.974	4.54E-02	1.74E-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 11-Dec-19-10018

L1-10214E-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/11/2019 9:57:50AM
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	9.24E-02	6.55E-02	6.55E-02
	BE-7	477.60		10.44	1.76E-01	4.31E-01	4.31E-01
+	K-40	1460.82	*	10.66	6.02E+00	4.95E-01	4.95E-01
	Mn-54	834.85		99.98	1.18E-02	5.03E-02	5.03E-02
	Co-60	1173.23		99.85	5.60E-02	5.60E-02	6.63E-02
		1332.49		99.98	7.27E-03		5.60E-02
	Nb-94	702.65		99.81	2.01E-03	4.83E-02	4.83E-02
		871.09		99.89	2.37E-02		4.90E-02
	Ag-108m	79.13		6.60	2.51E+00	4.42E-02	2.08E+00
		433.94		90.50	-2.52E-02		4.42E-02
		614.28		89.80	-5.46E-02		6.88E-02
		722.94		90.80	2.98E-02		5.79E-02
	Sb-125	176.31		6.84	-1.91E-01	1.41E-01	6.26E-01
		380.45		1.52	1.49E+00		2.78E+00
		427.87		29.60	5.14E-02		1.41E-01
		463.36		10.49	4.32E-01		4.28E-01
		600.60		17.65	-1.32E-01		2.90E-01
		606.71		4.98	9.43E-01		1.61E+00
		635.95		11.22	-1.05E-01		4.02E-01

Analysis Report for 11-Dec-19-10018

L1-10214E-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.64E+00	1.41E-01	2.38E+00
Ba-133	79.61	2.65	8.11E-01	8.22E-02	4.74E+00
	81.00	32.90	-3.38E-01		3.13E-01
	276.40	7.16	4.05E-01		6.22E-01
	302.85	18.34	5.41E-02		2.22E-01
	356.01	62.05	-2.28E-02		8.22E-02
	383.85	8.94	-1.03E-01		4.48E-01
Cs-134	475.36	1.48	3.54E-01	4.39E-02	3.01E+00
	563.25	8.34	-1.20E-01		5.45E-01
	569.33	15.37	1.26E-01		2.87E-01
	604.72	97.62	2.80E-02		7.64E-02
	795.86	85.46	-4.40E-02		4.39E-02
	801.95	8.69	-1.36E-01		4.81E-01
	1038.61	0.99	2.38E+00		5.48E+00
	1167.97	1.79	-2.12E+00		3.08E+00
	1365.19	3.02	1.69E-01		1.57E+00
Cs-137	661.66	85.10	4.12E-02	7.09E-02	7.09E-02
Eu-152	121.78	28.67	1.71E-02	1.42E-01	1.65E-01
	244.70	7.61	2.03E-01		6.08E-01
	295.94	0.45	1.01E+01		1.14E+01
	344.28	26.60	-7.41E-02		1.42E-01
	367.79	0.86	6.51E-01		4.47E+00
	411.12	2.24	-8.81E-02		1.76E+00
	443.96	2.83	5.39E-01		1.48E+00
	488.68	0.42	-3.14E+00		1.01E+01
	563.99	0.49	-3.84E-01		9.36E+00
	586.26	0.46	1.86E+01		1.48E+01
	678.62	0.47	-3.41E+00		7.92E+00
	688.67	0.86	2.62E+00		5.77E+00
	719.35	0.28	-3.95E+00		1.54E+01
	778.90	12.96	-2.79E-01		3.23E-01
	810.45	0.32	9.10E+00		1.77E+01
	867.37	4.26	-2.15E+00		1.06E+00
	919.33	0.43	4.40E+00		1.12E+01
	964.08	14.65	4.02E-01		5.61E-01
	1085.87	10.24	4.43E-01		5.24E-01
	1089.74	1.73	-2.10E+00		2.83E+00
	1112.07	13.69	-7.04E-02		4.38E-01
	1212.95	1.43	-2.60E+00		4.82E+00
	1249.94	0.19	1.17E+01		3.60E+01
	1299.14	1.63	-1.98E+00		3.47E+00
	1408.01	21.07	4.03E-02		2.30E-01
	1457.64	0.50	1.35E+02		4.22E+01
	1528.10	0.28	-1.75E+00		1.32E+01
Eu-154	123.07	40.40	2.26E-02	1.16E-01	1.16E-01
	247.93	6.89	-4.47E-01		5.22E-01
	591.76	4.95	3.78E-01		9.38E-01
	692.42	1.78	-1.62E+00		2.69E+00
	723.30	20.06	1.11E-01		2.65E-01
	756.80	4.52	9.04E-02		9.30E-01
	873.18	12.08	1.81E-01		3.99E-01

Analysis Report for 11-Dec-19-10018

L1-10214E-FSGS-017SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	1.46E-02	1.16E-01	3.79E-01
		1004.76		18.01	-2.96E-02		2.05E-01
		1274.43		34.80	6.03E-02		1.44E-01
		1596.48		1.80	3.59E-01		3.08E+00
	Eu-155	45.30		1.31	-7.59E+00	2.70E-01	3.18E+01
		60.01		1.22	2.23E-01		3.06E+01
		86.55		30.70	-1.47E-01		2.70E-01
		105.31		21.10	1.70E-01		2.80E-01
+	Ra-226	186.21	*	3.64	7.13E-01	8.68E-01	8.68E-01
	Pa-231	27.36		10.30	4.01E+00	1.69E+00	3.94E+00
		283.69		1.70	1.22E+00		2.28E+00
		300.07		2.47	-1.54E+00		1.69E+00
		302.65		2.20	-1.12E-01		1.82E+00
		330.06		1.40	1.66E+00		2.96E+00
+	U-235	143.76		10.96	-3.96E-02	5.52E-02	4.06E-01
		163.33		5.08	2.57E-01		8.65E-01
		185.71	*	57.20	4.54E-02		5.52E-02
		202.11		1.08	-9.86E-02		3.63E+00
		205.31		5.01	1.92E-02		7.85E-01
	Am-241	59.54		35.90	-2.93E-01	1.06E+00	1.06E+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 13-Dec-19-10004

L1-10214E-FSGS-006SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 13-Dec-19-10004
Sample Description	: L1-10214E-FSGS-006SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.795E+03 grams
Facility	: Default
Sample Taken On	: 12/11/2019 12:55:00PM
Acquisition Started	: 12/13/2019 9:11:52AM
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	: 12/16/2019
Efficiency Calibration Description	:
Sample Number	: 82035
Fill Height	: 1795.43 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/16/2019 7:05:18AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

123 ± 16.79

Analysis Report for 13-Dec-19-10004

L1-10214E-FSGS-006SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.27	306 -	315	309.60	5.14E+01	15.61	8.36E+01	0.84
M	2	238.79	946 -	973	954.73	2.11E+02	41.25	4.18E+01	1.16
m	3	241.94	946 -	973	967.32	5.70E+01	12.39	6.32E+01	1.17
	4	295.19	1174 -	1185	1180.03	6.40E+01	12.71	3.90E+01	0.79
	5	338.55	1348 -	1359	1353.26	4.05E+01	10.36	2.65E+01	1.04
	6	352.00	1398 -	1414	1407.00	1.40E+02	14.86	2.56E+01	0.75
	7	583.21	2325 -	2337	2330.94	6.13E+01	10.66	1.97E+01	0.81
	8	609.17	2427 -	2442	2434.71	7.36E+01	11.23	1.74E+01	0.66
	9	661.67	2635 -	2651	2644.57	7.62E+01	11.34	1.68E+01	1.14
	10	727.07	2902 -	2911	2906.04	9.55E+00	6.00	1.15E+01	0.39
	11	911.05	3634 -	3649	3641.66	4.87E+01	8.37	7.30E+00	0.41
	12	1460.03	5828 -	5850	5838.04	2.73E+02	17.45	8.33E+00	1.09

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	5.87E+00	4.54E-01
Cs-137	1.00	661.66	*	85.10	1.21E-01	1.94E-02
Tl-208	1.00	583.19	*	85.00	8.93E-02	1.64E-02
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	2.06E-01	1.30E-01

Analysis Report for 13-Dec-19-10004

L1-10214E-FSGS-006SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-212	0.99	785.37		1.10		
		1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	3.27E-01	6.92E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.58E-01	1.15E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.06E-01	3.38E-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	5.35E-01	1.24E-01
		295.22	*	18.42	2.66E-01	5.70E-02
		351.93	*	35.60	3.44E-01	4.56E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	6.30E-01	2.04E-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	3.04E-01	8.17E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.15E-01	5.59E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

Analysis Report for 13-Dec-19-10004

L1-10214E-FSGS-006SB

* = 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	0.904	5.87E+00	4.54E-01	
	Cs-137	1.000	1.21E-01	1.94E-02	
	Tl-208	1.000	8.93E-02	1.64E-02	
X	Bi-211	0.871			
	Bi-212	0.993	2.06E-01	1.30E-01	
	Pb-212	0.996	3.27E-01	6.92E-02	
?	Pb212-XR	0.998	3.58E-01	1.15E-01	
	Bi-214	0.998	2.06E-01	3.38E-02	
	Pb-214	0.999	3.30E-01	3.42E-02	
?	Pb214-XR	0.998	6.30E-01	2.04E-01	
	Ac-228	0.998	3.12E-01	4.62E-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 13-Dec-19-10004

L1-10214E-FSGS-006SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/16/2019 7:05:18AM
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	4.43E-02	5.21E-02	5.21E-02
	BE-7	477.60		10.44	-1.68E-02	3.79E-01	3.79E-01
+	K-40	1460.82	*	10.66	5.87E+00	4.73E-01	4.73E-01
	Mn-54	834.85		99.98	6.83E-03	4.25E-02	4.25E-02
	Co-60	1173.23		99.85	-7.68E-02	4.60E-02	4.91E-02
		1332.49		99.98	-6.04E-03		4.60E-02
	Nb-94	702.65		99.81	-1.05E-02	3.57E-02	3.57E-02
		871.09		99.89	1.12E-02		4.03E-02
	Ag-108m	79.13		6.60	-1.37E-01	4.07E-02	1.20E+00
		433.94		90.50	2.20E-02		4.07E-02
		614.28		89.80	-3.62E-02		5.40E-02
		722.94		90.80	-4.05E-02		5.18E-02
	Sb-125	176.31		6.84	-3.74E-01	1.32E-01	4.51E-01
		380.45		1.52	-1.82E+00		2.47E+00
		427.87		29.60	3.61E-02		1.32E-01
		463.36		10.49	-5.07E-02		3.68E-01
		600.60		17.65	-1.75E-01		1.99E-01
		606.71		4.98	1.83E+00		1.37E+00
		635.95		11.22	1.43E-01		3.26E-01

Analysis Report for 13-Dec-19-10004

L1-10214E-FSGS-006SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-9.95E-01	1.32E-01	2.25E+00
	Ba-133	79.61		2.65	-2.49E-01	6.92E-02	2.91E+00
		81.00		32.90	-9.36E-02		1.88E-01
		276.40		7.16	1.29E-01		4.85E-01
		302.85		18.34	1.16E-01		1.93E-01
		356.01		62.05	-4.61E-02		6.92E-02
		383.85		8.94	1.61E-01		4.43E-01
	Cs-134	475.36		1.48	-8.23E-01	6.10E-02	2.71E+00
		563.25		8.34	-5.54E-01		4.66E-01
		569.33		15.37	-1.04E-01		2.24E-01
		604.72		97.62	-1.13E-02		6.10E-02
		795.86		85.46	5.04E-02		6.27E-02
		801.95		8.69	2.21E-02		5.30E-01
		1038.61		0.99	4.61E-01		4.95E+00
		1167.97		1.79	1.79E+00		3.11E+00
		1365.19		3.02	-2.43E-01		1.60E+00
+	Cs-137	661.66	*	85.10	1.21E-01	4.35E-02	4.35E-02
	Eu-152	121.78		28.67	-5.39E-03	1.19E-01	1.19E-01
		244.70		7.61	-1.48E-01		5.24E-01
		295.94		0.45	1.31E+01		1.09E+01
		344.28		26.60	1.63E-02		1.37E-01
		367.79		0.86	2.28E+00		4.43E+00
		411.12		2.24	-1.18E-01		1.64E+00
		443.96		2.83	1.40E+00		1.45E+00
		488.68		0.42	-4.57E-01		8.87E+00
		563.99		0.49	-4.52E+00		7.90E+00
		586.26		0.46	-5.64E+00		1.41E+01
		678.62		0.47	1.08E+00		9.43E+00
		688.67		0.86	-1.85E+00		5.11E+00
		719.35		0.28	-5.18E+00		1.42E+01
		778.90		12.96	2.18E-01		3.33E-01
		810.45		0.32	-2.14E+00		1.52E+01
		867.37		4.26	-8.46E-01		8.59E-01
		919.33		0.43	6.44E+00		9.77E+00
		964.08		14.65	1.90E-01		4.78E-01
		1085.87		10.24	-1.13E-01		4.46E-01
		1089.74		1.73	-2.49E-02		2.87E+00
		1112.07		13.69	-1.29E-01		3.80E-01
		1212.95		1.43	1.71E+00		4.58E+00
		1249.94		0.19	1.85E+01		2.81E+01
		1299.14		1.63	-1.53E+00		3.15E+00
		1408.01		21.07	9.37E-02		2.34E-01
		1457.64		0.50	1.28E+02		3.85E+01
		1528.10		0.28	6.32E-01		1.15E+01
	Eu-154	123.07		40.40	-1.98E-02	8.45E-02	8.45E-02
		247.93		6.89	1.29E-01		4.83E-01
		591.76		4.95	1.18E-02		7.58E-01
		692.42		1.78	1.64E+00		2.77E+00
		723.30		20.06	-1.78E-01		2.32E-01
		756.80		4.52	9.10E-02		9.23E-01
		873.18		12.08	3.36E-02		3.61E-01

Analysis Report for 13-Dec-19-10004

L1-10214E-FSGS-006SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.02E-01	8.45E-02	4.30E-01
	1004.76	18.01	-3.56E-02		2.66E-01
	1274.43	34.80	4.16E-03		1.79E-01
	1596.48	1.80	-2.53E-01		1.86E+00
Eu-155	45.30	1.31	6.79E+00	1.98E-01	1.28E+01
	60.01	1.22	-4.90E+00		1.30E+01
	86.55	30.70	4.04E-02		1.98E-01
	105.31	21.10	6.65E-02		2.18E-01
Ra-226	186.21	3.64	6.21E-01	1.06E+00	1.06E+00
Pa-231	27.36	10.30	8.90E-01	1.24E+00	1.24E+00
	283.69	1.70	-1.20E+00		1.86E+00
	300.07	2.47	-4.50E-01		1.47E+00
	302.65	2.20	9.67E-01		1.61E+00
	330.06	1.40	1.89E+00		2.81E+00
U-235	143.76	10.96	6.88E-02	6.63E-02	3.46E-01
	163.33	5.08	-2.79E-01		6.11E-01
	185.71	57.20	5.73E-03		6.63E-02
	202.11	1.08	5.40E-01		3.22E+00
	205.31	5.01	-3.95E-01		6.61E-01
Am-241	59.54	35.90	-1.41E-01	4.44E-01	4.44E-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 13-Dec-19-10005

L1-10214E-FSGS-007SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 13-Dec-19-10005
Sample Description	: L1-10214E-FSGS-007SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.771E+03 grams
Facility	: Default
Sample Taken On	: 12/11/2019 1:00:00PM
Acquisition Started	: 12/13/2019 9:12:00AM
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	: 12/13/2019
Efficiency Calibration Description	:
Sample Number	: 82036
Fill Height	: 1771.09 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/13/2019 9:27:03AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

123-19

Analysis Report for 13-Dec-19-10005

L1-10214E-FSGS-007SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.88	741 -	750	744.24	3.97E+01	10.56	3.13E+01	0.41
2	238.57	950 -	962	954.76	1.55E+02	18.83	7.23E+01	0.58
3	295.20	1173 -	1186	1181.01	7.57E+01	11.94	2.44E+01	1.61
4	338.38	1346 -	1360	1353.56	3.94E+01	10.39	2.36E+01	0.55
5	351.78	1400 -	1414	1407.11	8.98E+01	12.87	2.63E+01	1.06
6	582.85	2325 -	2337	2330.73	4.42E+01	9.15	1.48E+01	1.54
7	609.12	2428 -	2444	2435.73	7.29E+01	10.99	1.51E+01	0.84
8	727.16	2902 -	2913	2907.72	2.29E+01	6.22	6.09E+00	0.59
9	910.83	3636 -	3649	3642.35	4.47E+01	7.71	5.28E+00	0.63
10	1460.32	5830 -	5853	5841.66	2.33E+02	15.98	5.71E+00	1.58

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	0.96	1460.82	*	10.66	4.71E+00	3.82E-01
Tl-208	0.98	583.19	*	85.00	6.14E-02	1.32E-02
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	4.69E-01	1.30E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	0.99	115.18		0.60		

Analysis Report for 13-Dec-19-10005

L1-10214E-FSGS-007SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	238.63	*	43.60	2.37E-01	3.46E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.95E-01	3.16E-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	3.08E-01	5.44E-02
		351.93	*	35.60	2.13E-01	3.50E-02
		785.96		1.06		
Ra-226	0.98	186.21	*	3.64	6.53E-01	1.82E-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	2.88E-01	7.94E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.74E-01	4.87E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.16E-02	1.16E-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 13-Dec-19-10005

L1-10214E-FSGS-007SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.961	4.71E+00	3.82E-01	
	Tl-208	0.982	6.14E-02	1.32E-02	
X	Bi-211	0.923			
	Bi-212	0.997	4.69E-01	1.30E-01	
	Pb-212	0.999	2.37E-01	3.46E-02	
	Bi-214	0.997	1.95E-01	3.16E-02	
	Pb-214	0.998	2.41E-01	2.94E-02	
?	Ra-226	0.983	6.53E-01	1.82E-01	
	Ac-228	0.993	2.78E-01	4.15E-02	
?	U-235	0.997	4.16E-02	1.16E-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 13-Dec-19-10005

L1-10214E-FSGS-007SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/13/2019 9:27:03AM
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	5.40E-02	5.08E-02	5.08E-02
	BE-7	477.60		10.44	1.50E-01	3.98E-01	3.98E-01
+	K-40	1460.82	*	10.66	4.71E+00	3.81E-01	3.81E-01
	Mn-54	834.85		99.98	1.80E-02	4.02E-02	4.02E-02
	Co-60	1173.23		99.85	-3.39E-02	4.56E-02	4.81E-02
		1332.49		99.98	7.40E-04		4.56E-02
	Nb-94	702.65		99.81	3.34E-04	4.12E-02	4.12E-02
		871.09		99.89	-2.23E-02		4.33E-02
	Ag-108m	79.13		6.60	-5.71E-01	4.10E-02	1.51E+00
		433.94		90.50	-4.66E-03		4.10E-02
		614.28		89.80	2.53E-04		6.86E-02
		722.94		90.80	-4.52E-03		5.66E-02
	Sb-125	176.31		6.84	1.93E-01	1.19E-01	4.93E-01
		380.45		1.52	5.15E-01		2.26E+00
		427.87		29.60	-6.95E-02		1.19E-01
		463.36		10.49	6.03E-02		4.03E-01
		600.60		17.65	7.22E-02		2.35E-01
		606.71		4.98	8.01E-01		1.28E+00
		635.95		11.22	1.34E-01		3.40E-01

Analysis Report for 13-Dec-19-10005

L1-10214E-FSGS-007SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.31E-01	1.19E-01	2.20E+00
Ba-133	79.61	2.65	-2.17E+00	7.15E-02	3.64E+00
	81.00	32.90	-3.23E-01		2.58E-01
	276.40	7.16	-5.25E-02		4.46E-01
	302.85	18.34	-6.27E-02		1.93E-01
	356.01	62.05	-9.68E-03		7.15E-02
	383.85	8.94	2.81E-02		3.73E-01
Cs-134	475.36	1.48	-9.67E-01	5.69E-02	2.63E+00
	563.25	8.34	-1.68E-02		4.39E-01
	569.33	15.37	2.53E-02		2.49E-01
	604.72	97.62	-1.37E-02		6.25E-02
	795.86	85.46	2.96E-02		5.69E-02
	801.95	8.69	1.09E-01		4.88E-01
	1038.61	0.99	1.03E+00		4.67E+00
	1167.97	1.79	1.37E+00		2.88E+00
	1365.19	3.02	5.89E-01		1.46E+00
Cs-137	661.66	85.10	4.69E-02	4.83E-02	4.83E-02
Eu-152	121.78	28.67	-1.47E-01	1.15E-01	1.30E-01
	244.70	7.61	1.63E-01		4.94E-01
	295.94	0.45	1.03E+01		9.89E+00
	344.28	26.60	-4.36E-02		1.15E-01
	367.79	0.86	1.57E+00		4.23E+00
	411.12	2.24	1.61E-01		1.57E+00
	443.96	2.83	-1.22E-01		1.03E+00
	488.68	0.42	2.73E+00		8.96E+00
	563.99	0.49	-1.04E+00		7.55E+00
	586.26	0.46	1.37E+01		1.22E+01
	678.62	0.47	1.24E+00		7.69E+00
	688.67	0.86	-1.14E+00		4.12E+00
	719.35	0.28	6.37E+00		1.42E+01
	778.90	12.96	-3.92E-01		3.16E-01
	810.45	0.32	3.20E+00		1.20E+01
	867.37	4.26	4.12E-01		1.14E+00
	919.33	0.43	-1.13E+01		9.97E+00
	964.08	14.65	4.92E-01		4.51E-01
	1085.87	10.24	-5.81E-02		4.29E-01
	1089.74	1.73	-1.51E+00		2.65E+00
	1112.07	13.69	-5.79E-01		3.64E-01
	1212.95	1.43	3.08E+00		4.21E+00
	1249.94	0.19	1.14E+01		2.79E+01
	1299.14	1.63	-7.95E-01		3.09E+00
	1408.01	21.07	-9.28E-02		2.01E-01
	1457.64	0.50	9.90E+01		3.34E+01
	1528.10	0.28	7.02E-01		1.36E+01
Eu-154	123.07	40.40	-9.65E-03	9.31E-02	9.31E-02
	247.93	6.89	1.95E-02		4.69E-01
	591.76	4.95	6.03E-03		8.28E-01
	692.42	1.78	-9.67E-01		2.23E+00
	723.30	20.06	1.53E-01		2.54E-01
	756.80	4.52	-1.08E-01		7.54E-01
	873.18	12.08	2.22E-01		3.70E-01

Analysis Report for 13-Dec-19-10005

L1-10214E-FSGS-007SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	2.82E-01	9.31E-02	5.12E-01
		1004.76		18.01	-6.78E-02		2.76E-01
		1274.43		34.80	-1.50E-01		1.43E-01
		1596.48		1.80	-1.94E+00		2.21E+00
	Eu-155	45.30		1.31	1.14E+01	2.24E-01	1.99E+01
		60.01		1.22	-8.97E+00		2.12E+01
		86.55		30.70	7.53E-02		2.37E-01
		105.31		21.10	-7.04E-02		2.24E-01
+	Ra-226	186.21	*	3.64	6.53E-01	5.21E-01	5.21E-01
	Pa-231	27.36		10.30	1.69E+00	1.57E+00	2.24E+00
		283.69		1.70	2.79E-01		2.06E+00
		300.07		2.47	-1.58E+00		1.57E+00
		302.65		2.20	-6.57E-02		1.59E+00
		330.06		1.40	-5.63E-03		2.60E+00
+	U-235	143.76		10.96	-2.31E-01	3.31E-02	3.26E-01
		163.33		5.08	-3.37E-01		6.62E-01
		185.71	*	57.20	4.16E-02		3.31E-02
		202.11		1.08	-1.50E-01		3.28E+00
		205.31		5.01	-1.02E+00		6.95E-01
	Am-241	59.54		35.90	-4.62E-01	7.39E-01	7.39E-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 09-Dec-19-10015
L1-10214E-FIGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Dec-19-10015
Sample Description	: L1-10214E-FIGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.127E+03 grams
Facility	: Default
Sample Taken On	: 12/7/2019 1:10:00PM
Acquisition Started	: 12/9/2019 8:03:36AM
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	: 0.04 %
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	: 12/9/2019
Efficiency Calibration Description	:
Sample Number	: 81907
Fill Height	: 1126.59 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/9/2019 8:18:39AM

Peak Analysis From Channel : 120
Peak Analysis To Channel : 8192

DATA VALIDATED 12/9/19 - 1600
JGraham

Analysis Report for 09-Dec-19-10015

L1-10214E-FIGS-001SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.19	306 -	317	310.07	3.48E+01	16.69	8.82E+01	1.00
	2	186.01	739 -	751	744.75	7.83E+01	15.77	6.47E+01	0.51
M	3	238.75	948 -	975	955.49	2.86E+02	45.36	6.98E+01	1.11
m	4	241.88	948 -	975	967.96	4.58E+01	11.13	7.25E+01	1.12
	5	295.26	1173 -	1191	1181.25	1.12E+02	17.15	5.30E+01	1.22
	6	338.39	1347 -	1359	1353.60	5.83E+01	12.96	4.17E+01	0.63
	7	352.06	1400 -	1416	1408.21	1.90E+02	16.55	2.70E+01	1.30
	8	510.19	2035 -	2045	2040.26	1.98E+01	10.40	3.52E+01	1.06
	9	583.37	2326 -	2340	2332.78	7.07E+01	11.10	1.83E+01	0.42
	10	609.39	2428 -	2444	2436.82	1.02E+02	13.89	2.91E+01	1.39
	11	911.36	3635 -	3654	3644.47	8.44E+01	10.55	7.60E+00	1.88
	12	969.63	3871 -	3885	3877.58	4.96E+01	8.39	7.39E+00	0.90
	13	1460.97	5830 -	5856	5844.24	4.41E+02	21.36	3.49E+00	2.31

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	0.90	511.00	*	100.00	2.48E-02	1.31E-02
K-40	0.99	1460.82	*	10.66	1.03E+01	6.69E-01
Tl-208	0.99	583.19	*	85.00	1.11E-01	1.86E-02
Pb-212	0.99	115.18		0.60		

Analysis Report for 09-Dec-19-10015

L1-10214E-FIGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	238.63	*	43.60	4.84E-01	8.61E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.41E-01	1.67E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	3.08E-01	4.58E-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	4.69E-01	1.20E-01
		295.22	*	18.42	5.05E-01	8.73E-02
		351.93	*	35.60	5.03E-01	5.95E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	6.02E-01	2.96E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.99	186.21	*	3.64	1.41E+00	3.06E-01
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	4.74E-01	1.12E-01
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	5.89E-01	7.79E-02
		964.77		4.99		
		968.97	*	15.80	5.90E-01	1.03E-01
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	8.97E-02	1.95E-02
		202.11		1.08		
		205.31		5.01		

Analysis Report for 09-Dec-19-10015

L1-10214E-FIGS-001SS

* = 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
	An Pk	0.901	2.48E-02	1.31E-02	
	K-40	0.997	1.03E+01	6.69E-01	
	Tl-208	0.995	1.11E-01	1.86E-02	
X	Bi-211	0.856			
	Pb-212	0.998	4.84E-01	8.61E-02	
?	Pb212-XR	0.999	3.41E-01	1.67E-01	
	Bi-214	1.000	3.08E-01	4.58E-02	
	Pb-214	0.998	4.98E-01	4.55E-02	
?	Pb214-XR	0.999	6.02E-01	2.96E-01	
?	Ra-226	0.993	1.41E+00	3.06E-01	
	Ac-228	0.986	5.62E-01	5.44E-02	
?	U-235	0.990	8.97E-02	1.95E-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 09-Dec-19-10015

L1-10214E-FIGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/9/2019 8:18:39AM
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	2.48E-02	4.34E-02	4.34E-02
	BE-7	477.60		10.44	2.82E-02	4.40E-01	4.40E-01
+	K-40	1460.82	*	10.66	1.03E+01	3.81E-01	3.81E-01
	Mn-54	834.85		99.98	-1.02E-02	5.72E-02	5.72E-02
	Co-60	1173.23		99.85	2.26E-02	6.24E-02	7.48E-02
		1332.49		99.98	-2.25E-02		6.24E-02
	Nb-94	702.65		99.81	9.28E-03	4.97E-02	4.97E-02
		871.09		99.89	-1.42E-02		5.53E-02
	Ag-108m	79.13		6.60	-5.24E-01	4.90E-02	1.70E+00
		433.94		90.50	-7.39E-04		4.90E-02
		614.28		89.80	-8.42E-02		9.62E-02
		722.94		90.80	7.42E-02		6.90E-02
	Sb-125	176.31		6.84	9.49E-02	1.59E-01	5.58E-01
		380.45		1.52	-1.13E+00		2.53E+00
		427.87		29.60	-1.86E-02		1.59E-01
		463.36		10.49	6.54E-02		5.11E-01
		600.60		17.65	2.35E-01		3.16E-01
		606.71		4.98	3.77E+00		1.81E+00
		635.95		11.22	1.93E-01		4.33E-01

Analysis Report for 09-Dec-19-10015

L1-10214E-FIGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.61E+00	1.59E-01	2.93E+00
Ba-133	79.61	2.65	-7.50E-01	1.09E-01	4.12E+00
	81.00	32.90	-7.64E-02		2.81E-01
	276.40	7.16	-3.95E-01		6.39E-01
	302.85	18.34	4.17E-02		2.54E-01
	356.01	62.05	-4.25E-02		1.09E-01
	383.85	8.94	5.61E-03		4.35E-01
Cs-134	475.36	1.48	-1.76E+00	6.61E-02	3.03E+00
	563.25	8.34	-3.91E-01		6.12E-01
	569.33	15.37	1.76E-03		3.32E-01
	604.72	97.62	-1.59E-02		8.13E-02
	795.86	85.46	2.94E-02		6.61E-02
	801.95	8.69	-6.17E-01		6.10E-01
	1038.61	0.99	-6.25E+00		5.97E+00
	1167.97	1.79	3.71E+00		4.16E+00
	1365.19	3.02	-1.76E-01		1.73E+00
Cs-137	661.66	85.10	-9.73E-03	6.62E-02	6.62E-02
Eu-152	121.78	28.67	5.57E-02	1.58E-01	1.65E-01
	244.70	7.61	-1.87E-01		6.53E-01
	295.94	0.45	1.56E+01		1.36E+01
	344.28	26.60	-5.26E-02		1.58E-01
	367.79	0.86	3.65E+00		5.25E+00
	411.12	2.24	1.99E+00		2.29E+00
	443.96	2.83	-1.47E-01		1.37E+00
	488.68	0.42	-2.83E+00		9.99E+00
	563.99	0.49	2.30E+00		1.07E+01
	586.26	0.46	2.23E+01		1.59E+01
	678.62	0.47	3.60E+00		1.16E+01
	688.67	0.86	8.17E-01		6.51E+00
	719.35	0.28	6.33E+00		1.70E+01
	778.90	12.96	-2.74E-01		4.60E-01
	810.45	0.32	2.21E+00		1.58E+01
	867.37	4.26	-1.88E+00		1.28E+00
	919.33	0.43	4.04E+00		1.45E+01
	964.08	14.65	-3.60E-01		6.28E-01
	1085.87	10.24	1.24E-01		6.41E-01
	1089.74	1.73	2.81E+00		3.81E+00
	1112.07	13.69	-5.94E-01		3.57E-01
	1212.95	1.43	2.56E+00		6.02E+00
	1249.94	0.19	4.47E+01		3.82E+01
	1299.14	1.63	2.29E+00		4.55E+00
	1408.01	21.07	7.75E-02		2.85E-01
	1457.64	0.50	2.19E+02		5.18E+01
	1528.10	0.28	5.48E+00		1.34E+01
Eu-154	123.07	40.40	-9.76E-02	1.14E-01	1.14E-01
	247.93	6.89	-7.88E-02		6.27E-01
	591.76	4.95	3.96E-01		1.00E+00
	692.42	1.78	1.20E+00		3.04E+00
	723.30	20.06	1.81E-01		3.08E-01
	756.80	4.52	3.86E-01		1.18E+00
	873.18	12.08	2.24E-01		4.81E-01

Analysis Report for 09-Dec-19-10015

L1-10214E-FIGS-001SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-3.04E-01	1.14E-01	5.08E-01
		1004.76		18.01	1.71E-01		3.30E-01
		1274.43		34.80	-1.88E-01		1.77E-01
		1596.48		1.80	-9.06E-02		2.56E+00
	Eu-155	45.30		1.31	3.09E+00	2.43E-01	2.25E+01
		60.01		1.22	-2.78E+01		2.43E+01
		86.55		30.70	-8.52E-02		2.80E-01
		105.31		21.10	1.80E-01		2.43E-01
+	Ra-226	186.21	*	3.64	1.41E+00	8.49E-01	8.49E-01
	Pa-231	27.36		10.30	3.73E+00	2.12E+00	2.87E+00
		283.69		1.70	-2.67E+00		2.43E+00
		300.07		2.47	2.27E-01		2.12E+00
		302.65		2.20	1.30E+00		2.13E+00
		330.06		1.40	1.09E+00		3.33E+00
+	U-235	143.76		10.96	1.33E-01	5.40E-02	4.14E-01
		163.33		5.08	-4.05E-01		8.12E-01
		185.71	*	57.20	8.97E-02		5.40E-02
		202.11		1.08	-4.33E-01		3.83E+00
		205.31		5.01	-3.53E-01		8.58E-01
	Am-241	59.54		35.90	-5.28E-01	8.65E-01	8.65E-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 09-Dec-19-10016
L1-10214E-FIGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Dec-19-10016
Sample Description	: L1-10214E-FIGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.380E+03 grams
Facility	: Default
Sample Taken On	: 12/7/2019 1:12:00PM
Acquisition Started	: 12/9/2019 8:20:17AM
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	: 12/9/2019
Efficiency Calibration Description	:
Sample Number	: 81908
Fill Height	: 1380.33 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/9/2019 8:35:20AM

Peak Analysis From Channel : 120
Peak Analysis To Channel : 4096

DATA VALIDATED 12/9/19 - 1600
JGraham

Analysis Report for 09-Dec-19-10016

L1-10214E-FIGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.64	473 -	481	477.46	2.19E+02	24.81	1.82E+02	1.14
2	270.42	538 -	545	540.95	2.93E+01	13.20	7.17E+01	0.78
3	295.24	587 -	595	590.54	8.40E+01	15.40	7.00E+01	1.14
4	351.82	698 -	708	703.59	1.88E+02	17.73	5.34E+01	1.27
5	583.14	1160 -	1170	1165.89	1.06E+02	13.68	3.43E+01	1.73
6	609.10	1212 -	1223	1217.77	1.41E+02	15.27	3.65E+01	1.52
7	727.21	1451 -	1457	1453.91	1.46E+01	7.20	1.84E+01	1.09
8	911.20	1817 -	1826	1821.84	5.51E+01	10.54	2.49E+01	0.99
9	969.27	1933 -	1944	1937.99	3.41E+01	10.43	2.89E+01	1.45
10	1120.21	2236 -	2243	2239.98	2.70E+01	8.04	1.80E+01	0.91
11	1460.34	2913 -	2928	2920.73	4.29E+02	20.71	0.00E+00	2.25

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	0.96	1460.82	*	10.66	8.32E+00	5.40E-01
Tl-208	1.00	583.19	*	85.00	1.40E-01	1.99E-02
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	2.84E-01	1.42E-01
		785.37		1.10		
		1620.50		1.47		

Analysis Report for 09-Dec-19-10016

L1-10214E-FIGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	3.14E-01	4.36E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	3.57E-01	4.44E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	3.13E-01	9.39E-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	3.21E-01	6.43E-02
		351.93	*	35.60	4.20E-01	5.21E-02
		785.96		1.06		
Ac-228	0.73	129.07		2.42		
		209.25		3.89		
		270.24	*	3.46	5.67E-01	2.59E-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	3.23E-01	6.33E-02
		964.77		4.99		
		968.97	*	15.80	3.40E-01	1.05E-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 09-Dec-19-10016

L1-10214E-FIGS-002SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.963	8.32E+00	5.40E-01	
	Tl-208	1.000	1.40E-01	1.99E-02	
X	Bi-211	0.913			
	Bi-212	0.999	2.84E-01	1.42E-01	
	Pb-212	1.000	3.14E-01	4.36E-02	
	Bi-214	0.997	3.49E-01	4.01E-02	
	Pb-214	0.999	3.81E-01	4.05E-02	
X	Rn-219	0.937			
	Ac-228	0.737	3.37E-01	5.30E-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 09-Dec-19-10016

L1-10214E-FIGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/9/2019 8:35:20AM
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	9.42E-02	6.15E-02	6.15E-02
	BE-7	477.60		10.44	-3.49E-02	3.92E-01	3.92E-01
+	K-40	1460.82	*	10.66	8.32E+00	5.58E-02	5.58E-02
	Mn-54	834.85		99.98	3.58E-03	5.11E-02	5.11E-02
	Co-60	1173.23		99.85	3.32E-03	4.02E-02	5.84E-02
		1332.49		99.98	-3.30E-02		4.02E-02
	Nb-94	702.65		99.81	-1.93E-02	3.72E-02	3.72E-02
		871.09		99.89	-8.74E-03		4.14E-02
	Ag-108m	79.13		6.60	1.45E+00	4.14E-02	1.47E+00
		433.94		90.50	-1.37E-02		4.14E-02
		614.28		89.80	-2.26E-02		6.56E-02
		722.94		90.80	-4.11E-02		5.54E-02
	Sb-125	176.31		6.84	8.96E-02	1.21E-01	5.65E-01
		380.45		1.52	5.60E-01		2.42E+00
		427.87		29.60	-2.08E-02		1.21E-01
		463.36		10.49	1.43E-01		3.74E-01
		600.60		17.65	-8.45E-02		2.26E-01
		606.71		4.98	-1.05E-01		1.63E+00
		635.95		11.22	-1.63E-01		3.49E-01

Analysis Report for 09-Dec-19-10016

L1-10214E-FIGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-8.59E-01	1.21E-01	2.13E+00
Ba-133	79.61	2.65	5.18E-01	8.83E-02	3.31E+00
	81.00	32.90	-5.10E-01		2.06E-01
	276.40	7.16	-1.27E-01		5.25E-01
	302.85	18.34	6.91E-02		2.07E-01
	356.01	62.05	-4.89E-02		8.83E-02
	383.85	8.94	1.29E-01		4.42E-01
Cs-134	475.36	1.48	6.42E-01	5.43E-02	2.74E+00
	563.25	8.34	-1.17E-01		4.18E-01
	569.33	15.37	5.95E-02		2.39E-01
	604.72	97.62	-1.10E-02		7.24E-02
	795.86	85.46	2.38E-02		5.43E-02
	801.95	8.69	1.20E-01		4.87E-01
	1038.61	0.99	-1.43E+00		4.78E+00
	1167.97	1.79	5.09E-01		3.22E+00
	1365.19	3.02	3.03E-01		1.72E+00
Cs-137	661.66	85.10	6.89E-02	6.80E-02	6.80E-02
Eu-152	121.78	28.67	-2.91E-02	1.20E-01	1.20E-01
	244.70	7.61	6.00E-02		5.62E-01
	295.94	0.45	9.07E+00		1.07E+01
	344.28	26.60	-1.52E-01		1.44E-01
	367.79	0.86	-1.20E+00		4.05E+00
	411.12	2.24	2.84E-02		1.71E+00
	443.96	2.83	-5.08E-02		1.21E+00
	488.68	0.42	-9.20E-01		9.37E+00
	563.99	0.49	3.54E-01		7.27E+00
	586.26	0.46	-9.02E+00		1.60E+01
	678.62	0.47	1.10E+00		9.24E+00
	688.67	0.86	-2.28E+00		5.43E+00
	719.35	0.28	2.24E+00		1.47E+01
	778.90	12.96	2.45E-02		3.79E-01
	810.45	0.32	-3.99E+00		1.21E+01
	867.37	4.26	-5.52E-01		9.84E-01
	919.33	0.43	-7.33E+00		1.05E+01
	964.08	14.65	9.39E-02		4.57E-01
	1085.87	10.24	-4.13E-01		4.36E-01
	1089.74	1.73	-7.05E-02		2.94E+00
	1112.07	13.69	1.58E-01		4.12E-01
	1212.95	1.43	1.63E+00		4.32E+00
	1249.94	0.19	6.12E+00		3.06E+01
	1299.14	1.63	2.38E+00		3.41E+00
	1408.01	21.07	-4.81E-02		1.99E-01
	1457.64	0.50	-5.06E+00		4.21E+01
	1528.10	0.28	-1.95E+00		1.18E+01
Eu-154	123.07	40.40	-4.50E-02	8.36E-02	8.36E-02
	247.93	6.89	-1.50E-01		5.09E-01
	591.76	4.95	6.40E-02		8.75E-01
	692.42	1.78	8.51E-01		2.61E+00
	723.30	20.06	-1.88E-01		2.59E-01
	756.80	4.52	2.61E-01		1.04E+00
	873.18	12.08	-2.19E-01		3.38E-01

Analysis Report for 09-Dec-19-10016

L1-10214E-FIGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	9.35E-02	8.36E-02	4.25E-01
	1004.76	18.01	-7.86E-02		2.40E-01
	1274.43	34.80	-9.48E-02		1.50E-01
	1596.48	1.80	6.77E-01		2.86E+00
Eu-155	45.30	1.31	1.70E+00	1.98E-01	1.29E+01
	60.01	1.22	-8.77E+00		1.43E+01
	86.55	30.70	2.26E-02		2.06E-01
	105.31	21.10	-1.42E-03		1.98E-01
Ra-226	186.21	3.64	9.44E-01	1.25E+00	1.25E+00
Pa-231	27.36	10.30	7.46E-01	1.34E+00	1.34E+00
	283.69	1.70	-7.65E-01		2.04E+00
	300.07	2.47	1.51E-01		1.57E+00
	302.65	2.20	5.75E-01		1.73E+00
	330.06	1.40	2.11E+00		2.85E+00
U-235	143.76	10.96	1.28E-01	7.87E-02	3.42E-01
	163.33	5.08	2.97E-01		7.85E-01
	185.71	57.20	6.17E-02		7.87E-02
	202.11	1.08	-2.79E-01		3.59E+00
	205.31	5.01	-8.83E-02		7.90E-01
Am-241	59.54	35.90	-5.55E-01	4.80E-01	4.80E-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 13-Dec-19-10001

L1-10214E-FIGS-001SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 13-Dec-19-10001
Sample Description	: L1-10214E-FIGS-001SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.625E+03 grams
Facility	: Default
Sample Taken On	: 12/11/2019 1:10:00PM
Acquisition Started	: 12/13/2019 9:11:38AM
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	: 12/13/2019
Efficiency Calibration Description	:
Sample Number	: 82033
Fill Height	: 1624.99 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/13/2019 9:26:41AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated

0900 12/15/19

Analysis Report for 13-Dec-19-10001

L1-10214E-FIGS-001SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.20	151 -	158	155.00	8.54E+01	19.21	1.38E+02	0.81
2	238.63	474 -	481	477.44	1.65E+02	20.62	1.25E+02	1.11
3	295.22	587 -	595	590.50	5.44E+01	13.87	6.36E+01	1.11
4	351.95	699 -	708	703.85	1.26E+02	14.63	3.88E+01	1.36
5	583.05	1161 -	1171	1165.70	4.47E+01	10.38	2.63E+01	1.27
6	609.27	1212 -	1223	1218.11	1.16E+02	12.98	2.09E+01	1.77
7	661.38	1319 -	1327	1322.30	2.43E+01	8.35	2.07E+01	0.95
8	911.25	1815 -	1827	1821.95	5.86E+01	10.12	1.64E+01	1.65
9	1120.23	2236 -	2244	2240.02	2.26E+01	5.84	5.42E+00	0.74
10	1460.69	2913 -	2928	2921.44	3.26E+02	18.21	1.92E+00	1.76
11	1764.01	3525 -	3534	3528.88	1.89E+01	4.62	1.11E+00	1.11

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	6.03E+00	4.27E-01
Cs-137	0.98	661.66	*	85.10	3.35E-02	1.17E-02
Tl-208	0.99	583.19	*	85.00	5.69E-02	1.36E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.28E-01	3.41E-02
		300.09		3.30		

Analysis Report for 13-Dec-19-10001

L1-10214E-FIGS-001SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	5.54E-01	1.37E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.84E-01	3.61E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.50E-01	6.55E-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	2.80E-01	6.94E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.01E-01	5.38E-02
		351.93	*	35.60	2.73E-01	3.85E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	9.76E-01	2.45E-01
		87.35		2.24		
		89.78		0.82		
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	3.29E-01	5.85E-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 13-Dec-19-10001

L1-10214E-FIGS-001SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	6.03E+00	4.27E-01	
	Cs-137	0.988	3.35E-02	1.17E-02	
	Tl-208	0.997	5.69E-02	1.36E-02	
X	Bi-211	0.883			
	Pb-212	1.000	2.28E-01	3.41E-02	
?	Pb212-XR	0.999	5.54E-01	1.37E-01	
	Bi-214	0.995	2.77E-01	2.87E-02	
	Pb-214	1.000	2.49E-01	3.13E-02	
?	Pb214-XR	0.999	9.76E-01	2.45E-01	
	Ac-228	1.000	3.29E-01	5.85E-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 13-Dec-19-10001

L1-10214E-FIGS-001SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/13/2019 9:26:41AM
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	5.62E-02	5.16E-02	5.16E-02
	BE-7	477.60		10.44	1.79E-02	3.42E-01	3.42E-01
+	K-40	1460.82	*	10.66	6.03E+00	2.02E-01	2.02E-01
	Mn-54	834.85		99.98	1.12E-02	4.00E-02	4.00E-02
	Co-60	1173.23		99.85	-4.57E-03	4.58E-02	5.52E-02
		1332.49		99.98	-7.77E-03		4.58E-02
	Nb-94	702.65		99.81	-3.11E-02	3.23E-02	3.23E-02
		871.09		99.89	-1.24E-02		3.56E-02
	Ag-108m	79.13		6.60	-3.38E-01	3.90E-02	1.13E+00
		433.94		90.50	1.23E-02		3.90E-02
		614.28		89.80	-2.53E-02		5.74E-02
		722.94		90.80	7.71E-03		4.85E-02
	Sb-125	176.31		6.84	4.60E-02	1.07E-01	5.17E-01
		380.45		1.52	-7.11E-02		2.00E+00
		427.87		29.60	-3.91E-02		1.07E-01
		463.36		10.49	7.51E-02		3.32E-01
		600.60		17.65	-3.87E-02		1.88E-01
		606.71		4.98	-1.78E-01		1.36E+00
		635.95		11.22	4.30E-01		3.99E-01

Analysis Report for 13-Dec-19-10001

L1-10214E-FIGS-001SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-1.40E+00	1.07E-01	2.10E+00
	Ba-133	79.61		2.65	-1.30E+00	7.42E-02	2.60E+00
		81.00		32.90	-2.23E-01		1.66E-01
		276.40		7.16	1.08E-01		4.56E-01
		302.85		18.34	7.42E-02		1.79E-01
		356.01		62.05	-3.19E-02		7.42E-02
		383.85		8.94	-8.56E-02		3.73E-01
	Cs-134	475.36		1.48	8.65E-01	5.49E-02	2.38E+00
		563.25		8.34	3.32E-01		4.76E-01
		569.33		15.37	-2.93E-02		2.33E-01
		604.72		97.62	7.18E-03		5.89E-02
		795.86		85.46	4.34E-02		5.49E-02
		801.95		8.69	-4.98E-02		4.47E-01
		1038.61		0.99	-4.38E-01		4.35E+00
		1167.97		1.79	2.13E-01		2.80E+00
		1365.19		3.02	-5.44E-01		1.17E+00
+	Cs-137	661.66	*	85.10	3.35E-02	3.55E-02	3.55E-02
	Eu-152	121.78		28.67	7.26E-03	1.20E-01	1.20E-01
		244.70		7.61	-3.67E-01		4.63E-01
		295.94		0.45	6.94E+00		9.37E+00
		344.28		26.60	-2.57E-02		1.32E-01
		367.79		0.86	-2.22E-01		3.46E+00
		411.12		2.24	4.84E-01		1.78E+00
		443.96		2.83	-4.21E-01		1.10E+00
		488.68		0.42	1.62E+00		7.78E+00
		563.99		0.49	3.44E+00		7.93E+00
		586.26		0.46	-2.62E+00		1.07E+01
		678.62		0.47	-9.38E-01		7.70E+00
		688.67		0.86	-7.83E-01		4.39E+00
		719.35		0.28	2.51E+00		1.30E+01
		778.90		12.96	-5.25E-02		2.75E-01
		810.45		0.32	1.06E+00		1.12E+01
		867.37		4.26	1.28E-01		8.83E-01
		919.33		0.43	-3.07E+00		9.46E+00
		964.08		14.65	-1.68E-01		3.77E-01
		1085.87		10.24	2.02E-01		4.81E-01
		1089.74		1.73	1.35E+00		2.86E+00
		1112.07		13.69	5.09E-02		3.34E-01
		1212.95		1.43	-7.12E-01		4.04E+00
		1249.94		0.19	8.42E+00		2.81E+01
		1299.14		1.63	-5.02E-01		2.32E+00
		1408.01		21.07	-3.33E-02		2.01E-01
		1457.64		0.50	-6.20E-01		3.53E+01
		1528.10		0.28	-1.81E-01		1.06E+01
	Eu-154	123.07		40.40	-3.98E-03	8.47E-02	8.47E-02
		247.93		6.89	-8.40E-02		4.61E-01
		591.76		4.95	-7.39E-02		6.43E-01
		692.42		1.78	1.60E+00		2.26E+00
		723.30		20.06	-1.29E-03		2.22E-01
		756.80		4.52	1.77E-01		8.75E-01
		873.18		12.08	-8.73E-03		3.01E-01

Analysis Report for 13-Dec-19-10001

L1-10214E-FIGS-001SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.93E-03	8.47E-02	3.93E-01
	1004.76	18.01	6.51E-02		2.34E-01
	1274.43	34.80	8.54E-03		1.31E-01
	1596.48	1.80	3.78E-01		2.20E+00
Eu-155	45.30	1.31	3.25E+00	1.83E-01	1.19E+01
	60.01	1.22	-6.46E+00		1.30E+01
	86.55	30.70	5.86E-02		1.83E-01
	105.31	21.10	3.91E-02		1.91E-01
Ra-226	186.21	3.64	7.13E-01	1.07E+00	1.07E+00
Pa-231	27.36	10.30	5.26E-01	1.15E+00	1.15E+00
	283.69	1.70	1.52E-01		1.94E+00
	300.07	2.47	4.63E-01		1.30E+00
	302.65	2.20	6.18E-01		1.49E+00
	330.06	1.40	6.39E-01		2.37E+00
U-235	143.76	10.96	1.85E-02	6.85E-02	2.89E-01
	163.33	5.08	2.98E-01		7.36E-01
	185.71	57.20	5.17E-02		6.85E-02
	202.11	1.08	-6.83E-01		3.21E+00
	205.31	5.01	3.28E-02		7.10E-01
Am-241	59.54	35.90	-3.41E-01	4.44E-01	4.44E-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 13-Dec-19-10002

L1-10214E-QIGS-001SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 13-Dec-19-10002
Sample Description	: L1-10214E-QIGS-001SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.694E+03 grams
Facility	: Default
Sample Taken On	: 12/11/2019 1:10:00PM
Acquisition Started	: 12/13/2019 9:31:57AM
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	: 12/13/2019
Efficiency Calibration Description	:
Sample Number	: 82037
Fill Height	: 1694.27 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/13/2019 9:47:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated

0900 12/17/5-19

Analysis Report for 13-Dec-19-10002

L1-10214E-QIGS-001SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	238.67	473 -	481	477.51	1.50E+02	22.25	1.57E+02	1.15
	2	295.10	585 -	594	590.26	8.02E+01	15.16	6.48E+01	1.32
	3	351.97	698 -	708	703.89	1.23E+02	15.45	4.81E+01	1.12
	4	583.07	1161 -	1171	1165.75	6.28E+01	10.78	2.23E+01	1.38
	5	609.10	1212 -	1223	1217.77	8.05E+01	12.33	2.85E+01	1.48
	6	911.29	1816 -	1828	1822.02	7.73E+01	10.14	9.75E+00	1.37
M	7	964.46	1924 -	1941	1928.38	1.59E+01	4.40	6.30E+00	1.19
m	8	968.92	1924 -	1941	1937.31	3.18E+01	6.09	7.27E+00	1.19
	9	1460.63	2913 -	2928	2921.31	3.43E+02	19.62	1.40E+01	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	0.99	1460.82	*	10.66	6.28E+00	4.51E-01
Tl-208	0.99	583.19	*	85.00	7.92E-02	1.44E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.06E-01	3.49E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.95E-01	3.21E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 13-Dec-19-10002

L1-10214E-QIGS-001SB

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	2.95E-01	6.06E-02
		351.93	*	35.60	2.64E-01	3.94E-02
		785.96		1.06		
Ac-228	0.73	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	4.30E-01	5.93E-02
		964.77	*	4.99	4.73E-01	1.33E-01
		968.97	*	15.80	3.00E-01	5.90E-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 13-Dec-19-10002

L1-10214E-QIGS-001SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.994	6.28E+00	4.51E-01	
	Tl-208	0.998	7.92E-02	1.44E-02	
X	Bi-211	0.878			
	Pb-212	1.000	2.06E-01	3.49E-02	
	Bi-214	0.997	1.95E-01	3.21E-02	
	Pb-214	0.999	2.74E-01	3.30E-02	
	Ac-228	0.739	3.74E-01	3.99E-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 13-Dec-19-10002

L1-10214E-QIGS-001SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/13/2019 9:47:00AM
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	6.37E-02	5.36E-02	5.36E-02
	BE-7	477.60		10.44	-1.51E-01	2.85E-01	2.85E-01
+	K-40	1460.82	*	10.66	6.28E+00	4.54E-01	4.54E-01
	Mn-54	834.85		99.98	2.43E-04	4.25E-02	4.25E-02
	Co-60	1173.23		99.85	-1.02E-02	4.82E-02	5.06E-02
		1332.49		99.98	-2.59E-03		4.82E-02
	Nb-94	702.65		99.81	6.16E-03	3.31E-02	3.59E-02
		871.09		99.89	-1.32E-02		3.31E-02
	Ag-108m	79.13		6.60	5.68E-01	3.45E-02	1.23E+00
		433.94		90.50	-4.56E-03		3.45E-02
		614.28		89.80	-3.28E-02		5.14E-02
		722.94		90.80	2.68E-03		4.86E-02
	Sb-125	176.31		6.84	1.06E-01	1.11E-01	5.12E-01
		380.45		1.52	-6.93E-01		1.87E+00
		427.87		29.60	-1.25E-03		1.11E-01
		463.36		10.49	1.06E-01		2.99E-01
		600.60		17.65	-2.11E-02		2.15E-01
		606.71		4.98	1.11E-01		1.27E+00
		635.95		11.22	-6.63E-03		3.44E-01

Analysis Report for 13-Dec-19-10002

L1-10214E-QIGS-001SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.89E-01	1.11E-01	1.80E+00
Ba-133	79.61	2.65	-5.40E-01	7.37E-02	2.80E+00
	81.00	32.90	-3.11E-01		1.94E-01
	276.40	7.16	1.71E-02		4.55E-01
	302.85	18.34	-2.19E-02		1.60E-01
	356.01	62.05	-5.05E-02		7.37E-02
	383.85	8.94	1.51E-01		3.59E-01
Cs-134	475.36	1.48	9.09E-01	4.93E-02	2.14E+00
	563.25	8.34	-1.06E-01		3.99E-01
	569.33	15.37	4.97E-02		2.09E-01
	604.72	97.62	6.69E-04		5.81E-02
	795.86	85.46	1.78E-02		4.93E-02
	801.95	8.69	-2.49E-01		4.08E-01
	1038.61	0.99	-1.74E+00		4.53E+00
	1167.97	1.79	-1.28E+00		2.93E+00
	1365.19	3.02	5.40E-01		1.32E+00
Cs-137	661.66	85.10	5.11E-02	5.73E-02	5.73E-02
Eu-152	121.78	28.67	6.36E-03	1.17E-01	1.17E-01
	244.70	7.61	2.29E-02		5.32E-01
	295.94	0.45	-2.10E+00		9.61E+00
	344.28	26.60	-1.47E-01		1.32E-01
	367.79	0.86	-7.84E-01		3.43E+00
	411.12	2.24	-6.83E-01		1.32E+00
	443.96	2.83	-3.17E-01		1.08E+00
	488.68	0.42	9.48E-01		7.38E+00
	563.99	0.49	-1.78E-01		6.85E+00
	586.26	0.46	-3.06E-01		1.20E+01
	678.62	0.47	-1.26E+00		7.64E+00
	688.67	0.86	-1.95E+00		4.00E+00
	719.35	0.28	-7.72E-01		1.46E+01
	778.90	12.96	-1.18E-01		2.96E-01
	810.45	0.32	9.15E+00		1.31E+01
	867.37	4.26	-7.58E-02		8.43E-01
	919.33	0.43	-5.62E+00		9.22E+00
	964.08	14.65	-6.73E-02		3.70E-01
	1085.87	10.24	2.47E-01		4.76E-01
	1089.74	1.73	2.52E+00		3.08E+00
	1112.07	13.69	-3.04E-01		2.95E-01
	1212.95	1.43	-2.17E+00		3.51E+00
	1249.94	0.19	-4.34E+00		2.70E+01
	1299.14	1.63	5.46E-01		2.44E+00
	1408.01	21.07	1.59E-01		2.19E-01
	1457.64	0.50	9.69E-02		3.65E+01
	1528.10	0.28	-6.26E+00		1.29E+01
Eu-154	123.07	40.40	-1.77E-02	8.02E-02	8.02E-02
	247.93	6.89	6.57E-02		4.97E-01
	591.76	4.95	-1.35E-01		6.75E-01
	692.42	1.78	-1.27E-01		1.94E+00
	723.30	20.06	2.15E-02		2.22E-01
	756.80	4.52	1.28E-02		7.14E-01
	873.18	12.08	-6.68E-02		2.81E-01

Analysis Report for 13-Dec-19-10002

L1-10214E-QIGS-001SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.12E-01	8.02E-02	4.16E-01
	1004.76	18.01	1.09E-01		2.51E-01
	1274.43	34.80	-2.55E-03		1.63E-01
	1596.48	1.80	-3.19E-01		2.00E+00
Eu-155	45.30	1.31	5.15E-01	1.89E-01	1.16E+01
	60.01	1.22	-3.72E-01		1.24E+01
	86.55	30.70	3.58E-02		1.89E-01
	105.31	21.10	3.11E-02		1.96E-01
Ra-226	186.21	3.64	3.20E-01	1.02E+00	1.02E+00
Pa-231	27.36	10.30	9.20E-01	1.19E+00	1.19E+00
	283.69	1.70	-1.15E+00		1.75E+00
	300.07	2.47	-1.04E+00		1.24E+00
	302.65	2.20	-1.82E-01		1.33E+00
	330.06	1.40	9.45E-02		2.60E+00
U-235	143.76	10.96	7.92E-02	6.49E-02	3.08E-01
	163.33	5.08	4.90E-01		7.55E-01
	185.71	57.20	3.09E-02		6.49E-02
	202.11	1.08	8.87E-02		3.35E+00
	205.31	5.01	-2.10E-01		7.06E-01
Am-241	59.54	35.90	-1.36E-01	4.23E-01	4.23E-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 13-Dec-19-10003

L1-10214E-FIGS-002SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 13-Dec-19-10003
Sample Description	: L1-10214E-FIGS-002SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.750E+03 grams
Facility	: Default
Sample Taken On	: 12/11/2019 1:20:00PM
Acquisition Started	: 12/13/2019 9:11:46AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.9 seconds
Dead Time	: 0.21 %
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	: 12/13/2019
Efficiency Calibration Description	:
Sample Number	: 82034
Fill Height	: 1749.64 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/13/2019 9:26:50AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0900 12-15-19

Analysis Report for 13-Dec-19-10003

L1-10214E-FIGS-002SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	238.69	949 -	974	954.85	2.65E+02	17.72	7.89E+01	0.94
m	2	241.91	949 -	974	967.72	5.53E+01	9.99	8.23E+01	0.94
	3	295.21	1173 -	1187	1180.74	1.49E+02	19.24	7.68E+01	1.01
	4	338.32	1345 -	1360	1353.04	6.86E+01	14.85	5.04E+01	1.15
	5	351.90	1401 -	1416	1407.33	2.60E+02	20.32	5.06E+01	1.04
	6	583.11	2324 -	2339	2331.66	8.62E+01	11.55	1.58E+01	1.12
	7	609.24	2428 -	2443	2436.15	1.88E+02	16.66	2.97E+01	1.22
	8	768.21	3067 -	3077	3071.82	2.27E+01	7.38	1.33E+01	0.38
	9	794.97	3174 -	3183	3178.88	1.26E+01	5.67	8.39E+00	0.35
	10	911.07	3635 -	3652	3643.25	5.09E+01	9.32	1.11E+01	1.02
	11	1120.25	4474 -	4487	4480.08	4.39E+01	8.46	1.01E+01	1.08
	12	1460.70	5833 -	5853	5842.64	2.35E+02	16.28	8.11E+00	1.21
	13	1764.29	7052 -	7065	7058.17	3.23E+01	7.13	6.74E+00	0.50

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	5.65E+00	4.62E-01
Tl-208	0.99	583.19	*	85.00	1.40E-01	2.05E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	4.65E-01	4.87E-02

Analysis Report for 13-Dec-19-10003

L1-10214E-FIGS-002SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	300.09		3.30		
Bi-214	0.99	609.32	*	45.49	5.88E-01	6.29E-02
		768.36	*	4.89	7.71E-01	2.54E-01
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	6.29E-01	1.24E-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	6.25E-01	1.40E-01
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99	*	7.25	5.86E-01	1.16E-01
		295.22	*	18.42	6.95E-01	1.05E-01
		351.93	*	35.60	7.11E-01	7.95E-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	5.75E-01	1.33E-01
		409.46		1.92		
		463.00		4.40		
		794.95	*	4.25	5.04E-01	2.28E-01
		911.20	*	25.80	3.67E-01	6.91E-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 13-Dec-19-10003

L1-10214E-FIGS-002SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	5.65E+00	4.62E-01	
X	Cs-134	0.952			
	Tl-208	0.999	1.40E-01	2.05E-02	
X	Bi-211	0.896			
	Pb-212	0.999	4.65E-01	4.87E-02	
	Bi-214	0.999	6.07E-01	5.10E-02	
	Pb-214	1.000	6.78E-01	5.57E-02	
	Ac-228	0.999	4.18E-01	5.92E-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 13-Dec-19-10003

L1-10214E-FIGS-002SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/13/2019 9:26:50AM
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	1.01E-01	7.43E-02	7.43E-02
	BE-7	477.60		10.44	-1.20E-01	5.17E-01	5.17E-01
+	K-40	1460.82	*	10.66	5.65E+00	5.18E-01	5.18E-01
	Mn-54	834.85		99.98	-4.58E-03	5.92E-02	5.92E-02
	Co-60	1173.23		99.85	2.24E-02	4.99E-02	6.43E-02
		1332.49		99.98	-1.71E-02		4.99E-02
	Nb-94	702.65		99.81	-7.13E-02	5.02E-02	5.02E-02
		871.09		99.89	-2.01E-02		5.34E-02
	Ag-108m	79.13		6.60	1.59E+00	5.63E-02	2.48E+00
		433.94		90.50	-1.40E-03		5.63E-02
		614.28		89.80	-8.48E-02		9.19E-02
		722.94		90.80	-8.84E-03		6.40E-02
	Sb-125	176.31		6.84	-2.21E-01	1.70E-01	7.40E-01
		380.45		1.52	-3.00E+00		2.74E+00
		427.87		29.60	-3.96E-02		1.70E-01
		463.36		10.49	1.45E-01		5.21E-01
		600.60		17.65	-7.18E-02		2.33E-01
		606.71		4.98	6.64E+00		2.23E+00
		635.95		11.22	4.78E-01		5.26E-01

Analysis Report for 13-Dec-19-10003

L1-10214E-FIGS-002SB

Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44		1.79	2.24E-01	1.70E-01	2.88E+00
Ba-133	79.61		2.65	-5.66E-01	1.13E-01	5.77E+00
	81.00		32.90	-6.59E-01		3.98E-01
	276.40		7.16	-1.53E-01		6.63E-01
	302.85		18.34	2.17E-01		2.68E-01
	356.01		62.05	-4.02E-02		1.13E-01
	383.85		8.94	1.56E-01		5.27E-01
Cs-134	475.36		1.48	-5.19E-01	3.56E-02	3.45E+00
	563.25		8.34	1.22E-01		6.22E-01
	569.33		15.37	-7.98E-02		3.13E-01
	604.72		97.62	-1.88E-02		9.85E-02
	795.86	*	85.46	2.51E-02		3.56E-02
	801.95		8.69	2.73E-01		6.47E-01
	1038.61		0.99	-4.11E+00		5.72E+00
	1167.97		1.79	3.07E-02		3.94E+00
	1365.19		3.02	2.08E-01		1.68E+00
Cs-137	661.66		85.10	1.95E-02	6.73E-02	6.73E-02
Eu-152	121.78		28.67	9.38E-02	1.60E-01	2.14E-01
	244.70		7.61	-2.55E-01		7.61E-01
	295.94		0.45	2.29E+01		1.60E+01
	344.28		26.60	-9.15E-02		1.60E-01
	367.79		0.86	2.88E+00		5.30E+00
	411.12		2.24	-1.44E+00		2.10E+00
	443.96		2.83	-3.13E-01		1.75E+00
	488.68		0.42	-3.42E-01		1.28E+01
	563.99		0.49	2.13E+00		1.04E+01
	586.26		0.46	-3.29E+00		1.67E+01
	678.62		0.47	-3.81E+00		1.04E+01
	688.67		0.86	-5.03E-01		6.24E+00
	719.35		0.28	-2.51E+01		1.58E+01
	778.90		12.96	-2.32E-01		3.66E-01
	810.45		0.32	-5.36E+00		1.59E+01
	867.37		4.26	-1.05E+00		1.32E+00
	919.33		0.43	-1.27E+01		1.26E+01
	964.08		14.65	5.11E-01		6.08E-01
	1085.87		10.24	-1.75E-01		4.98E-01
	1089.74		1.73	-1.34E+00		3.26E+00
	1112.07		13.69	-8.16E-02		4.53E-01
	1212.95		1.43	-1.46E+00		4.46E+00
	1249.94		0.19	1.52E+00		3.64E+01
	1299.14		1.63	4.71E-01		3.20E+00
	1408.01		21.07	-3.03E-02		2.68E-01
	1457.64		0.50	1.25E+02		4.04E+01
	1528.10		0.28	8.54E-01		1.55E+01
Eu-154	123.07		40.40	-1.88E-02	1.49E-01	1.49E-01
	247.93		6.89	-1.75E-01		6.84E-01
	591.76		4.95	5.50E-01		9.24E-01
	692.42		1.78	-1.31E+00		2.99E+00
	723.30		20.06	1.78E-01		3.03E-01
	756.80		4.52	7.39E-01		1.15E+00
	873.18		12.08	5.77E-03		4.68E-01

Analysis Report for 13-Dec-19-10003

L1-10214E-FIGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.59E-01	1.49E-01	5.16E-01
	1004.76	18.01	1.99E-02		3.22E-01
	1274.43	34.80	-1.38E-01		1.79E-01
	1596.48	1.80	1.68E+00		2.87E+00
Eu-155	45.30	1.31	6.78E+00	3.46E-01	4.12E+01
	60.01	1.22	1.29E+01		4.12E+01
	86.55	30.70	2.90E-01		3.72E-01
	105.31	21.10	-1.55E-01		3.46E-01
Ra-226	186.21	3.64	1.42E+00	1.56E+00	1.56E+00
Pa-231	27.36	10.30	3.73E+00	2.02E+00	4.52E+00
	283.69	1.70	7.69E-01		2.63E+00
	300.07	2.47	-1.17E+00		2.02E+00
	302.65	2.20	7.06E-01		2.20E+00
	330.06	1.40	-3.34E+00		3.21E+00
U-235	143.76	10.96	-8.93E-02	9.90E-02	5.22E-01
	163.33	5.08	-6.24E-01		9.41E-01
	185.71	57.20	8.30E-02		9.90E-02
	202.11	1.08	-1.03E+00		4.35E+00
	205.31	5.01	-5.94E-02		9.75E-01
Am-241	59.54	35.90	8.51E-02	1.45E+00	1.45E+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-46670

February 4, 2020

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

CASE NARRATIVE
Work Order # 20-01037-OR

SAMPLE RECEIPT

This work order contains fourteen soil samples received 01/09/2020. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L2-10214-A-FIGS-001-SS-A	20-01037-04	L2-10214-D-FSGS-007-SS-A	20-01037-11
L2-10214-A-QIGS-001-SS-A	20-01037-05	L2-10214-D-FSGS-003-SS-A	20-01037-12
L2-10214-A-FIGS-002-SS-A	20-01037-06	L2-10214-D-FIGS-006-SS-A	20-01037-13
L2-10214-B-FSGS-003-SS-A	20-01037-07	L2-10214-E-FSGS-008-SS-A	20-01037-14
L2-10214-B-FSGS-015-SS-A	20-01037-08	L2-10214-E-FSGS-006-SB-A	20-01037-15
L2-10214-C-FSGS-016-SS-A	20-01037-09	L2-10214-F-FSGS-001-SS-A	20-01037-16
L2-10214-C-FIGS-005-SS-A	20-01037-10	L2-10214-F-QIGS-001-SS-A	20-01037-17

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 an acceptable relative percent difference and normalized difference. 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. 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 Actinium-228, Bismuth-214 and 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: 20-01037
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
20-01037-01	LCS	KNOWN	01/09/20 00:00	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	2.02E+02	7.27E+00				pCi/g
20-01037-01	LCS	SPIKE	01/09/20 00:00	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	2.35E+02	8.10E+00	1.54E+01	5.44E+00		pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	9.56E-01	3.26E+00	3.26E+00	5.60E+00	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	-1.14E+00	3.15E+00	3.15E+00	5.54E+00	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	7.56E-01	3.21E+00	3.21E+00	5.53E+00	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	7.35E-01	3.12E+00	3.12E+00	5.38E+00	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	-1.85E-01	3.12E+00	3.12E+00	5.43E+00	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	5.54E-01	3.13E+00	3.13E+00	5.41E+00	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	1.21E+00	2.97E+00	2.97E+00	5.08E+00	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	1.47E+00	3.15E+00	3.15E+00	5.38E+00	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	9.05E-01	3.08E+00	3.09E+00	5.30E+00	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	-9.12E-01	3.04E+00	3.04E+00	5.34E+00	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	5.58E-01	3.16E+00	3.16E+00	5.45E+00	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/15/2020	20-01037	Tritium	LANL ER-210 Modified	-3.66E-01	3.07E+00	3.07E+00	5.36E+00	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/16/2020	20-01037	Tritium	LANL ER-210 Modified	-1.46E+00	3.03E+00	3.03E+00	5.35E+00	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/16/2020	20-01037	Tritium	LANL ER-210 Modified	0.00E+00	3.04E+00	3.04E+00	5.28E+00	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/16/2020	20-01037	Tritium	LANL ER-210 Modified	-9.27E-01	3.09E+00	3.09E+00	5.43E+00	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/16/2020	20-01037	Tritium	LANL ER-210 Modified	5.36E-01	3.03E+00	3.03E+00	5.23E+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
Final Report of Analysis

Report To:		Work Order Details:	
Jeffrey Graham		SDG:	20-01037
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
20-01037-01	LCS	KNOWN	01/09/20 00:00	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	1.50E+03	4.51E+01				pCi/g
20-01037-01	LCS	SPIKE	01/09/20 00:00	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	1.48E+03	1.30E+01	8.82E+01	3.20E+00		pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-6.06E-01	1.84E+00	1.84E+00	3.20E+00	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	4.55E-01	1.96E+00	1.96E+00	3.36E+00	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-6.03E-01	1.83E+00	1.83E+00	3.18E+00	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	5.49E-01	1.98E+00	1.98E+00	3.38E+00	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-7.54E-01	2.00E+00	2.00E+00	3.48E+00	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-3.53E-01	1.88E+00	1.88E+00	3.26E+00	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-1.50E+00	2.09E+00	2.09E+00	3.68E+00	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-8.95E-01	1.89E+00	1.89E+00	3.30E+00	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-2.31E-01	1.91E-01	1.91E-01	3.41E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	5.40E-01	1.94E+00	1.94E+00	3.32E+00	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-6.49E-01	1.96E+00	1.97E+00	3.42E+00	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/14/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-1.85E+00	1.83E+00	1.84E+00	3.26E+00	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/15/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-8.77E-01	1.85E+00	1.85E+00	3.24E+00	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/15/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-4.40E-01	1.87E+00	1.87E+00	3.25E+00	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/15/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-7.78E-01	2.75E+00	2.75E+00	4.79E+00	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/15/2020	20-01037	Nickel-63	ASTM 3500-Ni Modified	-2.15E+00	2.49E+00	2.49E+00	4.40E+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
Final Report of Analysis

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

Work Order Details:	
SDG:	20-01037
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
20-01037-01	LCS	KNOWN	01/09/20 00:00	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	5.44E+01	3.04E-01				pCi/g
20-01037-01	LCS	SPIKE	01/09/20 00:00	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	4.96E+01	1.38E+00	1.73E+01	8.80E-01		pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	1.80E-01	3.42E-01	3.47E-01	8.53E-01	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	3.03E-01	3.29E-01	3.45E-01	8.03E-01	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	3.22E-01	2.95E-01	3.16E-01	7.12E-01	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	5.59E-01	2.56E-01	3.21E-01	5.69E-01	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	3.37E-01	3.12E-01	3.34E-01	7.56E-01	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	4.22E-01	3.55E-01	3.84E-01	8.56E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	2.99E-01	2.65E-01	2.84E-01	6.38E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	7.30E-02	2.59E-01	2.60E-01	6.56E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	-2.90E-02	3.80E-01	3.80E-01	9.75E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	7.26E-01	3.73E-01	4.51E-01	8.58E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	3.44E-01	3.55E-01	3.75E-01	8.63E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	8.58E-01	4.08E-01	5.06E-01	9.31E-01	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	4.93E-01	3.70E-01	4.08E-01	8.80E-01	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	1.87E-01	2.85E-01	2.93E-01	7.07E-01	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	2.28E-01	3.75E-01	3.83E-01	9.31E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/14/2020	20-01037	Strontium-90	EIChroM SRW01 Modified	3.54E-01	3.61E-01	3.81E-01	8.79E-01	U	pCi/g
20-01037-01	LCS	KNOWN	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
20-01037-01	LCS	KNOWN	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
20-01037-01	LCS	SPIKE	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Cobalt-60	EPA 901.1 Modified	1.34E+02	7.67E+00	1.03E+01	9.92E-01		pCi/g
20-01037-01	LCS	SPIKE	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Cesium-137	EPA 901.1 Modified	8.80E+01	7.53E+00	8.78E+00	1.83E+00		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
Final Report of Analysis

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

Work Order Details:
SDG: 20-01037
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
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Actinium-228	EPA 901.1 Modified	-2.50E-02	7.77E-02	7.77E-02	1.14E-01	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Silver-108m	EPA 901.1 Modified	-8.61E-04	1.80E-02	1.80E-02	3.00E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Americium-241	EPA 901.1 Modified	-1.49E-02	4.63E-02	4.63E-02	6.98E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Barium-133	EPA 901.1 Modified	-4.31E-03	2.80E-02	2.80E-02	4.21E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Bismuth-214	EPA 901.1 Modified	4.67E-02	4.99E-02	5.00E-02	9.05E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Cobalt-60	EPA 901.1 Modified	1.88E-02	2.41E-02	2.42E-02	3.95E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Cesium-134	EPA 901.1 Modified	-1.03E-02	2.85E-02	2.86E-02	2.13E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Cesium-137	EPA 901.1 Modified	7.65E-03	2.04E-02	2.04E-02	3.62E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Europium-152	EPA 901.1 Modified	-9.02E-03	8.63E-02	8.63E-02	9.91E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Europium-154	EPA 901.1 Modified	-3.56E-03	3.40E-02	3.40E-02	4.90E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Europium-155	EPA 901.1 Modified	1.57E-02	5.30E-02	5.30E-02	7.88E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Holmium-166m	EPA 901.1 Modified	6.98E-03	2.97E-02	2.97E-02	3.56E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Iodine-129	EPA 901.1 Modified	1.89E-02	1.28E-01	1.28E-01	2.11E-01	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.82E-01	2.01E-01	2.01E-01	4.48E-01	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Manganese-54	EPA 901.1 Modified	1.26E-02	1.76E-02	1.76E-02	3.42E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	-9.96E-04	1.90E-02	1.90E-02	2.81E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Niobium-94	EPA 901.1 Modified	2.35E-02	1.71E-02	1.71E-02	3.50E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Lead-210	EPA 901.1 Modified	3.81E-01	4.96E-01	4.97E-01	8.50E-01	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Lead-212	EPA 901.1 Modified	4.36E-02	3.06E-02	3.07E-02	5.51E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Lead-214	EPA 901.1 Modified	-1.25E-02	4.56E-02	4.56E-02	6.77E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Promethium-145	EPA 901.1 Modified	1.49E-02	7.77E-02	7.77E-02	1.30E-01	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Radium-226	EPA 901.1 Modified	4.67E-02	4.99E-02	5.00E-02	9.05E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Antimony-125	EPA 901.1 Modified	-1.95E-03	6.01E-02	6.01E-02	9.32E-02	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Thorium-234	EPA 901.1 Modified	8.77E-01	3.75E-01	3.78E-01	6.96E-01	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Thallium-208	EPA 901.1 Modified	7.48E-02	6.68E-02	6.69E-02	1.06E-01	U	pCi/g
20-01037-02	MBL	BLANK	01/09/20 00:00	1/9/2020	1/10/2020	20-01037	Uranium-235	EPA 901.1 Modified	3.03E-02	1.06E-01	1.06E-01	1.68E-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
Final Report of Analysis

Report To:		Work Order Details:	
Jeffrey Graham		SDG:	20-01037
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
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Actinium-228	EPA 901.1 Modified	6.41E-01	1.78E-01	1.81E-01	5.51E-01		pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Silver-108m	EPA 901.1 Modified	8.84E-03	3.13E-02	3.13E-02	5.22E-02	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Americium-241	EPA 901.1 Modified	3.01E-02	1.34E-01	1.34E-01	1.73E-01	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Barium-133	EPA 901.1 Modified	-1.34E-02	4.47E-02	4.47E-02	7.77E-02	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Bismuth-214	EPA 901.1 Modified	9.09E-01	1.61E-01	1.68E-01	1.92E-01		pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Cobalt-60	EPA 901.1 Modified	-4.51E-03	5.08E-02	5.08E-02	7.33E-02	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Cesium-134	EPA 901.1 Modified	-1.34E-03	2.35E-02	2.35E-02	7.11E-02	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Cesium-137	EPA 901.1 Modified	2.58E-01	8.06E-02	8.17E-02	1.10E-01		pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Europium-152	EPA 901.1 Modified	-9.94E-03	1.29E-01	1.29E-01	2.20E-01	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Europium-154	EPA 901.1 Modified	-8.60E-02	1.56E-01	1.56E-01	1.13E-01	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Europium-155	EPA 901.1 Modified	1.26E-01	9.91E-02	9.93E-02	1.62E-01	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Holmium-166m	EPA 901.1 Modified	-1.68E-03	3.22E-02	3.23E-02	9.12E-02	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Iodine-129	EPA 901.1 Modified	2.14E-01	1.82E-01	1.82E-01	2.65E-01	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.19E+01	1.73E+00	1.84E+00	1.02E+00		pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Manganese-54	EPA 901.1 Modified	7.17E-03	4.67E-02	4.67E-02	7.50E-02	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	1.89E-02	3.98E-02	3.98E-02	5.83E-02	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Niobium-94	EPA 901.1 Modified	2.45E-02	4.08E-02	4.08E-02	6.84E-02	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Lead-210	EPA 901.1 Modified	1.31E+00	1.39E+00	1.39E+00	2.32E+00	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Lead-212	EPA 901.1 Modified	6.24E-01	1.31E-01	1.35E-01	2.46E-01		pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Lead-214	EPA 901.1 Modified	9.47E-01	1.70E-01	1.77E-01	2.39E-01		pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Promethium-145	EPA 901.1 Modified	-1.66E-01	2.03E-01	2.04E-01	2.45E-01	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Radium-226	EPA 901.1 Modified	9.09E-01	1.61E-01	1.68E-01	1.92E-01		pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Antimony-125	EPA 901.1 Modified	6.44E-02	1.14E-01	1.14E-01	2.02E-01	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Thorium-234	EPA 901.1 Modified	1.53E+00	1.26E+00	1.26E+00	1.75E+00	U	pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Thallium-208	EPA 901.1 Modified	4.59E-01	1.28E-01	1.30E-01	1.87E-01		pCi/g
20-01037-03	DUP	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Uranium-235	EPA 901.1 Modified	3.32E-01	3.44E-01	3.44E-01	4.86E-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
Final Report of Analysis

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

Work Order Details:
SDG: 20-01037
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
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Actinium-228	EPA 901.1 Modified	6.11E-01	2.05E-01	2.07E-01	4.22E-01		pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Silver-108m	EPA 901.1 Modified	2.06E-02	3.14E-02	3.15E-02	4.94E-02	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Americium-241	EPA 901.1 Modified	-1.48E-01	1.46E-01	1.47E-01	1.71E-01	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Barium-133	EPA 901.1 Modified	1.79E-02	3.08E-02	3.08E-02	8.47E-02	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Bismuth-214	EPA 901.1 Modified	8.37E-01	1.58E-01	1.64E-01	2.31E-01		pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Cobalt-60	EPA 901.1 Modified	-1.93E-02	5.58E-02	5.58E-02	5.83E-02	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Cesium-134	EPA 901.1 Modified	-6.47E-03	2.38E-02	2.38E-02	7.00E-02	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Cesium-137	EPA 901.1 Modified	1.92E-01	8.62E-02	8.68E-02	1.31E-01		pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Europium-152	EPA 901.1 Modified	1.23E-02	1.29E-01	1.29E-01	2.29E-01	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Europium-154	EPA 901.1 Modified	-4.07E-02	1.55E-01	1.55E-01	1.13E-01	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Europium-155	EPA 901.1 Modified	1.25E-01	1.00E-01	1.00E-01	1.64E-01	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Holmium-166m	EPA 901.1 Modified	3.76E-02	8.30E-02	8.30E-02	9.02E-02	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Iodine-129	EPA 901.1 Modified	1.19E-01	1.94E-01	1.94E-01	2.72E-01	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.29E+01	1.84E+00	1.95E+00	1.11E+00		pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Manganese-54	EPA 901.1 Modified	2.84E-02	4.65E-02	4.65E-02	7.85E-02	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	2.46E-02	3.98E-02	3.98E-02	5.83E-02	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Niobium-94	EPA 901.1 Modified	-3.27E-03	1.43E-02	1.43E-02	6.49E-02	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Lead-210	EPA 901.1 Modified	1.24E+00	1.30E+00	1.30E+00	1.82E+00	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Lead-212	EPA 901.1 Modified	6.06E-01	1.31E-01	1.34E-01	2.16E-01		pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Lead-214	EPA 901.1 Modified	8.27E-01	1.87E-01	1.92E-01	2.30E-01		pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Promethium-145	EPA 901.1 Modified	-1.56E-01	1.92E-01	1.93E-01	2.24E-01	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Radium-226	EPA 901.1 Modified	8.37E-01	1.58E-01	1.64E-01	2.31E-01		pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Antimony-125	EPA 901.1 Modified	4.00E-02	1.06E-01	1.06E-01	1.85E-01	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Thorium-234	EPA 901.1 Modified	2.49E+00	1.95E+00	1.95E+00	3.23E+00	U	pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Thallium-208	EPA 901.1 Modified	5.84E-01	1.73E-01	1.76E-01	3.29E-01		pCi/g
20-01037-04	DO	L2-10214-A-FIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Uranium-235	EPA 901.1 Modified	1.79E-01	2.89E-01	2.89E-01	4.57E-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
Final Report of Analysis

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

Work Order Details:
SDG: 20-01037
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
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Actinium-228	EPA 901.1 Modified	9.66E-01	2.48E-01	2.53E-01	5.08E-01		pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Silver-108m	EPA 901.1 Modified	1.95E-02	3.12E-02	3.12E-02	6.63E-02	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Americium-241	EPA 901.1 Modified	-1.06E-01	1.50E-01	1.50E-01	2.06E-01	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Barium-133	EPA 901.1 Modified	6.87E-02	1.69E-01	1.69E-01	1.53E-01	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Bismuth-214	EPA 901.1 Modified	1.24E+00	1.91E-01	2.02E-01	2.40E-01		pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Cobalt-60	EPA 901.1 Modified	2.89E-02	5.61E-02	5.61E-02	6.61E-02	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Cesium-134	EPA 901.1 Modified	2.89E-03	2.88E-02	2.88E-02	9.34E-02	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Cesium-137	EPA 901.1 Modified	2.19E-01	9.35E-02	9.42E-02	1.42E-01		pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Europium-152	EPA 901.1 Modified	-1.33E-01	2.58E-01	2.58E-01	2.79E-01	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Europium-154	EPA 901.1 Modified	2.39E-02	1.55E-01	1.55E-01	1.43E-01	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Europium-155	EPA 901.1 Modified	3.29E-01	1.63E-01	1.64E-01	2.85E-01		pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Holmium-166m	EPA 901.1 Modified	1.05E-02	9.53E-02	9.53E-02	1.07E-01	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Iodine-129	EPA 901.1 Modified	-6.54E-02	2.12E-01	2.12E-01	3.06E-01	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.23E+01	1.87E+00	1.98E+00	1.49E+00		pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Manganese-54	EPA 901.1 Modified	3.46E-03	6.29E-02	6.29E-02	8.93E-02	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	-1.38E-02	5.42E-02	5.42E-02	7.05E-02	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Niobium-94	EPA 901.1 Modified	2.01E-02	5.72E-02	5.72E-02	7.95E-02	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Lead-210	EPA 901.1 Modified	2.78E+00	1.89E+00	1.89E+00	3.10E+00	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Lead-212	EPA 901.1 Modified	8.88E-01	1.77E-01	1.83E-01	2.59E-01		pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Lead-214	EPA 901.1 Modified	1.32E+00	2.08E-01	2.18E-01	5.04E-01		pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Promethium-145	EPA 901.1 Modified	7.36E-02	1.81E-01	1.81E-01	2.69E-01	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Radium-226	EPA 901.1 Modified	1.24E+00	1.91E-01	2.02E-01	2.40E-01		pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Antimony-125	EPA 901.1 Modified	5.52E-02	1.46E-01	1.46E-01	2.26E-01	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Thorium-234	EPA 901.1 Modified	2.28E+00	1.34E+00	1.35E+00	2.06E+00	U	pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Thallium-208	EPA 901.1 Modified	8.48E-01	1.82E-01	1.88E-01	2.64E-01		pCi/g
20-01037-05	TRG	L2-10214-A-QIGS-001-SS-A	12/16/19 13:34	1/9/2020	1/10/2020	20-01037	Uranium-235	EPA 901.1 Modified	3.02E-02	3.92E-01	3.92E-01	5.75E-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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01037
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
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Actinium-228	EPA 901.1 Modified	6.28E-01	1.95E-01	1.98E-01	3.41E-01		pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Silver-108m	EPA 901.1 Modified	9.24E-03	2.82E-02	2.82E-02	6.14E-02	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Americium-241	EPA 901.1 Modified	-3.82E-01	1.57E-01	1.58E-01	1.93E-01	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Barium-133	EPA 901.1 Modified	-3.82E-03	2.53E-02	2.53E-02	1.49E-01	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Bismuth-214	EPA 901.1 Modified	9.11E-01	1.60E-01	1.66E-01	2.24E-01		pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Cobalt-60	EPA 901.1 Modified	-1.69E-02	6.32E-02	6.32E-02	8.83E-02	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Cesium-134	EPA 901.1 Modified	3.16E-03	2.85E-02	2.85E-02	8.42E-02	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Cesium-137	EPA 901.1 Modified	2.32E-01	6.07E-02	6.19E-02	9.32E-02		pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Europium-152	EPA 901.1 Modified	4.80E-02	8.57E-02	8.57E-02	2.58E-01	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Europium-154	EPA 901.1 Modified	2.29E-02	1.40E-01	1.40E-01	1.32E-01	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Europium-155	EPA 901.1 Modified	1.11E-01	1.54E-01	1.54E-01	2.28E-01	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Holmium-166m	EPA 901.1 Modified	-7.41E-02	9.89E-02	9.90E-02	9.94E-02	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Iodine-129	EPA 901.1 Modified	-3.25E-02	2.06E-01	2.06E-01	2.99E-01	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.16E+01	1.71E+00	1.81E+00	1.11E+00		pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Manganese-54	EPA 901.1 Modified	-3.56E-02	6.60E-02	6.60E-02	8.25E-02	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	-4.01E-02	5.55E-02	5.55E-02	6.80E-02	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Niobium-94	EPA 901.1 Modified	4.01E-02	3.75E-02	3.75E-02	6.54E-02	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Lead-210	EPA 901.1 Modified	2.58E+00	1.52E+00	1.53E+00	2.47E+00	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Lead-212	EPA 901.1 Modified	8.26E-01	1.93E-01	1.98E-01	2.40E-01		pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Lead-214	EPA 901.1 Modified	1.16E+00	2.04E-01	2.12E-01	2.71E-01		pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Promethium-145	EPA 901.1 Modified	3.10E-02	1.76E-01	1.76E-01	2.58E-01	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Radium-226	EPA 901.1 Modified	9.11E-01	1.60E-01	1.66E-01	2.24E-01		pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Antimony-125	EPA 901.1 Modified	5.25E-02	1.31E-01	1.31E-01	2.04E-01	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Thorium-234	EPA 901.1 Modified	1.98E+00	1.65E+00	1.65E+00	2.73E+00	U	pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Thallium-208	EPA 901.1 Modified	6.32E-01	1.60E-01	1.64E-01	1.79E-01		pCi/g
20-01037-06	TRG	L2-10214-A-FIGS-002-SS-A	12/16/19 13:36	1/9/2020	1/10/2020	20-01037	Uranium-235	EPA 901.1 Modified	3.32E-02	3.68E-01	3.68E-01	5.39E-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
Final Report of Analysis

Report To:		Work Order Details:	
Jeffrey Graham		SDG:	20-01037
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
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Actinium-228	EPA 901.1 Modified	4.19E-01	1.84E-01	1.85E-01	4.01E-01		pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Silver-108m	EPA 901.1 Modified	-7.03E-02	6.17E-02	6.18E-02	5.33E-02	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Americium-241	EPA 901.1 Modified	-2.00E-01	1.44E-01	1.45E-01	1.57E-01	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Barium-133	EPA 901.1 Modified	-1.36E-01	8.66E-02	8.69E-02	8.26E-02	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Bismuth-214	EPA 901.1 Modified	5.02E-01	1.31E-01	1.34E-01	1.93E-01		pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Cobalt-60	EPA 901.1 Modified	2.29E-02	5.02E-02	5.02E-02	8.09E-02	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Cesium-134	EPA 901.1 Modified	4.09E-03	3.10E-02	3.10E-02	7.27E-02	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Cesium-137	EPA 901.1 Modified	1.22E-01	6.23E-02	6.26E-02	9.26E-02		pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Europium-152	EPA 901.1 Modified	-6.37E-04	2.05E-01	2.05E-01	2.12E-01	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Europium-154	EPA 901.1 Modified	7.77E-02	1.31E-01	1.31E-01	1.09E-01	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Europium-155	EPA 901.1 Modified	2.05E-01	1.10E-01	1.11E-01	2.04E-01		pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Holmium-166m	EPA 901.1 Modified	4.62E-02	7.71E-02	7.72E-02	8.53E-02	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Iodine-129	EPA 901.1 Modified	1.51E-01	1.87E-01	1.88E-01	2.70E-01	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.27E+01	1.85E+00	1.96E+00	1.00E+00		pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Manganese-54	EPA 901.1 Modified	6.38E-03	4.92E-02	4.92E-02	7.90E-02	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	7.46E-03	3.74E-02	3.74E-02	4.87E-02	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Niobium-94	EPA 901.1 Modified	1.73E-02	3.49E-02	3.49E-02	6.45E-02	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Lead-210	EPA 901.1 Modified	3.06E+00	1.38E+00	1.39E+00	2.16E+00		pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Lead-212	EPA 901.1 Modified	6.01E-01	1.55E-01	1.58E-01	1.90E-01		pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Lead-214	EPA 901.1 Modified	4.51E-01	1.30E-01	1.32E-01	1.98E-01		pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Promethium-145	EPA 901.1 Modified	-1.38E-01	1.87E-01	1.87E-01	2.28E-01	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Radium-226	EPA 901.1 Modified	5.02E-01	1.31E-01	1.34E-01	1.93E-01		pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Antimony-125	EPA 901.1 Modified	3.09E-02	1.02E-01	1.02E-01	1.78E-01	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Thorium-234	EPA 901.1 Modified	8.83E-01	1.21E+00	1.21E+00	1.64E+00	U	pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Thallium-208	EPA 901.1 Modified	4.14E-01	1.55E-01	1.56E-01	3.11E-01		pCi/g
20-01037-07	TRG	L2-10214-B-FSGS-003-SS-A	12/14/19 12:34	1/9/2020	1/10/2020	20-01037	Uranium-235	EPA 901.1 Modified	5.01E-02	3.60E-01	3.60E-01	4.71E-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
Final Report of Analysis

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

Work Order Details:	
SDG:	20-01037
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
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Actinium-228	EPA 901.1 Modified	1.16E+00	3.02E-01	3.08E-01	5.72E-01		pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Silver-108m	EPA 901.1 Modified	3.13E-03	4.71E-02	4.71E-02	8.45E-02	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Americium-241	EPA 901.1 Modified	-2.02E-02	6.57E-02	6.57E-02	2.55E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Barium-133	EPA 901.1 Modified	-3.58E-02	3.27E-02	3.28E-02	2.13E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Bismuth-214	EPA 901.1 Modified	2.76E+00	2.98E-01	3.30E-01	2.88E-01		pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Cobalt-60	EPA 901.1 Modified	-2.67E-02	6.74E-02	6.74E-02	9.20E-02	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Cesium-134	EPA 901.1 Modified	-6.67E-03	2.25E-02	2.25E-02	1.23E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Cesium-137	EPA 901.1 Modified	-1.04E-02	2.43E-02	2.43E-02	1.10E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Europium-152	EPA 901.1 Modified	8.70E-02	1.48E-01	1.48E-01	3.37E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Europium-154	EPA 901.1 Modified	9.45E-02	1.41E-01	1.41E-01	1.72E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Europium-155	EPA 901.1 Modified	7.78E-01	2.56E-01	2.59E-01	3.37E-01		pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Holmium-166m	EPA 901.1 Modified	-8.11E-02	1.36E-01	1.36E-01	1.38E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Iodine-129	EPA 901.1 Modified	-1.06E-01	2.50E-01	2.50E-01	3.55E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.13E+01	1.81E+00	1.91E+00	1.59E+00		pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Manganese-54	EPA 901.1 Modified	-2.82E-02	7.72E-02	7.72E-02	1.00E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	6.99E-03	5.92E-02	5.92E-02	7.57E-02	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Niobium-94	EPA 901.1 Modified	1.35E-02	6.39E-02	6.39E-02	9.20E-02	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Lead-210	EPA 901.1 Modified	2.87E+00	1.93E+00	1.93E+00	3.16E+00	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Lead-212	EPA 901.1 Modified	1.41E+00	2.31E-01	2.42E-01	3.74E-01		pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Lead-214	EPA 901.1 Modified	3.16E+00	4.11E-01	4.42E-01	3.34E-01		pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Promethium-145	EPA 901.1 Modified	1.32E-01	2.13E-01	2.13E-01	3.18E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Radium-226	EPA 901.1 Modified	2.76E+00	2.98E-01	3.30E-01	2.88E-01		pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Antimony-125	EPA 901.1 Modified	1.37E-01	1.77E-01	1.77E-01	2.79E-01	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Thorium-234	EPA 901.1 Modified	2.49E+00	1.99E+00	1.99E+00	3.30E+00	U	pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Thallium-208	EPA 901.1 Modified	1.11E+00	2.31E-01	2.38E-01	1.82E-01		pCi/g
20-01037-08	TRG	L2-10214-B-FSGS-015-SS-A	12/14/19 12:58	1/9/2020	1/10/2020	20-01037	Uranium-235	EPA 901.1 Modified	4.00E-01	5.04E-01	5.05E-01	7.53E-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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01037
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
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Actinium-228	EPA 901.1 Modified	3.96E-01	2.91E-01	2.91E-01	6.49E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Silver-108m	EPA 901.1 Modified	-1.27E-02	7.47E-02	7.47E-02	9.07E-02	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Americium-241	EPA 901.1 Modified	-1.02E-01	1.40E-01	1.40E-01	2.10E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Barium-133	EPA 901.1 Modified	-1.54E-01	1.54E-01	1.54E-01	1.72E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Bismuth-214	EPA 901.1 Modified	6.54E-01	2.01E-01	2.04E-01	1.36E-01		pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Cobalt-60	EPA 901.1 Modified	-3.07E-02	9.44E-02	9.44E-02	1.02E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Cesium-134	EPA 901.1 Modified	-1.79E-02	2.60E-02	2.60E-02	1.18E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Cesium-137	EPA 901.1 Modified	2.30E-01	9.58E-02	9.65E-02	1.68E-01		pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Europium-152	EPA 901.1 Modified	-2.96E-02	2.12E-01	2.12E-01	3.07E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Europium-154	EPA 901.1 Modified	2.33E-01	1.71E-01	1.71E-01	1.59E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Europium-155	EPA 901.1 Modified	7.88E-02	1.73E-01	1.73E-01	2.56E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Holmium-166m	EPA 901.1 Modified	1.11E-01	8.48E-02	8.50E-02	1.43E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Iodine-129	EPA 901.1 Modified	-1.22E-01	3.00E-01	3.00E-01	5.52E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.03E+01	1.96E+00	2.03E+00	1.40E+00		pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Manganese-54	EPA 901.1 Modified	7.24E-03	3.67E-02	3.67E-02	1.29E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	4.91E-02	4.51E-02	4.51E-02	9.14E-02	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Niobium-94	EPA 901.1 Modified	-6.29E-02	6.61E-02	6.61E-02	8.17E-02	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Lead-210	EPA 901.1 Modified	4.59E+00	2.81E+00	2.82E+00	4.57E+00		pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Lead-212	EPA 901.1 Modified	4.57E-01	1.36E-01	1.38E-01	5.33E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Lead-214	EPA 901.1 Modified	5.76E-01	2.17E-01	2.19E-01	3.81E-01		pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Promethium-145	EPA 901.1 Modified	-1.79E-01	2.42E-01	2.42E-01	3.75E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Radium-226	EPA 901.1 Modified	6.54E-01	2.01E-01	2.04E-01	1.36E-01		pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Antimony-125	EPA 901.1 Modified	1.35E-02	1.81E-01	1.81E-01	2.80E-01	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Thorium-234	EPA 901.1 Modified	1.55E+00	1.22E+00	1.22E+00	2.08E+00	U	pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Thallium-208	EPA 901.1 Modified	4.86E-01	1.92E-01	1.93E-01	3.44E-01		pCi/g
20-01037-09	TRG	L2-10214-C-FSGS-016-SS-A	12/13/19 13:30	1/9/2020	1/10/2020	20-01037	Uranium-235	EPA 901.1 Modified	2.12E-01	3.81E-01	3.81E-01	5.88E-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
Final Report of Analysis

Report To:	Work Order Details:	
Jeffrey Graham	*SDG:*	20-01037
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
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Actinium-228	EPA 901.1 Modified	1.85E+00	3.67E-01	3.79E-01	6.56E-01		pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Silver-108m	EPA 901.1 Modified	3.74E-02	3.92E-02	3.92E-02	9.73E-02	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Americium-241	EPA 901.1 Modified	-5.05E-02	7.39E-02	7.39E-02	2.89E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Barium-133	EPA 901.1 Modified	-5.89E-03	5.46E-02	5.46E-02	2.78E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Bismuth-214	EPA 901.1 Modified	5.35E+00	4.66E-01	5.41E-01	4.07E-01		pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Cobalt-60	EPA 901.1 Modified	-1.68E-02	4.94E-02	4.94E-02	1.08E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Cesium-134	EPA 901.1 Modified	1.81E-02	3.59E-02	3.59E-02	1.44E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Cesium-137	EPA 901.1 Modified	7.57E-02	9.11E-02	9.12E-02	1.33E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Europium-152	EPA 901.1 Modified	1.00E-03	1.39E-01	1.39E-01	4.14E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Europium-154	EPA 901.1 Modified	-3.46E-02	1.84E-01	1.84E-01	2.10E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Europium-155	EPA 901.1 Modified	1.33E+00	2.96E-01	3.04E-01	4.14E-01		pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Holmium-166m	EPA 901.1 Modified	2.91E-02	1.29E-01	1.29E-01	1.61E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Iodine-129	EPA 901.1 Modified	1.37E-01	2.93E-01	2.93E-01	4.31E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.62E+01	2.29E+00	2.43E+00	1.84E+00		pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Manganese-54	EPA 901.1 Modified	1.11E-02	2.78E-02	2.78E-02	1.29E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	2.65E-02	7.71E-02	7.71E-02	1.09E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Niobium-94	EPA 901.1 Modified	-3.52E-02	8.06E-02	8.06E-02	1.06E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Lead-210	EPA 901.1 Modified	9.56E-01	1.84E+00	1.84E+00	2.70E+00	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Lead-212	EPA 901.1 Modified	2.54E+00	3.95E-01	4.16E-01	4.33E-01		pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Lead-214	EPA 901.1 Modified	5.50E+00	6.57E-01	7.15E-01	4.17E-01		pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Promethium-145	EPA 901.1 Modified	-1.62E-01	2.53E-01	2.53E-01	3.56E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Radium-226	EPA 901.1 Modified	5.35E+00	4.66E-01	5.41E-01	4.07E-01		pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Antimony-125	EPA 901.1 Modified	1.42E-01	2.16E-01	2.16E-01	3.29E-01	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Thorium-234	EPA 901.1 Modified	3.39E+00	2.34E+00	2.35E+00	3.88E+00	U	pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Thallium-208	EPA 901.1 Modified	2.21E+00	3.13E-01	3.33E-01	3.40E-01		pCi/g
20-01037-10	TRG	L2-10214-C-FIGS-005-SS-A	12/13/19 13:08	1/9/2020	1/13/2020	20-01037	Uranium-235	EPA 901.1 Modified	4.35E-01	6.12E-01	6.13E-01	8.95E-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
Final Report of Analysis

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

Work Order Details:
SDG: 20-01037
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
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Actinium-228	EPA 901.1 Modified	1.14E+00	3.08E-01	3.14E-01	4.56E-01		pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Silver-108m	EPA 901.1 Modified	2.07E-02	4.69E-02	4.69E-02	7.65E-02	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Americium-241	EPA 901.1 Modified	-2.21E-01	2.14E-01	2.14E-01	2.48E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Barium-133	EPA 901.1 Modified	7.41E-02	6.85E-02	6.86E-02	1.20E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Bismuth-214	EPA 901.1 Modified	1.23E+00	2.13E-01	2.23E-01	4.71E-01		pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Cobalt-60	EPA 901.1 Modified	3.34E-02	6.67E-02	6.67E-02	1.14E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Cesium-134	EPA 901.1 Modified	-4.81E-03	3.77E-02	3.77E-02	1.04E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Cesium-137	EPA 901.1 Modified	1.79E-01	7.16E-02	7.22E-02	1.44E-01		pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Europium-152	EPA 901.1 Modified	-1.18E-02	2.53E-01	2.53E-01	3.05E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Europium-154	EPA 901.1 Modified	-1.47E-01	2.27E-01	2.27E-01	1.61E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Europium-155	EPA 901.1 Modified	6.92E-02	2.26E-01	2.26E-01	2.96E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Holmium-166m	EPA 901.1 Modified	1.18E-02	1.11E-01	1.11E-01	1.28E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Iodine-129	EPA 901.1 Modified	-1.21E-01	3.16E-01	3.16E-01	4.05E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Potassium-40	EPA 901.1 Modified	2.20E+01	2.92E+00	3.13E+00	1.50E+00		pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Manganese-54	EPA 901.1 Modified	-6.17E-02	8.69E-02	8.70E-02	1.19E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	2.71E-03	5.73E-02	5.73E-02	8.67E-02	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Niobium-94	EPA 901.1 Modified	-3.28E-03	6.03E-02	6.03E-02	9.39E-02	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Lead-210	EPA 901.1 Modified	2.49E+00	1.87E+00	1.88E+00	2.66E+00	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Lead-212	EPA 901.1 Modified	1.26E+00	2.22E-01	2.31E-01	3.75E-01		pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Lead-214	EPA 901.1 Modified	1.43E+00	2.47E-01	2.58E-01	3.10E-01		pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Promethium-145	EPA 901.1 Modified	-2.01E-01	3.15E-01	3.15E-01	3.81E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Radium-226	EPA 901.1 Modified	1.23E+00	2.13E-01	2.23E-01	4.71E-01		pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Antimony-125	EPA 901.1 Modified	-6.70E-03	1.63E-01	1.63E-01	2.71E-01	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Thorium-234	EPA 901.1 Modified	2.91E+00	1.75E+00	1.76E+00	2.49E+00	U	pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Thallium-208	EPA 901.1 Modified	1.02E+00	2.32E-01	2.38E-01	3.62E-01		pCi/g
20-01037-11	TRG	L2-10214-D-FSGS-007-SS-A	12/11/19 10:02	1/9/2020	1/13/2020	20-01037	Uranium-235	EPA 901.1 Modified	1.68E-01	5.33E-01	5.33E-01	7.07E-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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01037
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
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Actinium-228	EPA 901.1 Modified	1.28E+00	3.37E-01	3.43E-01	5.31E-01		pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Silver-108m	EPA 901.1 Modified	-3.42E-03	2.47E-02	2.47E-02	9.30E-02	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Americium-241	EPA 901.1 Modified	-1.16E-01	1.49E-01	1.49E-01	2.27E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Barium-133	EPA 901.1 Modified	-1.77E-02	4.06E-02	4.06E-02	1.82E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Bismuth-214	EPA 901.1 Modified	1.14E+00	2.37E-01	2.45E-01	3.54E-01		pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Cobalt-60	EPA 901.1 Modified	9.22E-02	9.34E-02	9.35E-02	9.57E-02	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Cesium-134	EPA 901.1 Modified	-1.52E-02	2.70E-02	2.70E-02	1.13E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Cesium-137	EPA 901.1 Modified	2.28E-01	1.28E-01	1.28E-01	2.01E-01		pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Europium-152	EPA 901.1 Modified	5.05E-02	1.74E-01	1.74E-01	3.03E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Europium-154	EPA 901.1 Modified	1.30E-01	1.92E-01	1.92E-01	1.51E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Europium-155	EPA 901.1 Modified	1.75E-01	2.08E-01	2.08E-01	3.10E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Holmium-166m	EPA 901.1 Modified	6.09E-02	1.29E-01	1.29E-01	1.20E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Iodine-129	EPA 901.1 Modified	3.20E-01	3.61E-01	3.61E-01	5.77E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Potassium-40	EPA 901.1 Modified	2.11E+01	2.85E+00	3.05E+00	9.60E-01		pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Manganese-54	EPA 901.1 Modified	3.28E-02	8.14E-02	8.14E-02	1.27E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	7.85E-03	6.40E-02	6.40E-02	1.00E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Niobium-94	EPA 901.1 Modified	1.48E-02	5.89E-02	5.89E-02	9.70E-02	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Lead-210	EPA 901.1 Modified	2.68E+00	1.97E+00	1.98E+00	3.23E+00	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Lead-212	EPA 901.1 Modified	1.19E+00	2.95E-01	3.01E-01	3.64E-01		pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Lead-214	EPA 901.1 Modified	1.11E+00	2.51E-01	2.57E-01	3.32E-01		pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Promethium-145	EPA 901.1 Modified	-1.62E-02	2.48E-01	2.48E-01	3.96E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Radium-226	EPA 901.1 Modified	1.14E+00	2.37E-01	2.45E-01	3.54E-01		pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Antimony-125	EPA 901.1 Modified	4.78E-02	1.87E-01	1.87E-01	2.92E-01	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Thorium-234	EPA 901.1 Modified	1.78E+00	1.31E+00	1.32E+00	2.21E+00	U	pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Thallium-208	EPA 901.1 Modified	1.07E+00	2.49E-01	2.55E-01	2.50E-01		pCi/g
20-01037-12	TRG	L2-10214-D-FSGS-003-SS-A	12/11/19 09:24	1/9/2020	1/13/2020	20-01037	Uranium-235	EPA 901.1 Modified	2.45E-01	4.35E-01	4.35E-01	6.59E-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
Final Report of Analysis

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

Work Order Details:
SDG: 20-01037
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
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Actinium-228	EPA 901.1 Modified	9.28E-01	2.82E-01	2.86E-01	4.86E-01		pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Silver-108m	EPA 901.1 Modified	2.32E-02	3.72E-02	3.72E-02	8.20E-02	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Americium-241	EPA 901.1 Modified	-2.68E-01	1.95E-01	1.96E-01	2.58E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Barium-133	EPA 901.1 Modified	1.78E-03	3.64E-02	3.64E-02	1.90E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Bismuth-214	EPA 901.1 Modified	1.22E+00	2.18E-01	2.26E-01	3.36E-01		pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Cobalt-60	EPA 901.1 Modified	2.00E-02	7.70E-02	7.70E-02	1.08E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Cesium-134	EPA 901.1 Modified	-1.62E-02	4.30E-02	4.30E-02	1.22E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Cesium-137	EPA 901.1 Modified	1.94E-01	8.36E-02	8.42E-02	1.23E-01		pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Europium-152	EPA 901.1 Modified	-4.59E-02	1.37E-01	1.37E-01	3.18E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Europium-154	EPA 901.1 Modified	-1.13E-01	2.30E-01	2.30E-01	1.60E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Europium-155	EPA 901.1 Modified	5.18E-01	2.15E-01	2.17E-01	3.46E-01		pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Holmium-166m	EPA 901.1 Modified	5.11E-02	1.21E-01	1.21E-01	1.28E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Iodine-129	EPA 901.1 Modified	-3.66E-01	2.93E-01	2.94E-01	3.85E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Potassium-40	EPA 901.1 Modified	2.71E+01	3.28E+00	3.56E+00	1.32E+00		pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Manganese-54	EPA 901.1 Modified	-5.24E-03	8.12E-02	8.12E-02	1.13E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	3.39E-02	7.06E-02	7.06E-02	9.90E-02	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Niobium-94	EPA 901.1 Modified	-5.29E-02	7.78E-02	7.79E-02	9.34E-02	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Lead-210	EPA 901.1 Modified	2.06E+00	1.88E+00	1.88E+00	3.11E+00	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Lead-212	EPA 901.1 Modified	1.15E+00	2.17E-01	2.25E-01	3.01E-01		pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Lead-214	EPA 901.1 Modified	1.39E+00	2.40E-01	2.50E-01	3.33E-01		pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Promethium-145	EPA 901.1 Modified	-4.71E-03	2.42E-01	2.42E-01	3.53E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Radium-226	EPA 901.1 Modified	1.22E+00	2.18E-01	2.26E-01	3.36E-01		pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Antimony-125	EPA 901.1 Modified	-3.84E-02	1.67E-01	1.67E-01	2.46E-01	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Thorium-234	EPA 901.1 Modified	3.78E+00	1.72E+00	1.73E+00	2.67E+00	U	pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Thallium-208	EPA 901.1 Modified	9.87E-01	2.58E-01	2.63E-01	4.53E-01		pCi/g
20-01037-13	TRG	L2-10214-D-FIGS-006-SS-A	12/11/19 09:30	1/9/2020	1/13/2020	20-01037	Uranium-235	EPA 901.1 Modified	5.63E-01	4.41E-01	4.42E-01	6.87E-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
Final Report of Analysis

Report To:	Work Order Details:
Jeffrey Graham	SDG: 20-01037
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
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Actinium-228	EPA 901.1 Modified	1.04E+00	2.84E-01	2.89E-01	5.35E-01		pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Silver-108m	EPA 901.1 Modified	-1.77E-03	6.27E-02	6.27E-02	6.30E-02	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Americium-241	EPA 901.1 Modified	-1.14E-01	1.62E-01	1.62E-01	1.91E-01	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Barium-133	EPA 901.1 Modified	2.72E-02	3.08E-02	3.08E-02	8.82E-02	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Bismuth-214	EPA 901.1 Modified	9.74E-01	2.56E-01	2.61E-01	3.90E-01		pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Cobalt-60	EPA 901.1 Modified	5.63E-02	6.26E-02	6.27E-02	8.66E-02	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Cesium-134	EPA 901.1 Modified	1.70E-03	2.37E-02	2.37E-02	9.37E-02	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Cesium-137	EPA 901.1 Modified	1.33E-01	6.95E-02	6.99E-02	1.06E-01		pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Europium-152	EPA 901.1 Modified	0.00E+00	1.56E-01	1.56E-01	2.54E-01	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Europium-154	EPA 901.1 Modified	-4.24E-03	1.94E-01	1.94E-01	1.34E-01	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Europium-155	EPA 901.1 Modified	1.12E-01	1.13E-01	1.13E-01	1.88E-01	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Holmium-166m	EPA 901.1 Modified	4.55E-02	8.97E-02	8.97E-02	1.03E-01	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Iodine-129	EPA 901.1 Modified	3.49E-02	2.16E-01	2.16E-01	2.91E-01	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.71E+01	2.29E+00	2.46E+00	1.29E+00		pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Manganese-54	EPA 901.1 Modified	-2.56E-02	5.86E-02	5.86E-02	8.49E-02	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	-4.38E-02	5.27E-02	5.28E-02	6.27E-02	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Niobium-94	EPA 901.1 Modified	-1.45E-02	4.81E-02	4.81E-02	7.17E-02	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Lead-210	EPA 901.1 Modified	1.55E+00	1.52E+00	1.53E+00	2.53E+00	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Lead-212	EPA 901.1 Modified	9.83E-01	1.80E-01	1.87E-01	2.08E-01		pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Lead-214	EPA 901.1 Modified	1.07E+00	2.18E-01	2.25E-01	2.82E-01		pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Promethium-145	EPA 901.1 Modified	-4.88E-02	2.35E-01	2.35E-01	2.97E-01	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Radium-226	EPA 901.1 Modified	9.74E-01	2.56E-01	2.61E-01	3.90E-01		pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Antimony-125	EPA 901.1 Modified	-3.30E-02	1.07E-01	1.07E-01	1.76E-01	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Thorium-234	EPA 901.1 Modified	4.14E-01	1.49E+00	1.49E+00	1.91E+00	U	pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Thallium-208	EPA 901.1 Modified	7.51E-01	1.81E-01	1.85E-01	2.70E-01		pCi/g
20-01037-14	TRG	L2-10214-E-FSGS-008-SS-A	12/10/19 12:44	1/9/2020	1/13/2020	20-01037	Uranium-235	EPA 901.1 Modified	1.96E-01	3.87E-01	3.87E-01	5.26E-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
Final Report of Analysis

Report To:		Work Order Details:	
Jeffrey Graham		SDG:	20-01037
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
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Actinium-228	EPA 901.1 Modified	3.73E-01	1.44E-01	1.45E-01	2.73E-01		pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Silver-108m	EPA 901.1 Modified	1.54E-02	2.00E-02	2.00E-02	5.03E-02	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Americium-241	EPA 901.1 Modified	-5.89E-02	7.07E-02	7.08E-02	1.08E-01	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Barium-133	EPA 901.1 Modified	-4.95E-02	9.38E-02	9.39E-02	8.59E-02	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Bismuth-214	EPA 901.1 Modified	3.29E-01	1.05E-01	1.07E-01	1.77E-01		pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Cobalt-60	EPA 901.1 Modified	-1.68E-02	4.76E-02	4.76E-02	4.91E-02	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Cesium-134	EPA 901.1 Modified	-3.17E-03	1.47E-02	1.47E-02	6.12E-02	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Cesium-137	EPA 901.1 Modified	8.77E-02	5.44E-02	5.46E-02	8.53E-02		pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Europium-152	EPA 901.1 Modified	1.80E-02	1.17E-01	1.17E-01	1.53E-01	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Europium-154	EPA 901.1 Modified	-1.67E-02	1.06E-01	1.06E-01	7.79E-02	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Europium-155	EPA 901.1 Modified	1.79E-01	1.01E-01	1.01E-01	1.57E-01		pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Holmium-166m	EPA 901.1 Modified	4.96E-03	6.11E-02	6.11E-02	5.82E-02	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Iodine-129	EPA 901.1 Modified	2.28E-03	1.61E-01	1.61E-01	2.62E-01	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Potassium-40	EPA 901.1 Modified	7.45E+00	1.13E+00	1.20E+00	3.79E-01		pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Manganese-54	EPA 901.1 Modified	-7.12E-03	3.94E-02	3.94E-02	5.97E-02	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	-4.37E-03	3.50E-02	3.50E-02	4.39E-02	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Niobium-94	EPA 901.1 Modified	-2.13E-02	3.79E-02	3.79E-02	4.99E-02	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Lead-210	EPA 901.1 Modified	1.02E+00	7.27E-01	7.29E-01	1.24E+00	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Lead-212	EPA 901.1 Modified	4.84E-01	1.26E-01	1.28E-01	1.56E-01		pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Lead-214	EPA 901.1 Modified	4.36E-01	1.15E-01	1.17E-01	1.81E-01		pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Promethium-145	EPA 901.1 Modified	-5.20E-02	1.12E-01	1.12E-01	1.78E-01	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Radium-226	EPA 901.1 Modified	3.29E-01	1.05E-01	1.07E-01	1.77E-01		pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Antimony-125	EPA 901.1 Modified	7.68E-02	1.05E-01	1.05E-01	1.69E-01	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Thorium-234	EPA 901.1 Modified	2.62E-01	6.45E-01	6.45E-01	1.06E+00	U	pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Thallium-208	EPA 901.1 Modified	4.66E-01	1.30E-01	1.32E-01	1.33E-01		pCi/g
20-01037-15	TRG	L2-10214-E-FSGS-006-SB-A	12/11/19 12:55	1/9/2020	1/13/2020	20-01037	Uranium-235	EPA 901.1 Modified	1.90E-01	2.10E-01	2.10E-01	3.26E-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
Final Report of Analysis

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

Work Order Details:
SDG: 20-01037
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
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Actinium-228	EPA 901.1 Modified	4.28E-01	1.82E-01	1.84E-01	3.49E-01		pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Silver-108m	EPA 901.1 Modified	-4.63E-02	6.48E-02	6.49E-02	5.49E-02	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Americium-241	EPA 901.1 Modified	-2.10E-01	1.31E-01	1.31E-01	1.70E-01	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Barium-133	EPA 901.1 Modified	1.73E-02	1.00E-01	1.00E-01	1.17E-01	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Bismuth-214	EPA 901.1 Modified	5.98E-01	1.28E-01	1.31E-01	1.50E-01		pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Cobalt-60	EPA 901.1 Modified	5.28E-02	5.14E-02	5.15E-02	7.59E-02	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Cesium-134	EPA 901.1 Modified	8.23E-03	2.56E-02	2.56E-02	8.80E-02	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Cesium-137	EPA 901.1 Modified	8.34E-02	6.34E-02	6.36E-02	1.03E-01	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Europium-152	EPA 901.1 Modified	3.00E-02	1.23E-01	1.23E-01	2.22E-01	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Europium-154	EPA 901.1 Modified	-1.12E-01	1.41E-01	1.41E-01	1.15E-01	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Europium-155	EPA 901.1 Modified	3.54E-02	9.58E-02	9.58E-02	1.85E-01	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Holmium-166m	EPA 901.1 Modified	5.84E-03	7.23E-02	7.23E-02	8.74E-02	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Iodine-129	EPA 901.1 Modified	2.12E-01	1.87E-01	1.87E-01	2.87E-01	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.12E+01	1.64E+00	1.74E+00	9.14E-01		pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Manganese-54	EPA 901.1 Modified	-8.00E-03	5.65E-02	5.65E-02	7.84E-02	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	1.36E-02	4.51E-02	4.51E-02	5.79E-02	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Niobium-94	EPA 901.1 Modified	-1.96E-03	5.10E-02	5.10E-02	7.24E-02	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Lead-210	EPA 901.1 Modified	3.04E+00	1.33E+00	1.33E+00	2.08E+00		pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Lead-212	EPA 901.1 Modified	5.53E-01	1.63E-01	1.66E-01	2.25E-01		pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Lead-214	EPA 901.1 Modified	5.51E-01	1.46E-01	1.49E-01	2.52E-01		pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Promethium-145	EPA 901.1 Modified	-1.06E-01	1.58E-01	1.58E-01	2.24E-01	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Radium-226	EPA 901.1 Modified	5.98E-01	1.28E-01	1.31E-01	1.50E-01		pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Antimony-125	EPA 901.1 Modified	1.63E-01	1.18E-01	1.18E-01	2.04E-01	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Thorium-234	EPA 901.1 Modified	2.37E+00	1.12E+00	1.12E+00	1.77E+00	U	pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Thallium-208	EPA 901.1 Modified	4.58E-01	1.38E-01	1.40E-01	2.40E-01		pCi/g
20-01037-16	TRG	L2-10214-F-FSGS-001-SS-A	12/12/19 10:00	1/9/2020	1/13/2020	20-01037	Uranium-235	EPA 901.1 Modified	6.20E-02	3.11E-01	3.11E-01	4.66E-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
Final Report of Analysis

Report To:		Work Order Details:	
Jeffrey Graham		SDG:	20-01037
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
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Actinium-228	EPA 901.1 Modified	4.83E-01	2.18E-01	2.19E-01	5.91E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Silver-108m	EPA 901.1 Modified	6.57E-03	3.47E-02	3.47E-02	6.72E-02	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Americium-241	EPA 901.1 Modified	-1.18E-02	6.86E-02	6.86E-02	1.88E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Barium-133	EPA 901.1 Modified	-1.65E-02	4.81E-02	4.81E-02	1.24E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Bismuth-214	EPA 901.1 Modified	7.28E-01	1.70E-01	1.74E-01	2.64E-01		pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Cobalt-60	EPA 901.1 Modified	9.56E-03	7.72E-02	7.72E-02	1.01E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Cesium-134	EPA 901.1 Modified	2.10E-02	3.45E-02	3.46E-02	8.89E-02	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Cesium-137	EPA 901.1 Modified	1.20E-03	7.52E-02	7.52E-02	1.13E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Europium-152	EPA 901.1 Modified	5.13E-02	2.07E-01	2.07E-01	2.65E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Europium-154	EPA 901.1 Modified	5.11E-02	1.64E-01	1.64E-01	1.37E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Europium-155	EPA 901.1 Modified	2.19E-01	1.48E-01	1.48E-01	2.80E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Holmium-166m	EPA 901.1 Modified	1.26E-01	6.01E-02	6.04E-02	1.14E-01		pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Iodine-129	EPA 901.1 Modified	2.44E-01	2.35E-01	2.36E-01	3.55E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Potassium-40	EPA 901.1 Modified	1.77E+01	2.41E+00	2.58E+00	5.29E-01		pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Manganese-54	EPA 901.1 Modified	-2.92E-02	7.10E-02	7.10E-02	9.64E-02	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Molybdenum-93	EPA 901.1 Modified	-1.05E-02	5.37E-02	5.37E-02	5.58E-02	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Niobium-94	EPA 901.1 Modified	9.68E-03	5.19E-02	5.19E-02	8.55E-02	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Lead-210	EPA 901.1 Modified	2.82E+00	1.91E+00	1.92E+00	3.12E+00	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Lead-212	EPA 901.1 Modified	5.65E-01	1.81E-01	1.84E-01	2.56E-01		pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Lead-214	EPA 901.1 Modified	7.32E-01	2.16E-01	2.19E-01	3.25E-01		pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Promethium-145	EPA 901.1 Modified	-1.98E-02	2.58E-01	2.58E-01	3.30E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Radium-226	EPA 901.1 Modified	7.28E-01	1.70E-01	1.74E-01	2.64E-01		pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Antimony-125	EPA 901.1 Modified	1.08E-01	1.15E-01	1.15E-01	2.21E-01	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Thorium-234	EPA 901.1 Modified	2.16E+00	1.64E+00	1.64E+00	2.70E+00	U	pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Thallium-208	EPA 901.1 Modified	5.89E-01	1.74E-01	1.77E-01	2.64E-01		pCi/g
20-01037-17	TRG	L2-10214-F-QIGS-001-SS-A	12/12/19 12:45	1/9/2020	1/13/2020	20-01037	Uranium-235	EPA 901.1 Modified	3.85E-03	4.59E-01	4.59E-01	5.90E-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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ZS-WM-131
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REC'D JAN - 9 2020

20-01037

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	L2-10214-A-FIGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/16/19	1334	5 ROC HTD	NA	706.48
5	L2-10214-A-QIGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/16/19	1334	5 ROC HTD	NA	624.27
6	L2-10214-A-FIGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/16/19	1336	5 ROC HTD	NA	640.46
7	L2-10214-B-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/14/19	1234	5 ROC HTD	NA	586.29
8	L2-10214-B-FSGS-015-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/14/19	1258	5 ROC HTD	NA	700.59
9	L2-10214-C-FSGS-016-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/13/19	1330	5 ROC HTD	NA	493.05
10	L2-10214-C-FIGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/13/19	1308	5 ROC HTD	NA	679.18
11	L2-10214-D-FSGS-007-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/11/19	1002	5 ROC HTD	NA	488.04
12	L2-10214-D-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/11/19	0924	5 ROC HTD	NA	541.25
13	L2-10214-D-FIGS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/11/19	0930	5 ROC HTD	NA	538.3
14	L2-10214-E-FSGS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/10/19	1244	5 ROC HTD	NA	659.59
15	L2-10214-E-FSGS-006-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/11/19	1255	5 ROC HTD	NA	842.9
16	L2-10214-F-FSGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	12/12/19	1000	5 ROC HTD	NA	572.48
17	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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								4					

[254] REC BS 1-9-20 @ 1327

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ZION SOLUTIONS LLC
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20-01037
REC'D JAN - 9 2020

ZS-WM-131
Revision 0
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Laboratory:	Date Submitted To Lab:		Ship Container No.:	Cooler Temperature:		Airbill Number:	
EBERLINE LABS			003 ~~NA~~ Jan 7 2020	**N/A**		FedEx Standard Overnight 8132 0229 4959	
Relinquished by: Jack Mucig	Date (mm/dd/yyyy): 1/7/2020	Time: 1510	Received by: Richard F. Rickert	Date: (mm/dd/yyyy): 01/07/2020	1510		
Relinquished by: Richard F. Rickert	Date (mm/dd/yyyy): 01/08/2020	Time: 1600	Received by: FedEx Standard Overnight	Date: (mm/dd/yyyy): 01/08/2020	1600		
Relinquished by: FedEx	Date (mm/dd/yyyy):	Time:	Received by: Randolph Spencer	Date: (mm/dd/yyyy): 1/09/2020	1327		
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):			
Comments: PO # HTD's 67718				7 Day Turn Around			

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.

[256]

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

REC'D FEB 17 2020

REC'D OCT 21 2019

ZS-WM-131
Revision 0
Information Use

ZION SOLUTIONS LLC
An EnergySolutions Company

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

Rec PS 10-21-19 @1100

[259]

ZION SOLUTIONS LLC
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REC'D FEB 17 2020

REC'D NOV 08 2019

20-02089

ZS-WM-131
Revision 0
Information Use

~~89-11029~~ 2-18-20

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

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REC'D FEB 17 2020

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ZS-WM-131
Revision 0
Information Use

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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
L1-10208-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

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REC'D FEB 17 2020

20-02089

ZS-WM-131
Revision 0
Information Use

~~REC'D DEC 09 2019~~

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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					
L1-10206-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

Rec PB 12-9-19 @ 1439

[262]

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20-02089

~~REC'D DEC 16 2019~~ REC'D FEB 17 2020

ZS-WM-131
Revision 0
Information Use

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

[263]

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REC'D FEB 17 2020

20-02089 ~~REC'D DEC 23 2019~~

ZS-WM-131
Revision 0
Information Use

~~19-12107~~ 2-18-20

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

REC [264] RS 12-23-19 @ 1038

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REC'D FEB 17 2020

REC'D JAN - 9 2020

ZS-WM-131
Revision 0
Information Use

20-02089

20-01030 PS 2-18-20

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

Rec PS 1-9-20 1327

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20-02089

REC'D FEB 17 2020

REC'D JAN - 9 2020

ZS-WM-131
Revision 0
Information Use

205-01037 PB 2-18-20

2-18-20

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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REC PB 1-9-20 @ 1327

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REC'D FEB 17 2020

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ZS-WM-131
Revision 0
Information Use

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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	[redacted]		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 RB 1-14-20 | Date Submitted To Lab: | Ship Container No.: | Cooler Temperature: | Airbill Number:

0956

[267]