ZION SOLUTIONS LLC
An EnergySolutions Company

ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

AREA UNDER THE TURBINE BUILDING

SURVEY UNIT 12205E

REVISION 1

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LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
AMCG	Average Member of the Critical Group
BcDCGL	Base Case Derived Concentration Guideline Level
BcSOF	Base Case Sum of Fractions
CCDD	Clean Concrete Demolition Debris
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
RA	Radiological Assessment
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 12205E, the "Area Under the Turbine Building," 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 (L1-12205E-F, Plan #2) 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. One (1) area of elevated activity was detected during the gamma scans in scan rows 53 through 57. Four (4) investigation soil samples taken at this location showed no activity for the Radionuclides of Concern (ROC) above the Minimum Detectable Concentration (MDC). The analytical results for all soil samples (systematic and investigation) taken in survey unit 12205E indicated 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 0.083. The mean OpSOF for the systematic samples was 0.033. For the systematic samples, 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 0.211 mrem/yr Total Effective Dose Equivalent (TEDE). Therefore, the null hypothesis is rejected and survey unit 12205E is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 12205E, "Area Under the Turbine Building," is a Class 1 open land survey unit and is 1,825 m^2 in size. It is bounded on the west by survey unit 12109, 12110, and 12111, the south by survey units 12203A and 12203B, the east by survey unit 12113, and the north by survey unit 12205D.

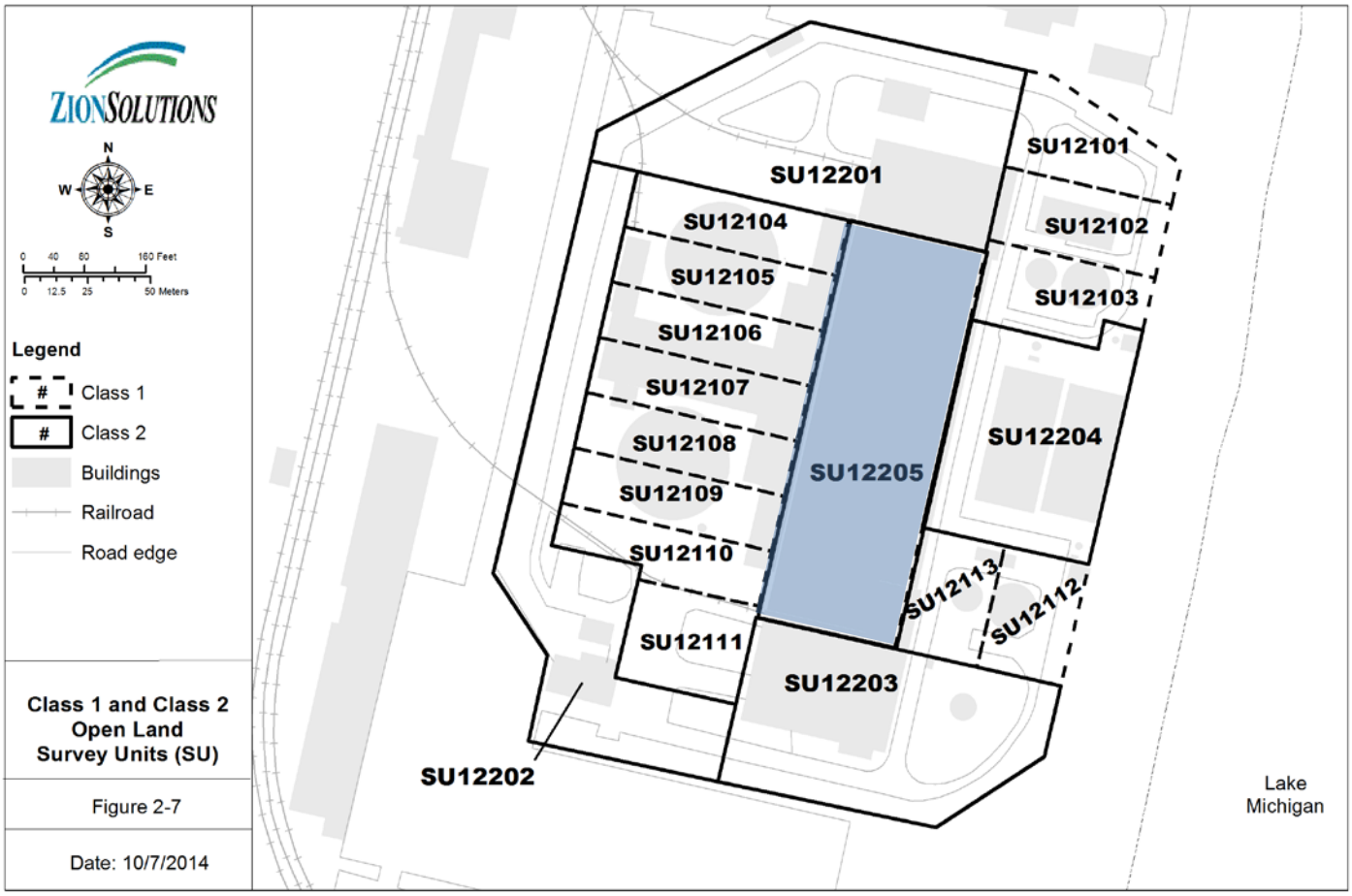
The topography of the survey unit is mainly flat with some small dips and depressions. The soil is mostly sand.

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 12205E was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 5). The *"Zion Station Historical Site Assessment"* (HSA) (Reference 6) did not designate a survey unit for this area. Subsequently, this area was described as "Area Around the Turbine Building" (survey unit 12205) in Table 2-4 of the ZSRP LTP as represented in Figure 2-7 of the LTP, which is replicated below as Figure 1. Survey unit 12205 was initially classified in the LTP as a Class 2.

Figure 1 - Class 1 and Class 2 Open Land Survey Units from Figure 2-7 of the LTP

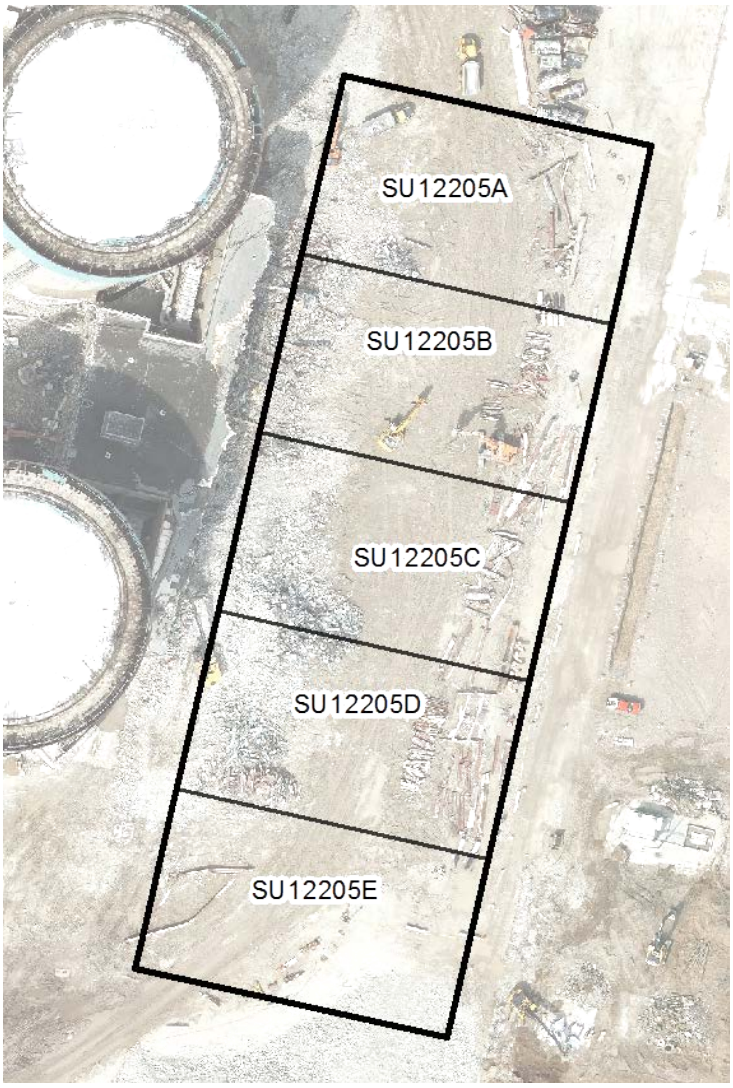


The Turbine Building was located in this area. Demolition of the Turbine Building to the 588 foot elevation level was completed in 2016 and the area was backfilled. Since clean fill was used, there were no characterization surveys performed in this area.

The HSA documents two instances, in 1988 and 1990, of contaminated material (up to 375,000 dpm fixed) being found in the outside trash area near the Turbine Building.

On July 15, 2016, due to changing radiological and operational conditions brought about by site decommissioning activities inside or adjacent to this area, survey unit 12205 was reclassified as a Class 1 open land survey unit and divided into five survey units: 12205A, 12205B, 12205C, 12205D and 12205E to comply with the survey unit size recommendations from MARSSIM Section 4.6. Figure 2 below shows the boundaries of the resulting Class 1 survey units. The change in classification was a conservative response and ensured that the survey unit was surveyed with the appropriate rigor.

Figure 2 - The Five Class 1 Open Land Survey Units Created from the Original Class 2 Survey Unit 12205



Surface soil samples were collected in this area under a Radiological Assessment (RA) during the Auxiliary Building open air demolition in 2017, with the highest result having an OpSOF of 13.53 (Co-60: 6.34 pCi/g, Cs-137: 23.10 pCi/g). After the Auxiliary Building demolition, the area was surveyed and remediated in support of the G-Wall excavation in 2018. The action levels, during the remediation, were established at the OpDCGLs for subsurface soils. The area was then backfilled with clean fill to bring it up to grade.

FSS was performed in December of 2018 through January of 2019. Gamma scans were performed on 100% of the surface area of the survey unit with one area of elevated activity observed. Eight (8) of the eleven (11) surface soil samples taken in this area were positive for both Co-60 and Cs-137 with a maximum OpSOF of 149.26 (Co-60: 1.06 pCi/g, Cs-137: 536 pCi/g). This area was subsequently remediated. Seventeen (17) systematic surface soil samples and eleven (11) subsurface soil samples were also obtained (systematic and investigation). Two (2) of the surface samples were positive for Co-60 and five (5) were positive for Cs-137 with maximum activities of 0.30 pCi/g and 0.44 pCi/g respectively. Three of the subsurface samples were positive for Cs-137 with a maximum activity of 0.09 pCi/g. None of the subsurface samples were positive for Co-60.

After completion of the FSS in January of 2019, Clean Concrete Demolition Debris (CCDD) from the demolition of the Containment Buildings was stored in the area. After the CCDD was removed in the summer of 2019, the area needed to be backfilled again to an elevation of 591 foot elevation over the basements due to a significant amount of soil being removed along with the CCDD. Since this action significantly changed the end state of the survey unit, it was decided to perform the FSS again.

A Radiological Engineer (RE) and a Characterization/License Termination (C/LT) Supervisor performed a visual inspection and walk-down of the survey unit on September 4, 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 procedure ZS-LT-300-001-002, "*Survey Unit Classification*" as part of the survey design for FSS. The assessment confirmed that survey unit 12205E was correctly classified as Class 1.

4. DATA QUALITY OBJECTIVES

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

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

The primary objective of the FSS sample plan is to demonstrate that the level of residual radioactivity in survey unit 12205E 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 Minimum Detectable Concentration (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 12205E. 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 were 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 12205E, 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

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

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

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

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

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

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

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

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. For this survey design, a conservative estimate of the sample variability of 0.30 was used as the coefficient of variation to calculate Δ/σ.

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

The computer program Visual Sample Plan (VSP) was used to generate the sample map, in accordance with ZS-LT-300-001-001. The map used was provided by the Survey Mapping/Computer Assisted Design Specialist, with coordinates based on the Illinois State Plane NAD 1983 standard topographical grid coordinate system. The number of samples generated by VSP for a systematic triangular grid was 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: $A = \frac{A_{SU}}{N} = \frac{1825}{17} = 107.4\ m^2$
- From the LTP, Table 5-16, the Area Factors for the next larger area (300 m^2) were used:
  - Cs-137 - 1.46
  - Cs-134 - 1.30
  - Co-60 - 1.16
- The $DCGL_{EMC}$ is the Surrogate Base Case DCGL times the Area Factor:
  - The $DCGL_{EMC}$ for Cs-137 = $1.46 * 14.15 = 20.66\ pCi/g$
  - The $DCGL_{EMC}$ for Cs-134 = $1.30 * 6.77 = 8.80\ pCi/g$
  - The $DCGL_{EMC}$ for Co-60 = $1.16 * 3.51 = 4.07\ pCi/g$

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

The implementation of quality control (QC) measures as referenced by LTP, Section 5.9 and Zion*Solutions* procedure ZS-LT-01, "*Quality Assurance Project Plan (for Characterization and FSS)*" (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 (L1-12205E-FQGS-109-SS) was selected randomly for split sample analysis for the FSS of this survey unit. One (1) QC split sample (L1-12205E-QIGS-101-SS) from investigation was added for QC analysis.

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 L1-12205E-FSGS-106-SB and L1-12205E-FSGS-117-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)
L1-12205E-FSGS-101-SS	641676.97	343705.43
L1-12205E-FSGS-102-SS	641686.62	343666.46
L1-12205E-FSGS-103-SS	641686.62	343677.60
L1-12205E-FSGS-104-SS	641686.62	343688.73
L1-12205E-FSGS-105-SS	641686.62	343699.87
L1-12205E-FSGS-106-SS	641686.62	343711.00
L1-12205E-FSGS-107-SS	641696.26	343660.90
L1-12205E-FSGS-108-SS	641696.26	343672.03
L1-12205E-FSGS-109-SS	641696.26	343683.17
L1-12205E-FSGS-110-SS	641696.26	343694.30
L1-12205E-FSGS-111-SS	641696.26	343705.43
L1-12205E-FSGS-112-SS	641705.90	343666.46
L1-12205E-FSGS-113-SS	641705.90	343677.60
L1-12205E-FSGS-114-SS	641705.90	343688.73
L1-12205E-FSGS-115-SS	641705.90	343699.87
L1-12205E-FSGS-116-SS	641705.90	343711.00
L1-12205E-FSGS-117-SS	641715.55	343672.03
L1-12205E-FSGS-106-SB	641686.62	343711.00
L1-12205E-FSGS-117-SB	641715.55	343672.03

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. No samples exceeded on OpSOF of 0.1 during the FSS of survey unit 12205E.

Three (3) soil samples, L1-12205E-FSGS-104-SS, L1-12205E-FSGS-117-SS, and L1-12205E-QIGS-101-SS were selected to meet the requirement that 10% of the samples collected for the FSS of survey unit 12205E be analyzed for HTD ROC. These samples were selected by having the highest OpSOF. Each 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 12205E.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	1,825 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	11.1 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	One (1) surface soil sample selected randomly for split sample analysis 2 actually obtained (1 systematic, 1 investigation)	(LTP, Section 5.9)
Number of Subsurface Soil Samples	Two (2) - systematic surface soil sample locations 106 and 117	(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 L1-12205E-F, Plan #2, 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 12205E, 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 12205E during the gamma scans in scan rows 53 to 57. An area 0.3 m x 5 m (1.5 m^2) with readings above the scan action level was identified. As part of the investigation, one (1) subsurface soil sample was taken (L1-12205E-FIGS-101-SB).

FSS field activities were conducted under FSS sample plan L1-12205E-F, Plan #2. 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 September 6, 2019, and concluding on September 16, 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) sodium iodide (NaI) detector operated in the rate-meter mode and using audio response. The probe was positioned within 2-inches to the ground and was moved at a scan speed of approximately 0.5 meters per second. One (1) area of elevated activity was 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 a check source to 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	304712/PR372143	12/18/2019
Ludlum 2350-1/Ludlum 44-10	304711/PR321902	1/18/2020
Ludlum 2350-1/Ludlum 44-10	304726/PR363452	8/28/2020
Ludlum 2350-1/Ludlum 44-10	304712/PR372143	9/9/2020
Ludlum 2350-1/Ludlum 44-10	266656/PR311750	7/24/2020

In accordance with the survey design, seventeen (17) surface soil samples were collected at the designated systematic sample points. In addition, two (2) subsurface samples were collected at the randomly selected sample locations, and four (4) surface samples and one (1) subsurface sample were collected at a location identified as elevated activity on the surface scans.

Three (3) samples (L1-12205E-FSGS-104-SS, L1-12205E-FSGS-117-SS, and L1-12205E-QIGS-101-SS) were selected for HTD radionuclide analysis. One (1) surface soil sample (L1-12205E-FQGS-109-SS) was selected randomly for QC sample analysis. One (1) QC split sample (L1-12205E-QIGS-101-SS) from investigation was added for QC analysis.

7. SURVEY RESULTS

One hundred percent (100%) of the surface of the survey unit was scanned for elevated radiation levels. Fifty-seven (57) 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. Five (5) elevated measurement locations were identified by surface scan. 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	2253	2585	None	None
Row 2	2207	2585	None	None
Row 3	2113	2585	None	None
Row 4	2046	2585	None	None
Row 5	2088	2585	None	None
Row 6	1977	2585	None	None
Row 7	2056	2585	None	None
Row 8	2062	2585	None	None
Row 9	2073	2600	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 10	2120	2600	None	None
Row 11	2136	2600	None	None
Row 12	2078	2600	None	None
Row 13	2065	2600	None	None
Row 14	2020	2600	None	None
Row 15	2146	2600	None	None
Row 16	2134	2600	None	None
Row 17	2169	2600	None	None
Row 18	2121	2600	None	None
Row 19	2244	2600	None	None
Row 20	2276	2600	None	None
Row 21	2303	2600	None	None
Row 22	2274	2600	None	None
Row 23	2385	2706	None	None
Row 24	2354	2706	None	None
Row 25	2254	2706	None	None
Row 26	2316	2706	None	None
Row 27	2242	2706	None	None
Row 28	2222	2706	None	None
Row 29	2306	2665	None	None
Row 30	2267	2665	None	None
Row 31	2473	2665	None	None
Row 32	2456	2665	None	None
Row 33	2557	2665	None	None
Row 34	2633	2665	None	None
Row 35	2523	2665	None	None
Row 36	2304	2665	None	None
Row 37	2367	2665	None	None
Row 38	2501	2665	None	None
Row 39	2612	2665	None	None
Row 40	2318	2665	None	None
Row 41	2524	2665	None	None
Row 42	2297	2665	None	None
Row 43	2326	2665	None	None
Row 44	2390	2665	None	None
Row 45	2015	2363	None	None
Row 46	2038	2363	None	None
Row 47	2555	2798	None	None
Row 48	2387	2798	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 49	2447	2798	None	None
Row 50	2474	2798	None	None
Row 51	2428	2798	None	None
Row 52	2510	2798	None	None
Row 53	3781	2798	1	L1-12205E-FIGS-101-SS L1-12205E-QIGS-101-SS L1-12205E-FIGS-102-SS L1-12205E-FIGS-103-SS L1-12205E-FIGS-104-SS L1-12205E-FIGS-101-SB
Row 54	3978	2798	1	
Row 55	3756	2798	1	
Row 56	3081	2798	1	
Row 57	3423	2798	1	

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

The seventeen (17) soil samples taken for non-parametric statistical testing, the four (4) investigation surface soil samples, and the three (3) subsurface soil samples (two selected at random and one taken as investigation), were analyzed using the on-site gamma spectroscopy system. Summaries of the sample analysis results are provided in Tables 12, 13, and 14, respectively. The basic statistics for the systematic sample population are summarized in Table 21. The gamma spectroscopy results revealed no samples with activity levels above the MDC for Co-60, Cs-137, 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)
L1-12205E-FSGS-101-SS	4.34E-02	4.68E-02	0.00E+00	7.83E+00	0.00E+00
L1-12205E-FSGS-102-SS	1.45E-02	0.00E+00	0.00E+00	2.62E+00	0.00E+00
L1-12205E-FSGS-103-SS	2.58E-02	0.00E+00	0.00E+00	4.66E+00	0.00E+00
L1-12205E-FSGS-104-SS	5.87E-02	3.00E-02	1.90E-03	1.06E+01	3.80E-06
L1-12205E-FSGS-105-SS	2.67E-02	1.53E-02	0.00E+00	4.82E+00	0.00E+00
L1-12205E-FSGS-106-SS	0.00E+00	1.47E-02	0.00E+00	0.00E+00	0.00E+00
L1-12205E-FSGS-107-SS	2.77E-02	2.64E-02	0.00E+00	5.00E+00	0.00E+00
L1-12205E-FSGS-108-SS	0.00E+00	0.00E+00	9.72E-03	0.00E+00	1.94E-05
L1-12205E-FSGS-109-SS	2.09E-02	2.69E-02	0.00E+00	3.77E+00	0.00E+00
L1-12205E-FSGS-110-SS	1.81E-02	1.09E-02	1.18E-03	3.27E+00	2.36E-06
L1-12205E-FSGS-111-SS	1.28E-02	1.67E-02	3.59E-02	2.31E+00	7.18E-05
L1-12205E-FSGS-112-SS	1.06E-02	1.41E-02	0.00E+00	1.91E+00	0.00E+00
L1-12205E-FSGS-113-SS	7.86E-03	6.83E-04	0.00E+00	1.42E+00	0.00E+00
L1-12205E-FSGS-114-SS	5.24E-03	3.08E-02	0.00E+00	9.46E-01	0.00E+00
L1-12205E-FSGS-115-SS	0.00E+00	3.01E-02	0.00E+00	0.00E+00	0.00E+00
L1-12205E-FSGS-116-SS	9.54E-03	0.00E+00	0.00E+00	1.72E+00	0.00E+00
L1-12205E-FSGS-117-SS	3.79E-02	5.59E-02	2.09E-02	6.84E+00	4.18E-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)
L1-12205E-FIGS-101-SS	3.55E-02	1.99E-02	0.00E+00	6.41E+00	0.00E+00
L1-12205E-FIGS-102-SS	0.00E+00	2.29E-02	4.04E-02	0.00E+00	8.08E-05
L1-12205E-FIGS-103-SS	2.75E-02	7.98E-03	1.74E-02	4.96E+00	3.48E-05
L1-12205E-FIGS-104-SS	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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)
L1-12205E-FSGS-106-SB	0.00E+00	2.54E-02	0.00E+00	0.00E+00	0.00E+00
L1-12205E-FSGS-117-SB	0.00E+00	3.99E-03	2.40E-02	0.00E+00	4.80E-05
L1-12205E-FIGS-101-SB	9.35E-03	0.00E+00	1.25E-03	1.69E+00	2.50E-06

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 three (3) samples selected for HTD ROC analysis. Samples L1-12205E-FSGS-104-SS-A, L1-12205E-FSGS-117-SS-A, and L1-12205E-QIGS-101-SS-A 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. No activity was positively detected in the samples at a concentration greater than MDC. Consequently, comparison of existing ratios versus the maximum ratios from Table 6 was not required. The off-site analysis results are provided in Table 15.

Table 15 - Off-Site Analysis Results

Sample # L1-12205E-FSGS-104-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	-2.95E-02	7.10E-02	1.05E-01	No
Cs-134	-1.03E-03	3.16E-02	7.07E-02	No
Cs-137	5.60E-02	5.35E-02	8.82E-02	No
Ni-63	8.92E-01	2.01E+00	3.41E+00	No
Sr-90	1.90E-01	3.03E-01	6.27E-01	No

Sample # L1-12205E-FSGS-117-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	-6.02E-03	4.90E-02	4.89E-02	No
Cs-134	-6.68E-03	1.79E-02	5.41E-02	No
Cs-137	-3.10E-02	3.96E-02	5.35E-02	No
Ni-63	-7.10E-01	1.95E+00	3.40E+00	No
Sr-90	9.84E-02	2.98E-01	6.27E-01	No

Sample # L1-12205E-QIGS-101-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	2.69E-02	4.79E-02	7.86E-02	No
Cs-134	-7.34E-03	1.98E-02	6.55E-02	No
Cs-137	-4.84E-02	4.80E-02	6.19E-02	No
Ni-63	-1.55E-01	1.72E+00	2.98E+00	No
Sr-90	3.57E-01	2.80E-01	5.58E-01	No

The implementation of survey specific QC measures included the collection of one (1) systematic sample (L1-12205E-FQGS-109-SS) and one (1) investigation sample (L1-12205E-QIGS-101-SS) for "split sample" analysis. The on-site laboratory analyzed the designated QC samples using the on-site gamma spectroscopy system. Gamma spectroscopy results (summarized in Table 16) indicate that concentrations for Cs-137, Co-60 and Cs-134 were less than MDC in the samples. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6.

Table 16 - Summary of Gamma Spectroscopy Results for QC Surface Soil Sample

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)
L1-12205E-FQGS-109-SS	2.78E-02	0.00E+00	1.53E-02	5.02E+00	3.06E-05
L1-12205E-QIGS-101-SS	3.92E-02	2.85E-02	0.00E+00	7.07E+00	0.00E+00

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

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

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 12205E are provided in Table 17. The results of the unity rule calculation for the ROC for the investigation samples are provided in Table 18, the results for 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 Systematic Surface Soil Samples compared to the OpDCGLs

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12205E-FSGS-101-SS	3.98E-02	2.70E-02	0.00E+00	8.56E-03	0.00E+00	0.075
L1-12205E-FSGS-102-SS	1.33E-02	0.00E+00	0.00E+00	2.86E-03	0.00E+00	0.016
L1-12205E-FSGS-103-SS	2.36E-02	0.00E+00	0.00E+00	5.09E-03	0.00E+00	0.029
L1-12205E-FSGS-104-SS	5.38E-02	1.73E-02	5.23E-04	1.16E-02	1.23E-06	0.083
L1-12205E-FSGS-105-SS	2.45E-02	8.83E-03	0.00E+00	5.27E-03	0.00E+00	0.039
L1-12205E-FSGS-106-SS	0.00E+00	8.48E-03	0.00E+00	0.00E+00	0.00E+00	0.008
L1-12205E-FSGS-107-SS	2.54E-02	1.52E-02	0.00E+00	5.47E-03	0.00E+00	0.046
L1-12205E-FSGS-108-SS	0.00E+00	0.00E+00	2.68E-03	0.00E+00	6.28E-06	0.003
L1-12205E-FSGS-109-SS	1.92E-02	1.55E-02	0.00E+00	4.12E-03	0.00E+00	0.039
L1-12205E-FSGS-110-SS	1.66E-02	6.29E-03	3.25E-04	3.57E-03	7.63E-07	0.027
L1-12205E-FSGS-111-SS	1.17E-02	9.64E-03	9.89E-03	2.53E-03	2.32E-05	0.034
L1-12205E-FSGS-112-SS	9.72E-03	8.14E-03	0.00E+00	2.09E-03	0.00E+00	0.020
L1-12205E-FSGS-113-SS	7.20E-03	3.94E-04	0.00E+00	1.55E-03	0.00E+00	0.009
L1-12205E-FSGS-114-SS	4.80E-03	1.78E-02	0.00E+00	1.03E-03	0.00E+00	0.024
L1-12205E-FSGS-115-SS	0.00E+00	1.74E-02	0.00E+00	0.00E+00	0.00E+00	0.017
L1-12205E-FSGS-116-SS	8.74E-03	0.00E+00	0.00E+00	1.88E-03	0.00E+00	0.011
L1-12205E-FSGS-117-SS	3.47E-02	3.23E-02	5.76E-03	7.48E-03	1.35E-05	0.080

Systematic Measurements

Number of Systematic Measurements =	17
# of Systematic Measurements with OpSOF $\geq$ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	0
Max Individual Systematic Measurement OpSOF =	0.083
Mean Systematic Measurement OpSOF =	0.033

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	
L1-12205E-FIGS-101-SS	3.25E-02	1.15E-02	0.00E+00	7.01E-03	0.00E+00	0.051
L1-12205E-FIGS-102-SS	0.00E+00	1.32E-02	1.11E-02	0.00E+00	2.61E-05	0.024
L1-12205E-FIGS-103-SS	2.52E-02	4.60E-03	4.79E-03	5.43E-03	1.12E-05	0.040
L1-12205E-FIGS-104-SS	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000

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	
L1-12205E-FSGS-106-SB	0.00E+00	2.23E-02	0.00E+00	0.00E+00	0.00E+00	0.022
L1-12205E-FSGS-117-SB	0.00E+00	3.51E-03	1.21E-02	0.00E+00	1.13E-04	0.016
L1-12205E-FIGS-101-SB	1.06E-02	0.00E+00	6.30E-04	8.64E-03	5.88E-06	0.020

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12205E-FQGS-109-SS	2.55E-02	0.00E+00	4.21E-03	5.49E-03	9.89E-06	0.035
L1-12205E-QIGS-101-SS	3.59E-02	1.64E-02	0.00E+00	7.74E-03	0.00E+00	0.060

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	1.88E-02	1.45E-02	5.87E-02	0.00E+00	0.016	4.26	4.42E-03	1.10E-01
Cs-134	1.88E-02	1.53E-02	5.59E-02	0.00E+00	0.017	6.77	2.77E-03	6.94E-02
Cs-137	4.09E-03	0.00E+00	3.59E-02	0.00E+00	0.010	14.18	2.89E-04	7.22E-03
Ni-63	3.39E+00	2.62E+00	1.06E+01	0.00E+00	2.968	3572.1	9.50E-04	2.38E-02
Sr-90	8.19E-06	0.00E+00	7.18E-05	0.00E+00	0.000	12.09	6.77E-07	1.69E-05

The mean BcSOF for survey unit 12205E is 0.008, which equates to a dose of 0.211 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, L1-12205E-FQGS-109-SS and L1-12205E-QIGS-101-SS, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in ZS-LT-01, *"Quality Assurance Project Plan (for Characterization and FSS)."* The standard and comparison samples did not both have a positive result for a gamma-emitting ROC, therefore K-40 was used in the QC comparisons. There was acceptable agreement between standard and comparison results when using K-40. Refer to Attachment 5 for data and QC analysis results.

9. INVESTIGATIONS AND RESULTS

An investigation was performed following scan alarms in the south end of rows 53 to 57 on September 11, 2019. Readings ranging from 300 to 1200 cpm above the scan action level were recorded. The area was bounded by scans as being 0.3 m in width by 5 m in length. Four (4)

investigation soil samples were taken in the bounded area: L1-12205E-FIGS-101-SS through L1-12205E-FIGS-104-SS. A split QC sample, L1-12205E-QIGS-101-SS, and a subsurface sample, L1-12205E-FIGS-101-SB, were also obtained. Gamma spectroscopy results revealed that activity level for the ROC was less than MDC in all of the samples. It was suspected that the higher readings in this area was due to the presence of clay approximately 6-inches below the surface of the sand used to backfill the area.

The investigation is documented in an Attachment 13 (from ZS- LT-300-001-004), "Final Status Survey Investigation."

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 coherence to the statistical principles of the DQO process. The Sign Test was performed on the data and compared to the original assumptions of the DQOs. The evaluation of the Sign Test results clearly demonstrates that the survey unit passes the unrestricted release criteria, thus, the null hypothesis is rejected. The Sign Test is included in Attachment 4.

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

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

13. ANOMALIES

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

14. CONCLUSION

Survey unit 12205E 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.

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 12205E of 0.211 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 12205E 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 Zion the 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"

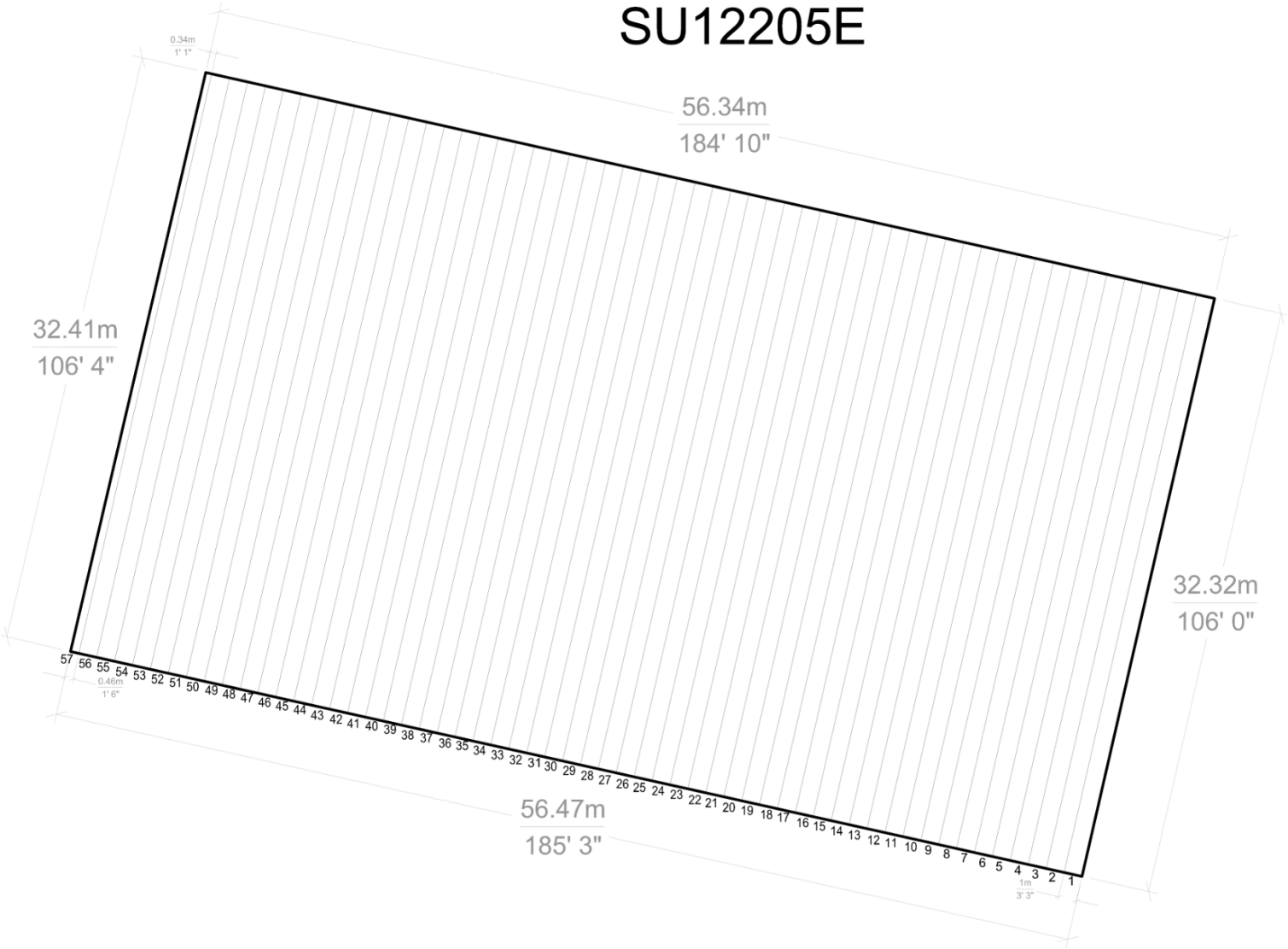
16. ATTACHMENTS

1. Attachment 1 - Figure 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
FIGURE AND MAP

Survey Unit 12205E Final Status Survey Boundaries and Systematic Sample Points

Survey Unit 12205E 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	PR372143	304712	12205E	GS023	9/6/2019 13:26	2385	2026	2706	No
44-10	PR372143	304712	12205E	GS023	9/6/2019 13:28	2297	2026	2706	No
44-10	PR372143	304712	12205E	GS023	9/6/2019 13:31	2300	2026	2706	No
44-10	PR372143	304712	12205E	GS023	9/6/2019 13:33	2268	2026	2706	No
44-10	PR372143	304712	12205E	GS024	9/6/2019 13:36	2249	2026	2706	No
44-10	PR372143	304712	12205E	GS024	9/6/2019 13:38	2218	2026	2706	No
44-10	PR372143	304712	12205E	GS024	9/6/2019 13:40	2175	2026	2706	No
44-10	PR372143	304712	12205E	GS024	9/6/2019 13:42	2354	2026	2706	No
44-10	PR372143	304712	12205E	GS025	9/6/2019 13:45	2249	2026	2706	No
44-10	PR372143	304712	12205E	GS025	9/6/2019 13:48	2254	2026	2706	No
44-10	PR372143	304712	12205E	GS025	9/6/2019 13:50	2249	2026	2706	No
44-10	PR372143	304712	12205E	GS025	9/6/2019 13:53	2246	2026	2706	No
44-10	PR372143	304712	12205E	GS026	9/6/2019 13:56	2281	2026	2706	No
44-10	PR372143	304712	12205E	GS026	9/6/2019 13:58	2198	2026	2706	No
44-10	PR372143	304712	12205E	GS026	9/6/2019 14:00	2152	2026	2706	No
44-10	PR372143	304712	12205E	GS026	9/6/2019 14:03	2316	2026	2706	No
44-10	PR372143	304712	12205E	GS027	9/6/2019 14:05	2203	2026	2706	No
44-10	PR372143	304712	12205E	GS027	9/6/2019 14:07	2176	2026	2706	No
44-10	PR372143	304712	12205E	GS027	9/6/2019 14:10	2242	2026	2706	No
44-10	PR372143	304712	12205E	GS027	9/6/2019 14:12	2219	2026	2706	No
44-10	PR372143	304712	12205E	GS028	9/6/2019 14:15	2185	2026	2706	No
44-10	PR372143	304712	12205E	GS028	9/6/2019 14:17	2202	2026	2706	No
44-10	PR372143	304712	12205E	GS028	9/6/2019 14:20	2186	2026	2706	No
44-10	PR372143	304712	12205E	GS028	9/6/2019 14:22	2222	2026	2706	No
44-10	PR321902	304711	12205E	GS001	9/6/2019 12:44	2121	1922	2585	No
44-10	PR321902	304711	12205E	GS001	9/6/2019 12:46	2237	1922	2585	No
44-10	PR321902	304711	12205E	GS001	9/6/2019 12:48	2253	1922	2585	No
44-10	PR321902	304711	12205E	GS001	9/6/2019 12:51	2124	1922	2585	No
44-10	PR321902	304711	12205E	GS002	9/6/2019 12:54	2115	1922	2585	No
44-10	PR321902	304711	12205E	GS002	9/6/2019 12:56	2165	1922	2585	No
44-10	PR321902	304711	12205E	GS002	9/6/2019 12:59	2207	1922	2585	No
44-10	PR321902	304711	12205E	GS002	9/6/2019 13:03	2070	1922	2585	No
44-10	PR321902	304711	12205E	GS003	9/6/2019 13:19	2057	1922	2585	No
44-10	PR321902	304711	12205E	GS003	9/6/2019 13:22	2021	1922	2585	No
44-10	PR321902	304711	12205E	GS003	9/6/2019 13:24	2113	1922	2585	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	12205E	GS003	9/6/2019 13:26	1974	1922	2585	No
44-10	PR321902	304711	12205E	GS004	9/6/2019 13:29	2046	1922	2585	No
44-10	PR321902	304711	12205E	GS004	9/6/2019 13:31	1984	1922	2585	No
44-10	PR321902	304711	12205E	GS004	9/6/2019 13:32	1925	1922	2585	No
44-10	PR321902	304711	12205E	GS004	9/6/2019 13:35	1980	1922	2585	No
44-10	PR321902	304711	12205E	GS005	9/6/2019 13:41	2034	1922	2585	No
44-10	PR321902	304711	12205E	GS005	9/6/2019 13:43	2050	1922	2585	No
44-10	PR321902	304711	12205E	GS005	9/6/2019 13:45	2088	1922	2585	No
44-10	PR321902	304711	12205E	GS005	9/6/2019 13:48	1981	1922	2585	No
44-10	PR321902	304711	12205E	GS006	9/6/2019 14:12	1948	1922	2585	No
44-10	PR321902	304711	12205E	GS006	9/6/2019 14:14	1977	1922	2585	No
44-10	PR321902	304711	12205E	GS006	9/6/2019 14:17	1953	1922	2585	No
44-10	PR321902	304711	12205E	GS006	9/6/2019 14:19	1955	1922	2585	No
44-10	PR321902	304711	12205E	GS007	9/6/2019 14:22	2011	1922	2585	No
44-10	PR321902	304711	12205E	GS007	9/6/2019 14:24	2056	1922	2585	No
44-10	PR321902	304711	12205E	GS007	9/6/2019 14:26	2042	1922	2585	No
44-10	PR321902	304711	12205E	GS007	9/6/2019 14:28	2027	1922	2585	No
44-10	PR321902	304711	12205E	GS008	9/6/2019 14:31	2030	1922	2585	No
44-10	PR321902	304711	12205E	GS008	9/6/2019 14:34	2062	1922	2585	No
44-10	PR321902	304711	12205E	GS008	9/6/2019 14:36	2049	1922	2585	No
44-10	PR321902	304711	12205E	GS008	9/6/2019 14:39	2021	1922	2585	No
44-10	PR363452	304726	12205E	GS029	9/9/2019 7:39	2277	1990	2665	No
44-10	PR363452	304726	12205E	GS029	9/9/2019 7:41	2306	1990	2665	No
44-10	PR363452	304726	12205E	GS029	9/9/2019 7:43	2266	1990	2665	No
44-10	PR363452	304726	12205E	GS029	9/9/2019 7:45	2277	1990	2665	No
44-10	PR363452	304726	12205E	GS030	9/9/2019 7:48	2208	1990	2665	No
44-10	PR363452	304726	12205E	GS030	9/9/2019 7:50	2267	1990	2665	No
44-10	PR363452	304726	12205E	GS030	9/9/2019 7:52	2216	1990	2665	No
44-10	PR363452	304726	12205E	GS030	9/9/2019 7:54	2215	1990	2665	No
44-10	PR363452	304726	12205E	GS031	9/9/2019 7:57	2308	1990	2665	No
44-10	PR363452	304726	12205E	GS031	9/9/2019 7:59	2261	1990	2665	No
44-10	PR363452	304726	12205E	GS031	9/9/2019 8:01	2386	1990	2665	No
44-10	PR363452	304726	12205E	GS031	9/9/2019 8:04	2473	1990	2665	No
44-10	PR363452	304726	12205E	GS032	9/9/2019 8:07	2456	1990	2665	No
44-10	PR363452	304726	12205E	GS032	9/9/2019 8:09	2174	1990	2665	No
44-10	PR363452	304726	12205E	GS032	9/9/2019 8:11	2180	1990	2665	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	12205E	GS032	9/9/2019 8:14	2131	1990	2665	No
44-10	PR363452	304726	12205E	GS033	9/9/2019 8:17	2279	1990	2665	No
44-10	PR363452	304726	12205E	GS033	9/9/2019 8:19	2308	1990	2665	No
44-10	PR363452	304726	12205E	GS033	9/9/2019 8:21	2291	1990	2665	No
44-10	PR363452	304726	12205E	GS033	9/9/2019 8:26	2557	1990	2665	No
44-10	PR363452	304726	12205E	GS034	9/9/2019 8:33	2633	1990	2665	No
44-10	PR363452	304726	12205E	GS034	9/9/2019 8:35	2193	1990	2665	No
44-10	PR363452	304726	12205E	GS034	9/9/2019 8:38	2387	1990	2665	No
44-10	PR363452	304726	12205E	GS034	9/9/2019 8:40	2275	1990	2665	No
44-10	PR363452	304726	12205E	GS035	9/9/2019 8:43	2188	1990	2665	No
44-10	PR363452	304726	12205E	GS035	9/9/2019 8:45	2167	1990	2665	No
44-10	PR363452	304726	12205E	GS035	9/9/2019 8:47	2194	1990	2665	No
44-10	PR363452	304726	12205E	GS035	9/9/2019 8:50	2523	1990	2665	No
44-10	PR363452	304726	12205E	GS036	9/9/2019 8:57	2304	1990	2665	No
44-10	PR363452	304726	12205E	GS036	9/9/2019 8:59	2230	1990	2665	No
44-10	PR363452	304726	12205E	GS036	9/9/2019 9:02	2171	1990	2665	No
44-10	PR363452	304726	12205E	GS036	9/9/2019 9:04	2260	1990	2665	No
44-10	PR363452	304726	12205E	GS037	9/9/2019 9:07	2202	1990	2665	No
44-10	PR363452	304726	12205E	GS037	9/9/2019 9:09	2178	1990	2665	No
44-10	PR363452	304726	12205E	GS037	9/9/2019 9:11	2139	1990	2665	No
44-10	PR363452	304726	12205E	GS037	9/9/2019 9:16	2367	1990	2665	No
44-10	PR363452	304726	12205E	GS038	9/9/2019 9:19	2501	1990	2665	No
44-10	PR363452	304726	12205E	GS038	9/9/2019 9:21	2148	1990	2665	No
44-10	PR363452	304726	12205E	GS038	9/9/2019 9:23	2311	1990	2665	No
44-10	PR363452	304726	12205E	GS038	9/9/2019 9:25	2319	1990	2665	No
44-10	PR363452	304726	12205E	GS039	9/9/2019 9:28	2325	1990	2665	No
44-10	PR363452	304726	12205E	GS039	9/9/2019 9:30	2292	1990	2665	No
44-10	PR363452	304726	12205E	GS039	9/9/2019 9:32	2364	1990	2665	No
44-10	PR363452	304726	12205E	GS039	9/9/2019 9:34	2612	1990	2665	No
44-10	PR363452	304726	12205E	GS040	9/9/2019 9:38	2431	1990	2665	No
44-10	PR363452	304726	12205E	GS040	9/9/2019 9:41	2318	1990	2665	No
44-10	PR363452	304726	12205E	GS040	9/9/2019 9:43	2206	1990	2665	No
44-10	PR363452	304726	12205E	GS040	9/9/2019 9:45	2182	1990	2665	No
44-10	PR363452	304726	12205E	GS041	9/9/2019 9:48	2273	1990	2665	No
44-10	PR363452	304726	12205E	GS041	9/9/2019 9:50	2395	1990	2665	No
44-10	PR363452	304726	12205E	GS041	9/9/2019 9:52	2283	1990	2665	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	12205E	GS041	9/9/2019 9:55	2524	1990	2665	No
44-10	PR363452	304726	12205E	GS042	9/9/2019 9:58	2297	1990	2665	No
44-10	PR363452	304726	12205E	GS042	9/9/2019 10:01	2190	1990	2665	No
44-10	PR363452	304726	12205E	GS042	9/9/2019 10:03	2286	1990	2665	No
44-10	PR363452	304726	12205E	GS042	9/9/2019 10:05	2265	1990	2665	No
44-10	PR363452	304726	12205E	GS043	9/9/2019 10:08	2326	1990	2665	No
44-10	PR363452	304726	12205E	GS043	9/9/2019 10:10	2256	1990	2665	No
44-10	PR363452	304726	12205E	GS043	9/9/2019 10:12	2245	1990	2665	No
44-10	PR363452	304726	12205E	GS043	9/9/2019 10:15	2286	1990	2665	No
44-10	PR363452	304726	12205E	GS044	9/9/2019 10:17	2390	1990	2665	No
44-10	PR363452	304726	12205E	GS044	9/9/2019 10:20	2374	1990	2665	No
44-10	PR363452	304726	12205E	GS044	9/9/2019 10:22	2343	1990	2665	No
44-10	PR363452	304726	12205E	GS044	9/9/2019 10:24	2222	1990	2665	No
44-10	PR321902	304711	12205E	GS009	9/9/2019 7:39	2039	1935	2600	No
44-10	PR321902	304711	12205E	GS009	9/9/2019 7:41	2073	1935	2600	No
44-10	PR321902	304711	12205E	GS009	9/9/2019 7:43	2016	1935	2600	No
44-10	PR321902	304711	12205E	GS009	9/9/2019 7:45	2062	1935	2600	No
44-10	PR321902	304711	12205E	GS010	9/9/2019 7:48	2120	1935	2600	No
44-10	PR321902	304711	12205E	GS010	9/9/2019 7:50	1980	1935	2600	No
44-10	PR321902	304711	12205E	GS010	9/9/2019 7:53	1950	1935	2600	No
44-10	PR321902	304711	12205E	GS010	9/9/2019 7:55	2068	1935	2600	No
44-10	PR321902	304711	12205E	GS011	9/9/2019 7:58	2136	1935	2600	No
44-10	PR321902	304711	12205E	GS011	9/9/2019 8:00	2128	1935	2600	No
44-10	PR321902	304711	12205E	GS011	9/9/2019 8:02	1988	1935	2600	No
44-10	PR321902	304711	12205E	GS011	9/9/2019 8:04	2036	1935	2600	No
44-10	PR321902	304711	12205E	GS012	9/9/2019 8:06	2052	1935	2600	No
44-10	PR321902	304711	12205E	GS012	9/9/2019 8:08	1980	1935	2600	No
44-10	PR321902	304711	12205E	GS012	9/9/2019 8:13	2021	1935	2600	No
44-10	PR321902	304711	12205E	GS012	9/9/2019 8:15	2078	1935	2600	No
44-10	PR321902	304711	12205E	GS013	9/9/2019 8:18	2065	1935	2600	No
44-10	PR321902	304711	12205E	GS013	9/9/2019 8:20	2059	1935	2600	No
44-10	PR321902	304711	12205E	GS013	9/9/2019 8:22	1947	1935	2600	No
44-10	PR321902	304711	12205E	GS013	9/9/2019 8:24	1978	1935	2600	No
44-10	PR321902	304711	12205E	GS014	9/9/2019 8:27	1978	1935	2600	No
44-10	PR321902	304711	12205E	GS014	9/9/2019 8:29	2020	1935	2600	No
44-10	PR321902	304711	12205E	GS014	9/9/2019 8:31	1945	1935	2600	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	12205E	GS014	9/9/2019 8:34	1965	1935	2600	No
44-10	PR321902	304711	12205E	GS015	9/9/2019 12:29	2146	1935	2600	No
44-10	PR321902	304711	12205E	GS015	9/9/2019 12:31	2011	1935	2600	No
44-10	PR321902	304711	12205E	GS015	9/9/2019 12:33	2007	1935	2600	No
44-10	PR321902	304711	12205E	GS015	9/9/2019 12:35	2111	1935	2600	No
44-10	PR321902	304711	12205E	GS016	9/9/2019 12:38	2134	1935	2600	No
44-10	PR321902	304711	12205E	GS016	9/9/2019 12:40	2096	1935	2600	No
44-10	PR321902	304711	12205E	GS016	9/9/2019 12:42	2129	1935	2600	No
44-10	PR321902	304711	12205E	GS016	9/9/2019 12:44	2120	1935	2600	No
44-10	PR321902	304711	12205E	GS017	9/9/2019 12:47	2139	1935	2600	No
44-10	PR321902	304711	12205E	GS017	9/9/2019 12:49	2169	1935	2600	No
44-10	PR321902	304711	12205E	GS017	9/9/2019 12:51	2102	1935	2600	No
44-10	PR321902	304711	12205E	GS017	9/9/2019 12:54	2042	1935	2600	No
44-10	PR321902	304711	12205E	GS018	9/9/2019 12:57	2089	1935	2600	No
44-10	PR321902	304711	12205E	GS018	9/9/2019 13:00	2121	1935	2600	No
44-10	PR321902	304711	12205E	GS018	9/9/2019 13:03	2063	1935	2600	No
44-10	PR321902	304711	12205E	GS018	9/9/2019 13:05	2017	1935	2600	No
44-10	PR321902	304711	12205E	GS019	9/9/2019 13:08	2188	1935	2600	No
44-10	PR321902	304711	12205E	GS019	9/9/2019 13:11	2077	1935	2600	No
44-10	PR321902	304711	12205E	GS019	9/9/2019 13:13	2104	1935	2600	No
44-10	PR321902	304711	12205E	GS019	9/9/2019 13:15	2244	1935	2600	No
44-10	PR321902	304711	12205E	GS020	9/9/2019 13:18	2198	1935	2600	No
44-10	PR321902	304711	12205E	GS020	9/9/2019 13:20	2276	1935	2600	No
44-10	PR321902	304711	12205E	GS020	9/9/2019 13:22	2146	1935	2600	No
44-10	PR321902	304711	12205E	GS020	9/9/2019 13:25	2173	1935	2600	No
44-10	PR321902	304711	12205E	GS021	9/9/2019 13:28	2303	1935	2600	No
44-10	PR321902	304711	12205E	GS021	9/9/2019 13:30	2260	1935	2600	No
44-10	PR321902	304711	12205E	GS021	9/9/2019 13:32	2180	1935	2600	No
44-10	PR321902	304711	12205E	GS021	9/9/2019 13:35	2209	1935	2600	No
44-10	PR321902	304711	12205E	GS022	9/9/2019 13:37	2242	1935	2600	No
44-10	PR321902	304711	12205E	GS022	9/9/2019 13:40	2271	1935	2600	No
44-10	PR321902	304711	12205E	GS022	9/9/2019 13:43	2274	1935	2600	No
44-10	PR321902	304711	12205E	GS022	9/9/2019 13:45	2268	1935	2600	No
44-10	PR372143	304712	12205E	GS047	9/11/2019 8:42	2555	2105	2798	No
44-10	PR372143	304712	12205E	GS047	9/11/2019 8:45	2381	2105	2798	No
44-10	PR372143	304712	12205E	GS047	9/11/2019 8:48	2486	2105	2798	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	PR372143	304712	12205E	GS047	9/11/2019 8:50	2369	2105	2798	No
44-10	PR372143	304712	12205E	GS048	9/11/2019 8:53	2370	2105	2798	No
44-10	PR372143	304712	12205E	GS048	9/11/2019 8:55	2332	2105	2798	No
44-10	PR372143	304712	12205E	GS048	9/11/2019 8:57	2246	2105	2798	No
44-10	PR372143	304712	12205E	GS048	9/11/2019 9:00	2387	2105	2798	No
44-10	PR372143	304712	12205E	GS049	9/11/2019 9:03	2325	2105	2798	No
44-10	PR372143	304712	12205E	GS049	9/11/2019 9:06	2440	2105	2798	No
44-10	PR372143	304712	12205E	GS049	9/11/2019 9:08	2447	2105	2798	No
44-10	PR372143	304712	12205E	GS049	9/11/2019 9:10	2244	2105	2798	No
44-10	PR372143	304712	12205E	GS050	9/11/2019 9:13	2447	2105	2798	No
44-10	PR372143	304712	12205E	GS050	9/11/2019 9:15	2474	2105	2798	No
44-10	PR372143	304712	12205E	GS050	9/11/2019 9:17	2290	2105	2798	No
44-10	PR372143	304712	12205E	GS050	9/11/2019 9:19	2368	2105	2798	No
44-10	PR372143	304712	12205E	GS051	9/11/2019 9:21	2268	2105	2798	No
44-10	PR372143	304712	12205E	GS051	9/11/2019 9:23	2339	2105	2798	No
44-10	PR372143	304712	12205E	GS051	9/11/2019 9:26	2428	2105	2798	No
44-10	PR372143	304712	12205E	GS051	9/11/2019 9:28	2310	2105	2798	No
44-10	PR372143	304712	12205E	GS052	9/11/2019 9:31	2249	2105	2798	No
44-10	PR372143	304712	12205E	GS052	9/11/2019 9:33	2400	2105	2798	No
44-10	PR372143	304712	12205E	GS052	9/11/2019 9:35	2356	2105	2798	No
44-10	PR372143	304712	12205E	GS052	9/11/2019 9:37	2510	2105	2798	No
44-10	PR372143	304712	12205E	GS053	9/11/2019 9:43	3781	2105	2798	Yes
44-10	PR372143	304712	12205E	GS053	9/11/2019 9:45	2468	2105	2798	No
44-10	PR372143	304712	12205E	GS053	9/11/2019 9:49	2289	2105	2798	No
44-10	PR372143	304712	12205E	GS053	9/11/2019 9:51	2237	2105	2798	No
44-10	PR372143	304712	12205E	GS054	9/11/2019 9:53	2409	2105	2798	No
44-10	PR372143	304712	12205E	GS054	9/11/2019 9:55	2484	2105	2798	No
44-10	PR372143	304712	12205E	GS054	9/11/2019 9:57	2475	2105	2798	No
44-10	PR372143	304712	12205E	GS054	9/11/2019 10:01	3978	2105	2798	Yes
44-10	PR372143	304712	12205E	GS055	9/11/2019 10:06	3756	2105	2798	Yes
44-10	PR372143	304712	12205E	GS055	9/11/2019 10:08	2446	2105	2798	No
44-10	PR372143	304712	12205E	GS055	9/11/2019 10:11	2430	2105	2798	No
44-10	PR372143	304712	12205E	GS055	9/11/2019 10:13	2372	2105	2798	No
44-10	PR372143	304712	12205E	GS056	9/11/2019 10:16	2441	2105	2798	No
44-10	PR372143	304712	12205E	GS056	9/11/2019 10:18	2527	2105	2798	No
44-10	PR372143	304712	12205E	GS056	9/11/2019 10:20	2473	2105	2798	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	PR372143	304712	12205E	GS056	9/11/2019 10:22	3081	2105	2798	Yes
44-10	PR372143	304712	12205E	GS057	9/11/2019 10:28	2319	2105	2798	No
44-10	PR372143	304712	12205E	GS057	9/11/2019 10:30	2353	2105	2798	No
44-10	PR372143	304712	12205E	GS057	9/11/2019 10:32	2314	2105	2798	No
44-10	PR311750	266656	12205E	GS045	9/12/2019 12:37	1877	1734	2363	No
44-10	PR311750	266656	12205E	GS045	9/12/2019 12:40	2015	1734	2363	No
44-10	PR311750	266656	12205E	GS045	9/12/2019 12:42	1937	1734	2363	No
44-10	PR311750	266656	12205E	GS045	9/12/2019 12:44	2006	1734	2363	No
44-10	PR311750	266656	12205E	GS046	9/12/2019 12:47	2038	1734	2363	No
44-10	PR311750	266656	12205E	GS046	9/12/2019 12:49	2025	1734	2363	No
44-10	PR311750	266656	12205E	GS046	9/12/2019 12:51	1958	1734	2363	No
44-10	PR311750	266656	12205E	GS046	9/12/2019 12:53	1953	1734	2363	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

ZION SOLUTIONS LLC
An EnergySolutions Company

Attachment 12
Sign Statistical Test

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

Survey Area: No. 12000 **Description:** Radiological Restricted Area Grounds
Survey Unit: No. 12205E **Description:** Area Under the Turbine Building
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			
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	(as applicable)			
1	3.98E-02	2.70E-02	0.00E+00	8.56E-03	0.00E+00	SOF	0.075	0.925	+
2	1.33E-02	0.00E+00	0.00E+00	2.86E-03	0.00E+00	SOF	0.016	0.984	+
3	2.36E-02	0.00E+00	0.00E+00	5.09E-03	0.00E+00	SOF	0.029	0.971	+
4	5.38E-02	1.73E-02	5.23E-04	1.16E-02	1.23E-06	SOF	0.083	0.917	+
5	2.45E-02	8.83E-03	0.00E+00	5.27E-03	0.00E+00	SOF	0.039	0.961	+
6	0.00E+00	8.48E-03	0.00E+00	0.00E+00	0.00E+00	SOF	0.008	0.992	+
7	2.54E-02	1.52E-02	0.00E+00	5.47E-03	0.00E+00	SOF	0.046	0.954	+
8	0.00E+00	0.00E+00	2.68E-03	0.00E+00	6.28E-06	SOF	0.003	0.997	+
9	1.92E-02	1.55E-02	0.00E+00	4.12E-03	0.00E+00	SOF	0.039	0.961	+
10	1.66E-02	6.29E-03	3.25E-04	3.57E-03	7.63E-07	SOF	0.027	0.973	+
11	1.17E-02	9.64E-03	9.89E-03	2.53E-03	2.32E-05	SOF	0.034	0.966	+
12	9.72E-03	8.14E-03	0.00E+00	2.09E-03	0.00E+00	SOF	0.020	0.980	+
13	7.20E-03	3.94E-04	0.00E+00	1.55E-03	0.00E+00	SOF	0.009	0.991	+
14	4.80E-03	1.78E-02	0.00E+00	1.03E-03	0.00E+00	SOF	0.024	0.976	+
15	0.00E+00	1.74E-02	0.00E+00	0.00E+00	0.00E+00	SOF	0.017	0.983	+
16	8.74E-03	0.00E+00	0.00E+00	1.88E-03	0.00E+00	SOF	0.011	0.989	+
17	3.47E-02	3.23E-02	5.76E-03	7.48E-03	1.35E-05	SOF	0.080	0.920	+

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): J Graham / [signature] 1/7/2020
(Print Name) (Signature) (Date)

Peer Reviewed By (RE): R.J. Mandz / [signature] 1-7-20
(Print Name) (Signature) (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #:	12000	Survey Unit #:	12205E	Survey Unit Name:	Area Under the Turbine Building
Sample Plan#:		L1-12205E-F, Plan #2			

Sample Description: Comparison of split samples collected from systematic surface soil sample #109 and investigation surface soil sample #101. The samples were analyzed using gamma spectroscopy by on-site HPGe system. The standard/comparison samples were L1-12205E-FSGS-109SS/L1-12205E-FQGS-109SS and L1-12205E-FIGS-101SS/L1-12205E-QIGS-101SS.

	STANDARD				COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
Systematic Sample #109								
K-40	7.67E+00	5.31E-01	14.40	0.6 - 1.66	7.33E+00	5.52E-01	1.05	Y
Investigation Sample #101								
K-40	8.35E+00	5.64E-01	14.8	0.6 - 1.66	8.19E+00	5.62E-01	1.02	Y

Comments/Corrective Actions:
The standard samples and QC samples did not have positive results for a gamma emitting ROC, therefore K-40 was used in the QC comparisons.There was acceptable agreement when using K-40. No further action is necessary.

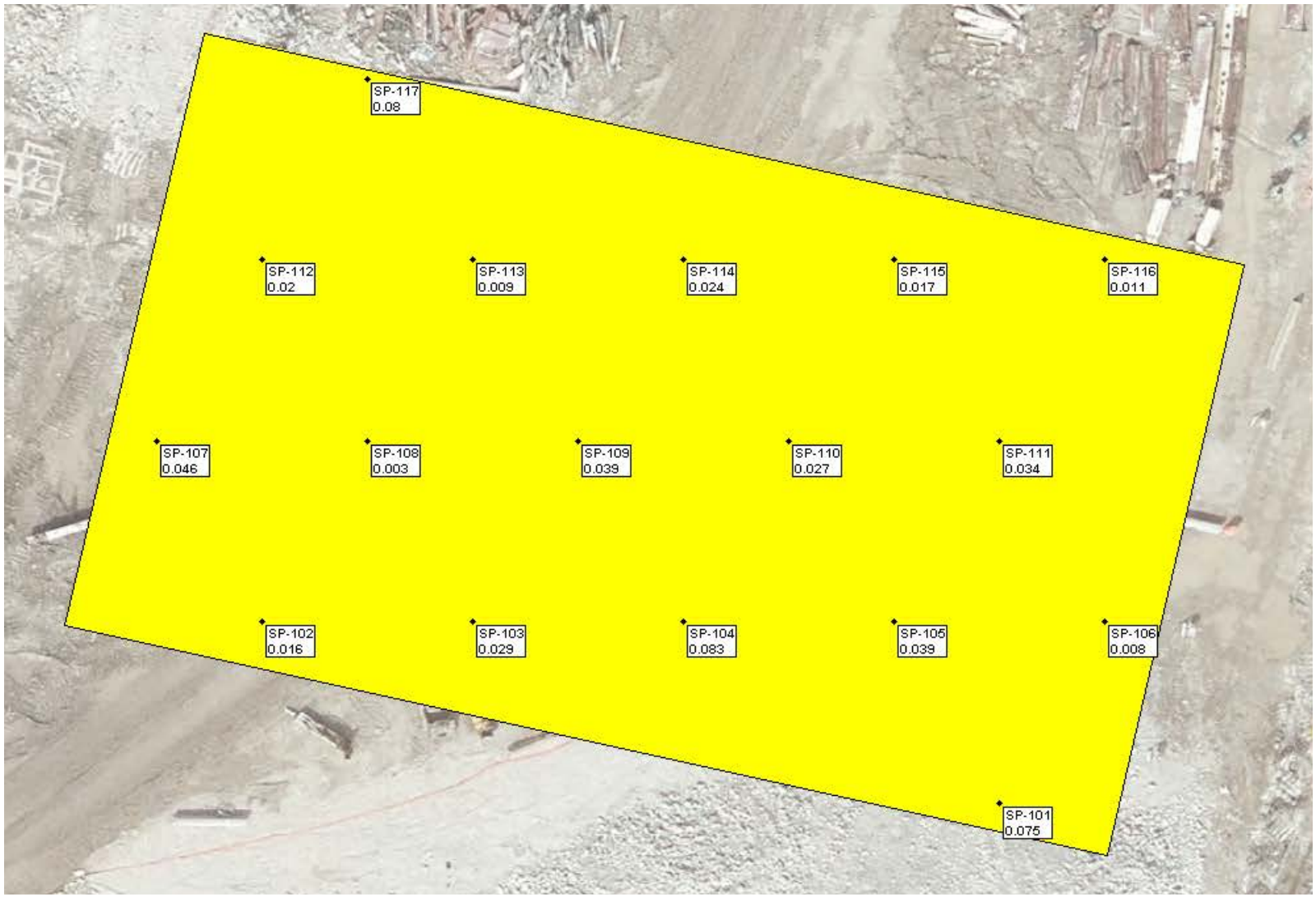
Table 4-1 from the QAPP is reproduced below to show acceptance criteria used to assess split samples.

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:
T Graham	1/7/2020	R. J. Mandia	1-7-20

ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot

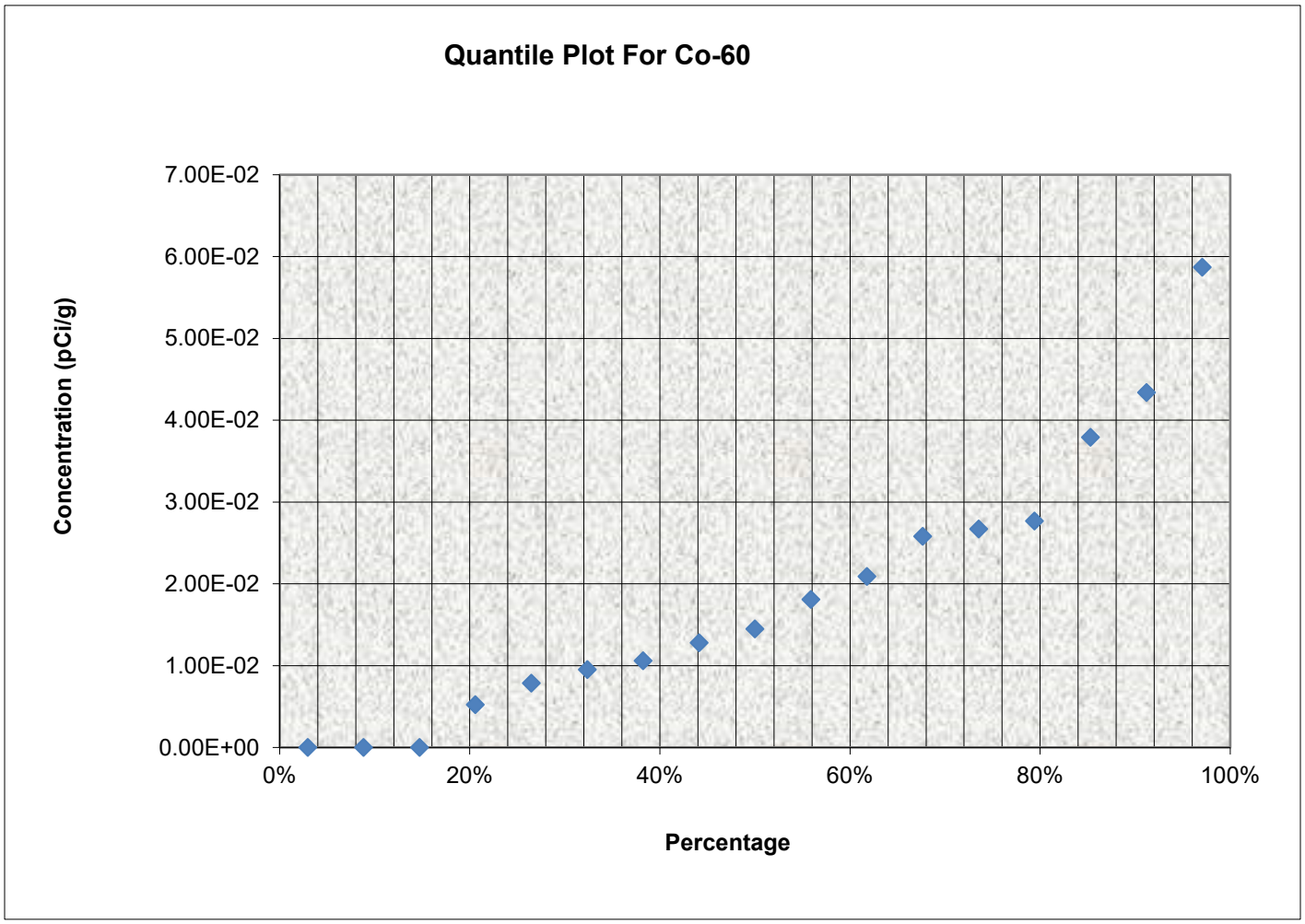


QUANTILE PLOT FOR Co-60

Survey Unit: 12205E

Survey Unit Name: Area Under the Turbine Building

Mean: 1.88E-02 pCi/g

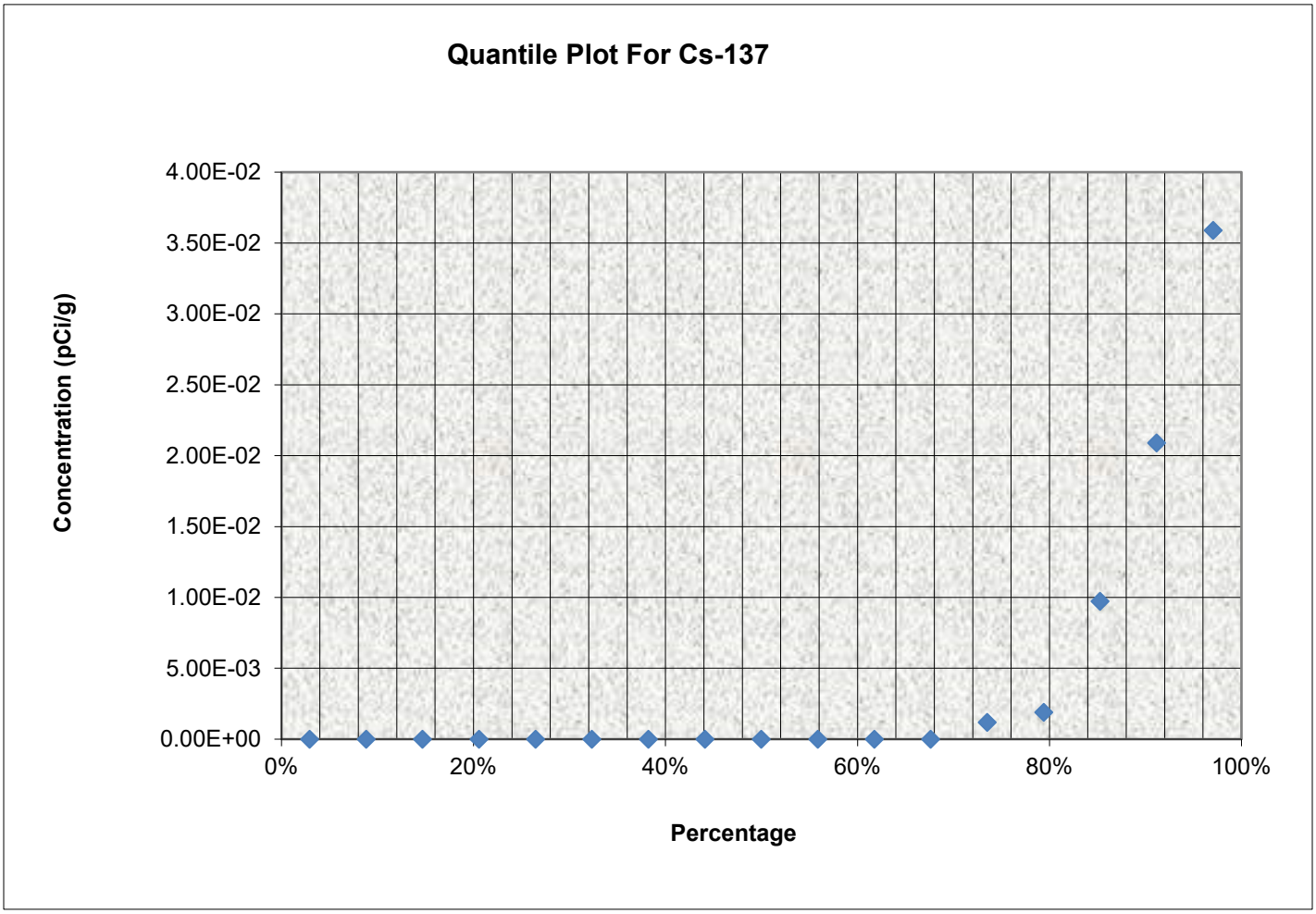


QUANTILE PLOT FOR Cs-137

Survey Unit: 12205E

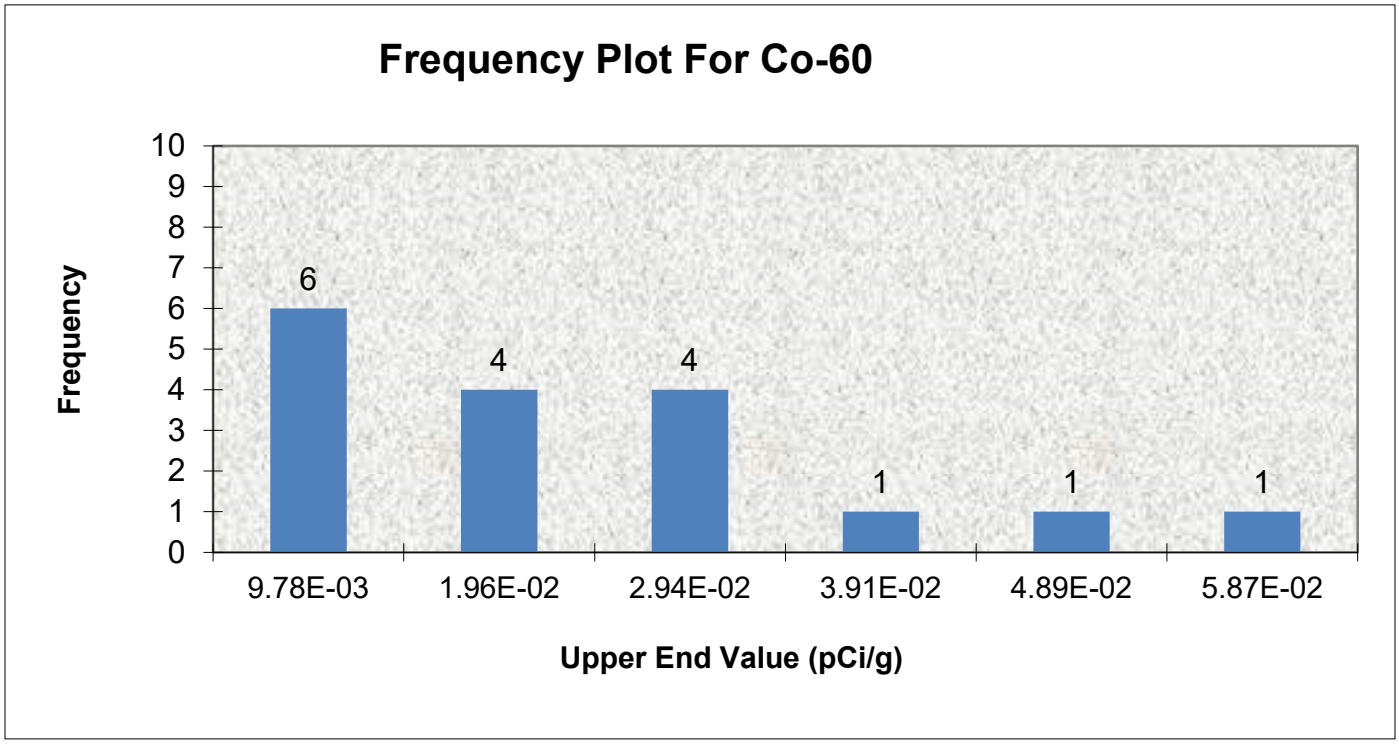
Survey Unit Name: Area Under the Turbine Building

Mean: 4.09E-03 pCi/g



HISTOGRAM FOR Co-60

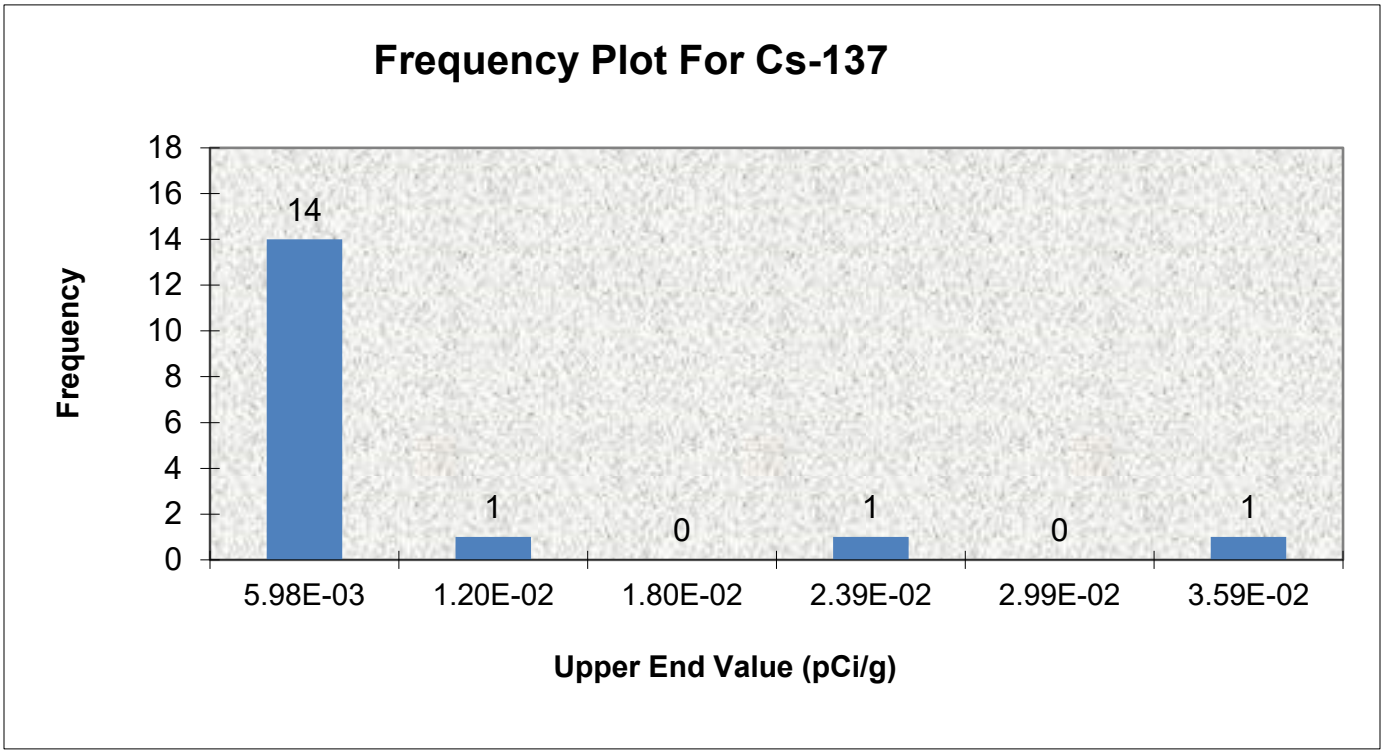
Survey Unit:	12205E	
Survey Unit Name:	Area Under the Turbine Building	
Mean:	1.88E-02	pCi/g
Median:	1.45E-02	pCi/g
ST DEV:	0.016	
Skew:	0.978	



Upper Value	Observation Frequency	Observation %
9.78E-03	6	35%
1.96E-02	4	24%
2.94E-02	4	24%
3.91E-02	1	6%
4.89E-02	1	6%
5.87E-02	1	6%
TOTAL	17	100%

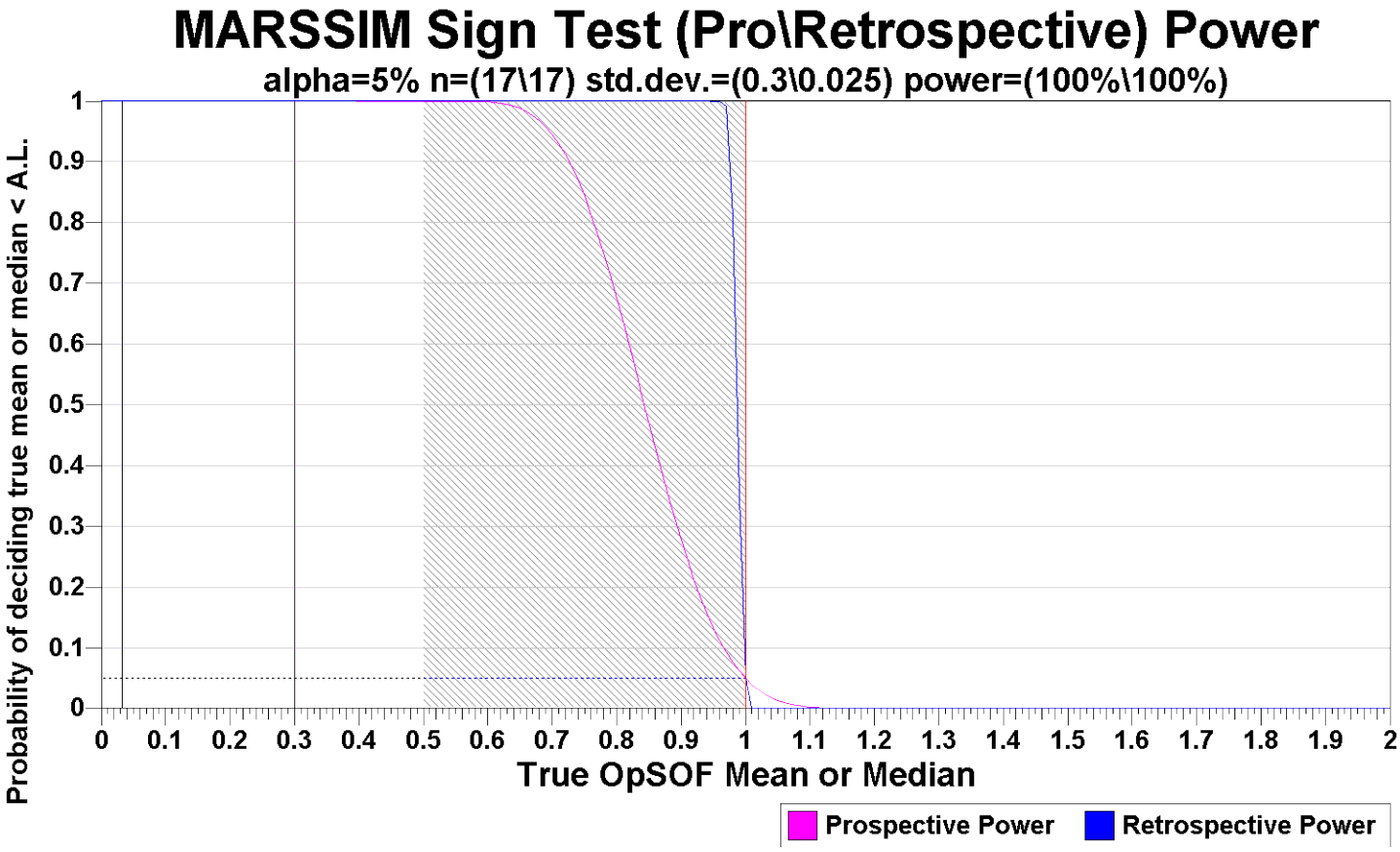
HISTOGRAM FOR Cs-137

Survey Unit:	12205E	
Survey Unit Name:	Area Under the Turbine Building	
Mean:	4.09E-03	pCi/g
Median:	0.00E+00	pCi/g
ST DEV:	0.010	
Skew:	2.718	



Upper Value	Observation Frequency	Observation %
5.98E-03	14	82%
1.20E-02	1	6%
1.80E-02	0	0%
2.39E-02	1	6%
2.99E-02	0	0%
3.59E-02	1	6%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Unit 12205E



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 10-Sep-19-10005

L1-12205E-FSGS-101SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10005
Sample Description	: L1-12205E-FSGS-101SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.700E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:00:00PM
Acquisition Started	: 9/10/2019 8:44:53AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.3 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	: 1/29/2019
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79364
Fill Height	: 1700.24 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 8:59:57AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10005

L1-12205E-FSGS-101SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.38	950 -	960	953.62	8.18E+01	14.01	4.72E+01	0.73
2	295.09	1174 -	1187	1180.25	5.07E+01	10.84	2.43E+01	1.06
3	351.77	1400 -	1412	1406.83	6.38E+01	12.19	3.22E+01	1.42
4	510.45	2036 -	2046	2041.15	1.76E+01	8.72	2.44E+01	0.97
5	582.99	2325 -	2338	2331.16	5.12E+01	9.14	1.18E+01	0.67
6	609.04	2430 -	2442	2435.34	3.74E+01	9.17	1.76E+01	1.03
7	910.67	3635 -	3648	3641.62	2.93E+01	7.71	1.07E+01	0.59
8	1460.20	5829 -	5853	5840.63	3.50E+02	19.01	2.89E+00	1.70

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	0.95	511.00	*	100.00	2.25E-02	1.13E-02
K-40	0.94	1460.82	*	10.66	8.48E+00	5.90E-01
Tl-208	0.99	583.19	*	85.00	8.35E-02	1.57E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.44E-01	2.72E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.17E-01	2.96E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 10-Sep-19-10005

L1-12205E-FSGS-101SS

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	2.37E-01	5.41E-02
		351.93	*	35.60	1.75E-01	3.63E-02
		785.96		1.06		
Ac-228	0.98	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	2.13E-01	5.67E-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 10-Sep-19-10005

L1-12205E-FSGS-101SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.953	2.25E-02	1.13E-02	
	K-40	0.940	8.48E+00	5.90E-01	
	Tl-208	0.994	8.35E-02	1.57E-02	
X	Bi-211	0.924			
	Pb-212	0.991	1.44E-01	2.72E-02	
	Bi-214	0.995	1.17E-01	2.96E-02	
	Pb-214	0.997	1.94E-01	3.01E-02	
	Ac-228	0.986	2.13E-01	5.67E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Sep-19-10005

L1-12205E-FSGS-101SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 8:59:57AM
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	2.25E-02	3.69E-02	3.69E-02
	BE-7	477.60		10.44	2.40E-01	3.98E-01	3.98E-01
+	K-40	1460.82	*	10.66	8.48E+00	3.45E-01	3.45E-01
	Mn-54	834.85		99.98	1.33E-02	4.91E-02	4.91E-02
	Co-60	1173.23		99.85	-6.83E-03	5.60E-02	6.93E-02
		1332.49		99.98	4.34E-02		5.60E-02
	Nb-94	702.65		99.81	6.66E-03	4.59E-02	4.59E-02
		871.09		99.89	-5.09E-02		4.61E-02
	Ag-108m	79.13		6.60	4.02E-01	4.97E-02	1.87E+00
		433.94		90.50	2.46E-02		4.97E-02
		614.28		89.80	-5.69E-03		5.72E-02
		722.94		90.80	2.84E-02		6.06E-02
	Sb-125	176.31		6.84	3.44E-01	1.30E-01	5.77E-01
		380.45		1.52	-1.25E+00		2.36E+00
		427.87		29.60	-8.83E-02		1.30E-01
		463.36		10.49	3.13E-01		4.16E-01
		600.60		17.65	-2.32E-01		2.47E-01
		606.71		4.98	9.81E-01		1.36E+00
		635.95		11.22	-1.54E-01		3.52E-01

Analysis Report for 10-Sep-19-10005

L1-12205E-FSGS-101SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	5.67E-01	1.30E-01	2.52E+00
Ba-133	79.61	2.65	2.20E-01	7.18E-02	4.46E+00
	81.00	32.90	-5.14E-02		3.14E-01
	276.40	7.16	3.31E-01		5.41E-01
	302.85	18.34	8.85E-02		2.20E-01
	356.01	62.05	-5.11E-02		7.18E-02
	383.85	8.94	-2.13E-01		4.04E-01
Cs-134	475.36	1.48	-5.91E-01	6.25E-02	2.62E+00
	563.25	8.34	-4.15E-02		4.88E-01
	569.33	15.37	9.33E-02		2.55E-01
	604.72	97.62	-1.11E-02		6.75E-02
	795.86	85.46	4.68E-02		6.25E-02
	801.95	8.69	2.97E-02		5.02E-01
	1038.61	0.99	-1.03E-01		5.35E+00
	1167.97	1.79	1.17E+00		3.81E+00
	1365.19	3.02	-1.02E+00		1.64E+00
Cs-137	661.66	85.10	-1.81E-02	5.40E-02	5.40E-02
Eu-152	121.78	28.67	1.22E-02	1.32E-01	1.56E-01
	244.70	7.61	3.29E-01		5.26E-01
	295.94	0.45	-6.64E+00		9.98E+00
	344.28	26.60	-4.70E-02		1.32E-01
	367.79	0.86	-5.62E-01		4.54E+00
	411.12	2.24	-3.29E-01		1.81E+00
	443.96	2.83	-8.37E-03		1.25E+00
	488.68	0.42	-3.16E+00		9.39E+00
	563.99	0.49	1.68E-01		8.29E+00
	586.26	0.46	-2.10E+00		1.39E+01
	678.62	0.47	-9.21E+00		8.90E+00
	688.67	0.86	-1.78E+00		4.68E+00
	719.35	0.28	1.34E+01		1.88E+01
	778.90	12.96	1.10E-01		3.43E-01
	810.45	0.32	-5.25E+00		1.34E+01
	867.37	4.26	8.66E-01		1.16E+00
	919.33	0.43	-2.20E-01		1.12E+01
	964.08	14.65	2.62E-02		4.41E-01
	1085.87	10.24	6.80E-02		5.72E-01
	1089.74	1.73	-1.51E+00		3.50E+00
	1112.07	13.69	-2.83E-02		4.82E-01
	1212.95	1.43	-7.59E+00		4.56E+00
	1249.94	0.19	-9.19E+00		3.82E+01
	1299.14	1.63	-4.33E+00		3.22E+00
	1408.01	21.07	-1.42E-01		1.86E-01
	1457.64	0.50	1.86E+02		4.83E+01
	1528.10	0.28	3.79E+00		1.18E+01
Eu-154	123.07	40.40	-3.28E-02	1.09E-01	1.09E-01
	247.93	6.89	2.30E-01		5.38E-01
	591.76	4.95	-6.79E-01		8.37E-01
	692.42	1.78	-1.23E+00		2.22E+00
	723.30	20.06	2.29E-01		2.80E-01
	756.80	4.52	-3.78E-01		9.28E-01
	873.18	12.08	-7.27E-02		3.97E-01

Analysis Report for 10-Sep-19-10005

L1-12205E-FSGS-101SS

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	1.09E-01	5.19E-01
	1004.76	18.01	-7.92E-02		2.88E-01
	1274.43	34.80	-1.21E-01		1.52E-01
	1596.48	1.80	7.39E-01		2.78E+00
Eu-155	45.30	1.31	-8.84E+00	2.58E-01	3.00E+01
	60.01	1.22	-3.65E+00		3.04E+01
	86.55	30.70	2.74E-03		2.58E-01
	105.31	21.10	-8.02E-02		2.68E-01
Ra-226	186.21	3.64	7.16E-01	1.12E+00	1.12E+00
Pa-231	27.36	10.30	2.84E-01	1.64E+00	3.23E+00
	283.69	1.70	-2.16E-01		1.95E+00
	300.07	2.47	4.69E-02		1.64E+00
	302.65	2.20	-1.71E-01		1.81E+00
	330.06	1.40	3.60E+00		3.11E+00
U-235	143.76	10.96	-2.33E-02	6.89E-02	4.04E-01
	163.33	5.08	-5.76E-02		7.42E-01
	185.71	57.20	4.56E-03		6.89E-02
	202.11	1.08	6.50E-01		3.46E+00
	205.31	5.01	-4.76E-01		7.16E-01
Am-241	59.54	35.90	-1.92E-01	1.07E+00	1.07E+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 10-Sep-19-10006

L1-12205E-FSGS-102SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10006
Sample Description	: L1-12205E-FSGS-102SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.730E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:02:00PM
Acquisition Started	: 9/10/2019 8:44:59AM
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	: 1/24/2019
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79365
Fill Height	: 1729.69 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 9:00:02AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10006

L1-12205E-FSGS-102SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.82	947 -	961	954.86	1.16E+02	18.59	7.84E+01	0.92
2	295.59	1175 -	1187	1181.66	4.28E+01	9.94	2.12E+01	0.88
3	352.06	1401 -	1414	1407.26	7.79E+01	11.89	2.31E+01	0.61
4	583.21	2326 -	2338	2330.98	4.64E+01	9.36	1.56E+01	0.56
5	609.31	2429 -	2441	2435.27	4.52E+01	9.59	1.78E+01	0.75
6	1460.22	5825 -	5852	5838.81	3.69E+02	19.64	3.56E+00	1.72

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.94	1460.82	*	10.66	8.02E+00	5.51E-01
Tl-208	1.00	583.19	*	85.00	6.80E-02	1.43E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.80E-01	3.24E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.28E-01	2.81E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 10-Sep-19-10006

L1-12205E-FSGS-102SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.79E-01	4.40E-02
		351.93	*	35.60	1.92E-01	3.31E-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	0.943	8.02E+00	5.51E-01	
	Tl-208	1.000	6.80E-02	1.43E-02	
X	Bi-211	0.855			
	Pb-212	0.995	1.80E-01	3.24E-02	
	Bi-214	1.000	1.28E-01	2.81E-02	
	Pb-214	0.992	1.87E-01	2.64E-02	

Analysis Report for 10-Sep-19-10006

L1-12205E-FSGS-102SS

? = 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 10-Sep-19-10006

L1-12205E-FSGS-102SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 9:00:02AM
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	7.94E-02	5.48E-02	5.48E-02
	BE-7	477.60		10.44	2.15E-01	3.83E-01	3.83E-01
+	K-40	1460.82	*	10.66	8.02E+00	3.59E-01	3.59E-01
	Mn-54	834.85		99.98	-2.04E-02	4.34E-02	4.34E-02
	Co-60	1173.23		99.85	-4.98E-03	4.36E-02	6.06E-02
		1332.49		99.98	1.45E-02		4.36E-02
	Nb-94	702.65		99.81	-3.91E-02	3.87E-02	3.87E-02
		871.09		99.89	6.94E-03		4.76E-02
	Ag-108m	79.13		6.60	6.33E-01	3.64E-02	1.10E+00
		433.94		90.50	1.32E-02		3.64E-02
		614.28		89.80	-3.47E-02		5.29E-02
		722.94		90.80	1.67E-02		4.69E-02
	Sb-125	176.31		6.84	8.53E-02	1.13E-01	4.54E-01
		380.45		1.52	2.49E-01		2.33E+00
		427.87		29.60	1.70E-02		1.13E-01
		463.36		10.49	8.51E-02		3.48E-01
		600.60		17.65	-1.25E-01		1.90E-01
		606.71		4.98	1.04E+00		1.22E+00
		635.95		11.22	-2.71E-02		3.44E-01

Analysis Report for 10-Sep-19-10006

L1-12205E-FSGS-102SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.23E+00	1.13E-01	2.30E+00
Ba-133	79.61	2.65	1.63E+00	6.37E-02	2.70E+00
	81.00	32.90	-3.18E-01		1.68E-01
	276.40	7.16	1.12E-01		4.21E-01
	302.85	18.34	5.71E-02		1.71E-01
	356.01	62.05	-1.75E-02		6.37E-02
	383.85	8.94	-1.90E-01		3.95E-01
Cs-134	475.36	1.48	8.36E-01	4.56E-02	2.72E+00
	563.25	8.34	-6.79E-01		4.68E-01
	569.33	15.37	7.13E-03		2.26E-01
	604.72	97.62	-1.26E-02		5.48E-02
	795.86	85.46	-3.52E-02		4.56E-02
	801.95	8.69	-1.62E-01		4.51E-01
	1038.61	0.99	4.64E-01		4.99E+00
	1167.97	1.79	3.02E+00		3.64E+00
	1365.19	3.02	-9.61E-01		1.07E+00
Cs-137	661.66	85.10	-2.30E-02	5.12E-02	5.12E-02
Eu-152	121.78	28.67	2.96E-02	1.08E-01	1.18E-01
	244.70	7.61	1.08E-01		4.79E-01
	295.94	0.45	6.36E+00		8.42E+00
	344.28	26.60	-9.17E-02		1.08E-01
	367.79	0.86	-3.93E-01		3.60E+00
	411.12	2.24	6.00E-01		1.63E+00
	443.96	2.83	5.81E-01		1.33E+00
	488.68	0.42	-2.35E+00		8.53E+00
	563.99	0.49	-9.10E+00		7.45E+00
	586.26	0.46	1.68E+01		1.27E+01
	678.62	0.47	2.85E+00		8.27E+00
	688.67	0.86	7.31E-01		4.28E+00
	719.35	0.28	-8.36E-01		1.36E+01
	778.90	12.96	1.12E-02		3.19E-01
	810.45	0.32	9.83E+00		1.32E+01
	867.37	4.26	4.95E-01		1.10E+00
	919.33	0.43	-8.45E-01		1.08E+01
	964.08	14.65	1.02E-01		4.23E-01
	1085.87	10.24	-2.79E-01		5.54E-01
	1089.74	1.73	-1.05E+00		3.33E+00
	1112.07	13.69	5.30E-01		5.06E-01
	1212.95	1.43	3.86E+00		4.68E+00
	1249.94	0.19	-9.45E+00		2.48E+01
	1299.14	1.63	2.48E+00		3.11E+00
	1408.01	21.07	8.85E-02		2.29E-01
	1457.64	0.50	1.71E+02		4.41E+01
	1528.10	0.28	6.80E+00		1.40E+01
Eu-154	123.07	40.40	2.25E-02	8.44E-02	8.44E-02
	247.93	6.89	-4.54E-02		4.28E-01
	591.76	4.95	-7.67E-01		5.91E-01
	692.42	1.78	-1.54E+00		2.08E+00
	723.30	20.06	1.19E-01		2.16E-01
	756.80	4.52	3.86E-01		9.14E-01
	873.18	12.08	3.34E-01		4.39E-01

Analysis Report for 10-Sep-19-10006

L1-12205E-FSGS-102SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-6.54E-02	8.44E-02	3.96E-01
	1004.76	18.01	1.30E-01		2.91E-01
	1274.43	34.80	-9.19E-02		1.33E-01
	1596.48	1.80	3.51E-01		2.02E+00
Eu-155	45.30	1.31	3.41E+00	1.77E-01	1.15E+01
	60.01	1.22	-2.68E+00		1.22E+01
	86.55	30.70	1.35E-01		1.77E-01
	105.31	21.10	-7.70E-02		1.91E-01
Ra-226	186.21	3.64	1.38E-01	9.27E-01	9.27E-01
Pa-231	27.36	10.30	9.02E-01	1.21E+00	1.21E+00
	283.69	1.70	1.08E+00		1.77E+00
	300.07	2.47	-5.05E-01		1.23E+00
	302.65	2.20	4.76E-01		1.43E+00
	330.06	1.40	8.58E-01		2.20E+00
U-235	143.76	10.96	-1.20E-01	6.07E-02	2.93E-01
	163.33	5.08	1.53E-01		6.06E-01
	185.71	57.20	4.56E-02		6.07E-02
	202.11	1.08	4.51E-01		2.82E+00
	205.31	5.01	-2.18E-01		5.70E-01
Am-241	59.54	35.90	4.41E-02	4.42E-01	4.42E-01

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

Apex-Gamma

Analysis Report for 10-Sep-19-10007

L1-12205E-FSGS-103SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10007
Sample Description	: L1-12205E-FSGS-103SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.793E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:04:00PM
Acquisition Started	: 9/10/2019 8:45:06AM
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	: 9/29/2018
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79366
Fill Height	: 1793.17 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 9:00:28AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500

J Graham

Analysis Report for 10-Sep-19-10007

L1-12205E-FSGS-103SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	946 -	961	955.06	1.04E+02	16.25	5.26E+01	1.16
2	351.90	1399 -	1413	1407.58	8.21E+01	11.96	2.09E+01	1.67
3	583.06	2326 -	2339	2331.54	4.20E+01	8.25	9.04E+00	0.72
4	609.32	2431 -	2443	2436.54	5.22E+01	7.96	3.78E+00	0.49
5	911.24	3637 -	3651	3644.02	3.36E+01	8.33	1.24E+01	1.45
6	1460.83	5831 -	5855	5843.69	3.72E+02	21.12	1.81E+01	1.53
7	1764.35	7053 -	7066	7059.47	1.70E+01	4.12	0.00E+00	0.38

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	7.49E+00	5.35E-01
Tl-208	0.99	583.19	*	85.00	5.82E-02	1.20E-02
Bi-211	0.89	351.07	*	13.02	5.32E-01	8.86E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.60E-01	2.80E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.39E-01	2.28E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 10-Sep-19-10007

L1-12205E-FSGS-103SS

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	2.74E-01	6.75E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.95E-01	3.24E-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	2.05E-01	5.16E-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 10-Sep-19-10007

L1-12205E-FSGS-103SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	7.49E+00	5.35E-01	
	Tl-208	0.997	5.82E-02	1.20E-02	
?	Bi-211	0.897	5.32E-01	8.86E-02	
	Pb-212	1.000	1.60E-01	2.80E-02	
	Bi-214	1.000	1.53E-01	2.16E-02	
?	Pb-214	1.000	1.95E-01	3.24E-02	
	Ac-228	1.000	2.05E-01	5.16E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Sep-19-10007

L1-12205E-FSGS-103SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 9:00:28AM
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	4.74E-02	4.67E-02	4.67E-02
	BE-7	477.60		10.44	-1.87E-01	3.25E-01	3.25E-01
+	K-40	1460.82	*	10.66	7.49E+00	6.45E-01	6.45E-01
	Mn-54	834.85		99.98	-2.23E-03	3.78E-02	3.78E-02
	Co-60	1173.23		99.85	2.15E-02	4.66E-02	5.72E-02
		1332.49		99.98	2.58E-02		4.66E-02
	Nb-94	702.65		99.81	-1.73E-02	4.00E-02	4.00E-02
		871.09		99.89	8.79E-03		4.46E-02
	Ag-108m	79.13		6.60	8.46E-02	3.99E-02	1.40E+00
		433.94		90.50	-1.47E-03		3.99E-02
		614.28		89.80	-2.77E-02		5.69E-02
		722.94		90.80	2.68E-02		5.07E-02
	Sb-125	176.31		6.84	-2.75E-01	1.11E-01	4.79E-01
		380.45		1.52	-1.83E+00		2.12E+00
		427.87		29.60	-2.41E-02		1.11E-01
		463.36		10.49	9.68E-03		3.39E-01
		600.60		17.65	-1.20E-01		2.24E-01
		606.71		4.98	1.43E+00		1.09E+00
		635.95		11.22	-1.67E-02		3.70E-01

Analysis Report for 10-Sep-19-10007

L1-12205E-FSGS-103SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	5.35E-01	1.11E-01	2.26E+00
Ba-133	79.61	2.65	-1.33E+00	7.26E-02	3.31E+00
	81.00	32.90	-4.03E-01		2.35E-01
	276.40	7.16	7.30E-02		5.03E-01
	302.85	18.34	1.96E-02		1.91E-01
	356.01	62.05	-7.47E-02		7.26E-02
	383.85	8.94	-4.28E-02		3.76E-01
Cs-134	475.36	1.48	-2.29E-01	4.45E-02	2.35E+00
	563.25	8.34	1.25E-01		3.97E-01
	569.33	15.37	-3.17E-02		2.27E-01
	604.72	97.62	-6.99E-02		5.22E-02
	795.86	85.46	-1.90E-02		4.45E-02
	801.95	8.69	-1.37E-01		5.08E-01
	1038.61	0.99	6.68E-01		4.90E+00
	1167.97	1.79	-2.52E-01		3.39E+00
	1365.19	3.02	7.02E-01		1.61E+00
Cs-137	661.66	85.10	-2.32E-02	4.88E-02	4.88E-02
Eu-152	121.78	28.67	7.60E-02	1.30E-01	1.35E-01
	244.70	7.61	-6.73E-02		5.09E-01
	295.94	0.45	5.97E-02		8.95E+00
	344.28	26.60	-2.46E-02		1.30E-01
	367.79	0.86	9.09E-01		3.58E+00
	411.12	2.24	-9.06E-01		1.51E+00
	443.96	2.83	-1.24E-01		1.20E+00
	488.68	0.42	3.68E+00		8.86E+00
	563.99	0.49	-8.82E-01		6.54E+00
	586.26	0.46	1.79E+01		1.15E+01
	678.62	0.47	-9.67E+00		7.54E+00
	688.67	0.86	2.37E-02		4.39E+00
	719.35	0.28	1.22E+01		1.63E+01
	778.90	12.96	-1.71E-01		3.29E-01
	810.45	0.32	-5.42E+00		1.28E+01
	867.37	4.26	-1.27E+00		1.01E+00
	919.33	0.43	-8.55E+00		9.01E+00
	964.08	14.65	2.62E-01		4.07E-01
	1085.87	10.24	-3.33E-03		5.09E-01
	1089.74	1.73	9.97E-01		3.31E+00
	1112.07	13.69	2.44E-01		3.92E-01
	1212.95	1.43	-4.30E+00		4.83E+00
	1249.94	0.19	-2.41E+00		3.23E+01
	1299.14	1.63	-4.25E-01		3.26E+00
	1408.01	21.07	3.82E-02		1.79E-01
	1457.64	0.50	1.67E+02		4.23E+01
	1528.10	0.28	-6.25E+00		1.36E+01
Eu-154	123.07	40.40	-1.88E-03	9.37E-02	9.37E-02
	247.93	6.89	3.00E-02		5.18E-01
	591.76	4.95	1.41E-01		8.08E-01
	692.42	1.78	-2.29E+00		2.20E+00
	723.30	20.06	1.25E-01		2.27E-01
	756.80	4.52	4.19E-01		1.00E+00
	873.18	12.08	-1.07E-01		3.64E-01

Analysis Report for 10-Sep-19-10007

L1-12205E-FSGS-103SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.62E-01	9.37E-02	4.57E-01
	1004.76	18.01	-1.70E-01		2.59E-01
	1274.43	34.80	-9.93E-02		1.96E-01
	1596.48	1.80	6.38E-01		1.74E+00
Eu-155	45.30	1.31	-9.46E+00	2.11E-01	1.75E+01
	60.01	1.22	-1.67E+01		2.12E+01
	86.55	30.70	1.52E-02		2.24E-01
	105.31	21.10	1.13E-01		2.11E-01
Ra-226	186.21	3.64	5.57E-01	9.88E-01	9.88E-01
Pa-231	27.36	10.30	1.66E+00	1.47E+00	2.19E+00
	283.69	1.70	-6.75E-01		1.82E+00
	300.07	2.47	-2.39E+00		1.47E+00
	302.65	2.20	8.45E-01		1.61E+00
	330.06	1.40	1.07E+00		2.51E+00
U-235	143.76	10.96	-9.04E-02	6.15E-02	3.08E-01
	163.33	5.08	1.09E-01		6.58E-01
	185.71	57.20	-1.36E-03		6.15E-02
	202.11	1.08	-1.53E-01		3.00E+00
	205.31	5.01	-2.34E-01		6.28E-01
Am-241	59.54	35.90	-2.90E-01	7.50E-01	7.50E-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 10-Sep-19-10008

L1-12205E-FSGS-104SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10008
Sample Description	: L1-12205E-FSGS-104SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.798E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:06:00PM
Acquisition Started	: 9/10/2019 9:42:34AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.3 seconds
Dead Time	: 0.14 %
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	: 1/29/2019
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79369
Fill Height	: 1798.00 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 9:57:38AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10008

L1-12205E-FSGS-104SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.58	949 -	960	954.40	9.50E+01	14.95	5.10E+01	0.73
2	295.46	1176 -	1188	1181.75	3.11E+01	11.46	3.69E+01	0.51
3	338.24	1348 -	1359	1352.75	2.54E+01	9.99	2.96E+01	0.44
4	351.84	1401 -	1411	1407.10	4.74E+01	10.76	2.86E+01	0.60
5	608.82	2429 -	2442	2434.44	6.37E+01	10.20	1.43E+01	0.80
6	1460.33	5830 -	5852	5841.14	3.72E+02	19.55	2.71E+00	1.82

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	8.90E+00	6.06E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.66E-01	2.93E-02
		300.09		3.30		
Bi-214	0.98	609.32	*	45.49	1.98E-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		

Analysis Report for 10-Sep-19-10008

L1-12205E-FSGS-104SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.98	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	1.44E-01	5.44E-02
		351.93	*	35.60	1.29E-01	3.10E-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	2.12E-01	8.52E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

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

Analysis Report for 10-Sep-19-10008

L1-12205E-FSGS-104SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.961	8.90E+00	6.06E-01	
X	Bi-211	0.909			
	Pb-212	1.000	1.66E-01	2.93E-02	
	Bi-214	0.984	1.98E-01	3.38E-02	
	Pb-214	0.997	1.33E-01	2.70E-02	
	Ac-228	1.000	2.12E-01	8.52E-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 10-Sep-19-10008

L1-12205E-FSGS-104SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 9:57:38AM
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	2.98E-02	6.10E-02	6.10E-02
	BE-7	477.60		10.44	-3.46E-01	3.98E-01	3.98E-01
+	K-40	1460.82	*	10.66	8.90E+00	3.26E-01	3.26E-01
	Mn-54	834.85		99.98	-4.37E-04	5.46E-02	5.46E-02
	Co-60	1173.23		99.85	5.87E-02	3.24E-02	7.68E-02
		1332.49		99.98	-2.02E-03		3.24E-02
	Nb-94	702.65		99.81	1.39E-02	4.54E-02	4.54E-02
		871.09		99.89	8.53E-03		4.91E-02
	Ag-108m	79.13		6.60	1.84E+00	4.68E-02	1.84E+00
		433.94		90.50	2.30E-02		4.68E-02
		614.28		89.80	-2.53E-02		6.19E-02
		722.94		90.80	4.55E-02		5.80E-02
	Sb-125	176.31		6.84	5.13E-02	1.27E-01	5.71E-01
		380.45		1.52	-1.98E+00		2.27E+00
		427.87		29.60	-2.16E-02		1.27E-01
		463.36		10.49	4.54E-01		4.23E-01
		600.60		17.65	-8.60E-02		2.28E-01
		606.71		4.98	2.25E+00		1.44E+00
		635.95		11.22	-9.52E-02		3.67E-01

Analysis Report for 10-Sep-19-10008

L1-12205E-FSGS-104SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	6.18E-01	1.27E-01	2.49E+00
Ba-133	79.61	2.65	2.97E+00	7.12E-02	4.35E+00
	81.00	32.90	-1.07E-01		2.98E-01
	276.40	7.16	-9.68E-02		5.11E-01
	302.85	18.34	-5.47E-02		1.99E-01
	356.01	62.05	-1.15E-01		7.12E-02
	383.85	8.94	-8.50E-02		4.36E-01
Cs-134	475.36	1.48	-4.15E-03	5.85E-02	2.65E+00
	563.25	8.34	3.69E-02		4.83E-01
	569.33	15.37	6.43E-02		2.36E-01
	604.72	97.62	-2.39E-02		6.75E-02
	795.86	85.46	3.00E-02		5.85E-02
	801.95	8.69	-3.77E-02		5.25E-01
	1038.61	0.99	3.69E+00		5.39E+00
	1167.97	1.79	-2.68E+00		4.05E+00
	1365.19	3.02	1.64E-01		1.57E+00
Cs-137	661.66	85.10	1.90E-03	5.63E-02	5.63E-02
Eu-152	121.78	28.67	-9.09E-03	1.42E-01	1.58E-01
	244.70	7.61	1.44E-01		5.13E-01
	295.94	0.45	6.54E+00		9.90E+00
	344.28	26.60	5.95E-02		1.42E-01
	367.79	0.86	-2.09E+00		4.02E+00
	411.12	2.24	-6.69E-01		1.71E+00
	443.96	2.83	-3.31E-01		1.29E+00
	488.68	0.42	2.32E+00		7.92E+00
	563.99	0.49	-4.18E+00		7.84E+00
	586.26	0.46	1.05E+01		1.20E+01
	678.62	0.47	-4.99E+00		8.34E+00
	688.67	0.86	1.34E+00		5.73E+00
	719.35	0.28	2.15E+00		1.63E+01
	778.90	12.96	2.30E-01		3.33E-01
	810.45	0.32	1.86E+00		1.41E+01
	867.37	4.26	-9.25E-01		9.51E-01
	919.33	0.43	-4.97E+00		1.13E+01
	964.08	14.65	4.59E-01		4.79E-01
	1085.87	10.24	-2.43E-01		4.60E-01
	1089.74	1.73	1.81E-01		3.24E+00
	1112.07	13.69	-1.12E-01		4.36E-01
	1212.95	1.43	-3.29E+00		4.43E+00
	1249.94	0.19	1.01E+01		3.06E+01
	1299.14	1.63	-7.70E-01		3.72E+00
	1408.01	21.07	-1.10E-01		1.93E-01
	1457.64	0.50	1.92E+02		4.87E+01
	1528.10	0.28	9.36E-01		7.18E+00
Eu-154	123.07	40.40	-8.97E-03	1.14E-01	1.14E-01
	247.93	6.89	1.23E-01		4.91E-01
	591.76	4.95	5.31E-01		8.64E-01
	692.42	1.78	-7.87E-01		2.57E+00
	723.30	20.06	2.51E-01		2.69E-01
	756.80	4.52	2.68E-01		9.71E-01
	873.18	12.08	2.44E-01		4.20E-01

Analysis Report for 10-Sep-19-10008

L1-12205E-FSGS-104SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.21E-01	1.14E-01	4.86E-01
	1004.76	18.01	-3.02E-02		3.25E-01
	1274.43	34.80	8.60E-02		2.02E-01
	1596.48	1.80	7.59E-01		2.07E+00
Eu-155	45.30	1.31	2.62E+00	2.53E-01	3.31E+01
	60.01	1.22	-1.74E+01		3.09E+01
	86.55	30.70	2.29E-02		2.53E-01
	105.31	21.10	1.83E-01		2.65E-01
Ra-226	186.21	3.64	8.17E-04	1.13E+00	1.13E+00
Pa-231	27.36	10.30	2.28E+00	1.37E+00	3.28E+00
	283.69	1.70	-8.61E-01		2.30E+00
	300.07	2.47	-9.15E-01		1.37E+00
	302.65	2.20	-9.87E-02		1.67E+00
	330.06	1.40	1.22E-01		2.73E+00
U-235	143.76	10.96	6.07E-02	7.16E-02	3.94E-01
	163.33	5.08	-4.64E-02		7.94E-01
	185.71	57.20	1.42E-02		7.16E-02
	202.11	1.08	3.75E-01		3.46E+00
	205.31	5.01	-2.70E-01		7.55E-01
Am-241	59.54	35.90	-2.68E-01	1.12E+00	1.12E+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 10-Sep-19-10009

L1-12205E-FSGS-105SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10009
Sample Description	: L1-12205E-FSGS-105SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.733E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:08:00PM
Acquisition Started	: 9/10/2019 9:42:41AM
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	: 1/24/2019
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79370
Fill Height	: 1733.36 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 9:57:44AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500

J Graham

Analysis Report for 10-Sep-19-10009

L1-12205E-FSGS-105SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.92	950 -	961	955.26	9.60E+01	14.92	5.00E+01	0.78
2	295.42	1176 -	1186	1180.98	3.85E+01	9.34	2.05E+01	0.68
3	352.25	1399 -	1414	1408.00	6.72E+01	10.42	1.38E+01	1.05
4	609.29	2429 -	2442	2435.20	5.20E+01	8.45	7.00E+00	1.34
5	1460.35	5827 -	5852	5839.35	3.81E+02	20.82	1.25E+01	2.16

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.82	*	10.66	8.28E+00	5.78E-01
Pb-212	0.98	115.18		0.60		
		238.63	*	43.60	1.50E-01	2.62E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.47E-01	2.54E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		

Analysis Report for 10-Sep-19-10009

L1-12205E-FSGS-105SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.98	241.99		7.25		
		295.22	*	18.42	1.61E-01	4.12E-02
		351.93	*	35.60	1.65E-01	2.89E-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	0.966	8.28E+00	5.78E-01	
Pb-212	0.988	1.50E-01	2.62E-02	
Bi-214	1.000	1.47E-01	2.54E-02	
Pb-214	0.989	1.64E-01	2.36E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Sep-19-10009

L1-12205E-FSGS-105SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 9:57:44AM
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	5.16E-02	4.91E-02	4.91E-02
	BE-7	477.60		10.44	8.22E-02	3.37E-01	3.37E-01
+	K-40	1460.82	*	10.66	8.28E+00	5.94E-01	5.94E-01
	Mn-54	834.85		99.98	-3.70E-03	4.96E-02	4.96E-02
	Co-60	1173.23		99.85	-4.27E-03	5.90E-02	6.68E-02
		1332.49		99.98	2.67E-02		5.90E-02
	Nb-94	702.65		99.81	3.06E-03	3.59E-02	3.59E-02
		871.09		99.89	8.16E-04		4.38E-02
	Ag-108m	79.13		6.60	-1.06E-01	4.02E-02	1.14E+00
		433.94		90.50	-1.65E-02		4.02E-02
		614.28		89.80	-1.17E-02		5.14E-02
		722.94		90.80	-2.19E-02		4.89E-02
	Sb-125	176.31		6.84	1.99E-01	1.18E-01	4.40E-01
		380.45		1.52	4.40E-01		2.05E+00
		427.87		29.60	3.06E-02		1.18E-01
		463.36		10.49	4.01E-01		3.96E-01
		600.60		17.65	1.64E-01		2.16E-01
		606.71		4.98	1.00E+00		1.12E+00
		635.95		11.22	1.00E-01		3.59E-01

Analysis Report for 10-Sep-19-10009

L1-12205E-FSGS-105SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	4.51E-01	1.18E-01	2.09E+00
Ba-133	79.61	2.65	1.13E+00	5.74E-02	2.82E+00
	81.00	32.90	-2.31E-01		1.94E-01
	276.40	7.16	1.79E-01		4.33E-01
	302.85	18.34	6.48E-02		1.74E-01
	356.01	62.05	1.46E-03		5.74E-02
	383.85	8.94	1.23E-01		3.80E-01
Cs-134	475.36	1.48	-5.21E-01	4.95E-02	2.32E+00
	563.25	8.34	-8.39E-01		3.92E-01
	569.33	15.37	6.78E-02		2.22E-01
	604.72	97.62	-2.42E-02		4.95E-02
	795.86	85.46	1.53E-02		5.16E-02
	801.95	8.69	-4.00E-01		4.69E-01
	1038.61	0.99	-9.98E-01		5.49E+00
	1167.97	1.79	1.26E+00		3.92E+00
	1365.19	3.02	4.56E-01		1.73E+00
Cs-137	661.66	85.10	-9.97E-03	4.13E-02	4.13E-02
Eu-152	121.78	28.67	-1.52E-02	1.08E-01	1.08E-01
	244.70	7.61	-1.44E-01		4.33E-01
	295.94	0.45	-3.52E+00		8.42E+00
	344.28	26.60	-2.44E-02		1.27E-01
	367.79	0.86	2.19E-01		3.56E+00
	411.12	2.24	3.60E-01		1.65E+00
	443.96	2.83	1.76E-01		1.27E+00
	488.68	0.42	5.06E+00		8.42E+00
	563.99	0.49	-1.17E+01		6.29E+00
	586.26	0.46	1.21E+01		1.22E+01
	678.62	0.47	1.32E+00		7.72E+00
	688.67	0.86	-3.31E+00		4.12E+00
	719.35	0.28	8.10E+00		1.41E+01
	778.90	12.96	-6.82E-02		3.46E-01
	810.45	0.32	2.43E+00		1.35E+01
	867.37	4.26	-1.64E-01		9.69E-01
	919.33	0.43	7.86E+00		1.06E+01
	964.08	14.65	3.21E-01		4.96E-01
	1085.87	10.24	3.01E-03		4.78E-01
	1089.74	1.73	-3.19E+00		2.94E+00
	1112.07	13.69	-8.35E-02		4.38E-01
	1212.95	1.43	2.13E+00		5.04E+00
	1249.94	0.19	-8.87E+00		3.60E+01
	1299.14	1.63	-3.27E-01		3.38E+00
	1408.01	21.07	-3.03E-01		1.56E-01
	1457.64	0.50	1.83E+02		4.55E+01
	1528.10	0.28	-5.16E-01		1.32E+01
Eu-154	123.07	40.40	2.16E-02	7.68E-02	7.68E-02
	247.93	6.89	1.36E-01		4.28E-01
	591.76	4.95	-6.33E-01		7.52E-01
	692.42	1.78	2.36E+00		2.30E+00
	723.30	20.06	-1.24E-01		2.22E-01
	756.80	4.52	8.70E-01		1.05E+00
	873.18	12.08	4.26E-02		3.70E-01

Analysis Report for 10-Sep-19-10009

L1-12205E-FSGS-105SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.81E-01	7.68E-02	4.33E-01
	1004.76	18.01	7.27E-02		2.87E-01
	1274.43	34.80	-6.37E-02		1.70E-01
	1596.48	1.80	6.90E-01		1.88E+00
Eu-155	45.30	1.31	4.89E+00	1.75E-01	1.03E+01
	60.01	1.22	-4.95E+00		1.11E+01
	86.55	30.70	-5.41E-03		1.75E-01
	105.31	21.10	6.45E-02		1.89E-01
Ra-226	186.21	3.64	5.63E-01	9.48E-01	9.48E-01
Pa-231	27.36	10.30	6.52E-01	1.16E+00	1.16E+00
	283.69	1.70	-1.07E+00		1.70E+00
	300.07	2.47	8.55E-02		1.30E+00
	302.65	2.20	1.09E+00		1.47E+00
	330.06	1.40	8.84E-01		2.48E+00
U-235	143.76	10.96	-9.85E-02	6.02E-02	2.93E-01
	163.33	5.08	6.02E-02		5.95E-01
	185.71	57.20	4.23E-02		6.02E-02
	202.11	1.08	-1.27E+00		2.76E+00
	205.31	5.01	-2.88E-02		5.74E-01
Am-241	59.54	35.90	-5.02E-03	3.94E-01	3.94E-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 10-Sep-19-10010

L1-12205E-FSGS-106SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10010
Sample Description	: L1-12205E-FSGS-106SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.610E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:10:00PM
Acquisition Started	: 9/10/2019 9:42:52AM
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	: 9/29/2018
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79371
Fill Height	: 1610.09 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 9:58:11AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10010

L1-12205E-FSGS-106SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.59	949 -	960	954.84	9.99E+01	14.84	4.81E+01	0.61
2	295.17	1175 -	1188	1180.89	4.92E+01	11.44	2.88E+01	0.77
3	338.38	1349 -	1359	1353.57	1.55E+01	8.69	2.45E+01	0.33
4	351.86	1399 -	1414	1407.42	6.69E+01	12.60	3.01E+01	1.55
5	583.19	2326 -	2340	2332.07	5.24E+01	8.76	8.59E+00	0.98
6	1460.78	5831 -	5855	5843.47	3.72E+02	19.91	6.08E+00	1.97

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	7.68E+00	5.29E-01
Tl-208	1.00	583.19	*	85.00	7.41E-02	1.32E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.55E-01	2.62E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.03E-01	4.99E-02
		351.93	*	35.60	1.61E-01	3.30E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		

Analysis Report for 10-Sep-19-10010

L1-12205E-FSGS-106SS

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	1.15E-01	6.51E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	7.68E+00	5.29E-01	
	Tl-208	1.000	7.41E-02	1.32E-02	
X	Bi-211	0.906			
	Pb-212	1.000	1.55E-01	2.62E-02	
	Pb-214	0.999	1.74E-01	2.75E-02	
	Ac-228	1.000	1.15E-01	6.51E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Sep-19-10010

L1-12205E-FSGS-106SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 9:58:11AM
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	4.26E-02	4.76E-02	4.76E-02
	BE-7	477.60		10.44	1.86E-01	3.72E-01	3.72E-01
+	K-40	1460.82	*	10.66	7.68E+00	4.07E-01	4.07E-01
	Mn-54	834.85		99.98	4.19E-03	4.94E-02	4.94E-02
	Co-60	1173.23		99.85	-5.45E-02	4.89E-02	6.30E-02
		1332.49		99.98	-1.95E-02		4.89E-02
	Nb-94	702.65		99.81	-2.62E-02	4.08E-02	4.08E-02
		871.09		99.89	2.34E-03		4.27E-02
	Ag-108m	79.13		6.60	1.43E-01	3.98E-02	1.47E+00
		433.94		90.50	-2.60E-02		3.98E-02
		614.28		89.80	1.36E-02		6.15E-02
		722.94		90.80	1.56E-02		5.29E-02
	Sb-125	176.31		6.84	-7.59E-02	1.18E-01	4.54E-01
		380.45		1.52	-9.59E-01		2.39E+00
		427.87		29.60	-9.27E-03		1.18E-01
		463.36		10.49	2.85E-01		3.85E-01
		600.60		17.65	-4.81E-02		2.20E-01
		606.71		4.98	8.68E-01		1.11E+00
		635.95		11.22	4.78E-02		3.16E-01

Analysis Report for 10-Sep-19-10010

L1-12205E-FSGS-106SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-5.19E-02	1.18E-01	2.39E+00
Ba-133	79.61	2.65	-5.88E-01	7.16E-02	3.52E+00
	81.00	32.90	-2.14E-01		2.39E-01
	276.40	7.16	1.16E-01		5.00E-01
	302.85	18.34	1.53E-01		1.88E-01
	356.01	62.05	5.94E-03		7.16E-02
	383.85	8.94	-3.36E-02		4.14E-01
Cs-134	475.36	1.48	1.20E+00	4.79E-02	2.55E+00
	563.25	8.34	-5.55E-02		5.09E-01
	569.33	15.37	1.78E-02		2.81E-01
	604.72	97.62	9.96E-03		4.98E-02
	795.86	85.46	1.47E-02		4.79E-02
	801.95	8.69	-1.04E-01		4.41E-01
	1038.61	0.99	-2.82E+00		5.17E+00
	1167.97	1.79	2.38E+00		4.02E+00
	1365.19	3.02	-3.72E-01		1.57E+00
Cs-137	661.66	85.10	-2.40E-02	4.92E-02	4.92E-02
Eu-152	121.78	28.67	-4.19E-02	1.21E-01	1.21E-01
	244.70	7.61	2.16E-01		4.80E-01
	295.94	0.45	2.83E+00		9.30E+00
	344.28	26.60	3.44E-02		1.25E-01
	367.79	0.86	-1.13E-01		3.74E+00
	411.12	2.24	2.52E-01		1.58E+00
	443.96	2.83	-1.36E+00		1.08E+00
	488.68	0.42	3.10E+00		9.20E+00
	563.99	0.49	-2.93E+00		8.73E+00
	586.26	0.46	8.36E+00		1.17E+01
	678.62	0.47	-1.03E+01		8.32E+00
	688.67	0.86	-4.84E+00		4.62E+00
	719.35	0.28	6.07E+00		1.64E+01
	778.90	12.96	-1.43E-01		3.12E-01
	810.45	0.32	-2.04E-01		1.33E+01
	867.37	4.26	-1.45E-01		1.08E+00
	919.33	0.43	-2.11E+01		9.80E+00
	964.08	14.65	2.67E-01		4.08E-01
	1085.87	10.24	3.56E-02		5.43E-01
	1089.74	1.73	-1.02E+00		3.09E+00
	1112.07	13.69	-8.53E-02		4.07E-01
	1212.95	1.43	-1.89E+00		4.61E+00
	1249.94	0.19	1.23E+01		3.39E+01
	1299.14	1.63	3.49E+00		3.52E+00
	1408.01	21.07	-3.39E-02		1.98E-01
	1457.64	0.50	1.51E+02		4.24E+01
	1528.10	0.28	3.23E+00		1.01E+01
Eu-154	123.07	40.40	-4.12E-02	8.48E-02	8.48E-02
	247.93	6.89	-9.95E-02		4.59E-01
	591.76	4.95	-5.27E-02		7.57E-01
	692.42	1.78	-1.24E+00		2.30E+00
	723.30	20.06	1.53E-02		2.39E-01
	756.80	4.52	4.07E-01		1.07E+00
	873.18	12.08	5.32E-02		3.28E-01

Analysis Report for 10-Sep-19-10010

L1-12205E-FSGS-106SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.61E-01	8.48E-02	3.69E-01
	1004.76	18.01	1.36E-01		2.65E-01
	1274.43	34.80	-6.45E-02		1.70E-01
	1596.48	1.80	-1.21E+00		1.91E+00
Eu-155	45.30	1.31	-3.14E+00	1.95E-01	1.81E+01
	60.01	1.22	-1.22E+01		2.02E+01
	86.55	30.70	-4.17E-02		2.02E-01
	105.31	21.10	1.44E-02		1.95E-01
Ra-226	186.21	3.64	3.39E-01	1.04E+00	1.04E+00
Pa-231	27.36	10.30	1.79E+00	1.35E+00	2.21E+00
	283.69	1.70	1.12E-01		1.88E+00
	300.07	2.47	-8.48E-01		1.35E+00
	302.65	2.20	1.40E+00		1.56E+00
	330.06	1.40	2.93E-01		2.60E+00
U-235	143.76	10.96	-6.76E-02	6.69E-02	3.31E-01
	163.33	5.08	8.61E-02		6.66E-01
	185.71	57.20	3.76E-02		6.69E-02
	202.11	1.08	-1.71E+00		3.04E+00
	205.31	5.01	-4.51E-01		6.43E-01
Am-241	59.54	35.90	-1.20E-01	7.25E-01	7.25E-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 10-Sep-19-10011

L1-12205E-FSGS-107SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10011
Sample Description	: L1-12205E-FSGS-107SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.625E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:12:00PM
Acquisition Started	: 9/10/2019 10:08:23AM
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	: 0.03 %
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	: 9/29/2018
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79372
Fill Height	: 1624.72 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 10:23:26AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10011

L1-12205E-FSGS-107SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.62	475 -	480	477.42	7.94E+01	15.85	9.06E+01	0.98
2	295.42	586 -	595	590.90	6.74E+01	13.32	4.86E+01	1.16
3	583.01	1161 -	1170	1165.63	4.73E+01	9.45	1.87E+01	1.56
4	609.27	1212 -	1223	1218.12	7.81E+01	10.74	1.49E+01	1.75
5	911.25	1816 -	1826	1821.94	3.96E+01	9.28	1.94E+01	1.05
6	1460.65	2914 -	2928	2921.36	4.32E+02	21.27	7.25E+00	2.13

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	7.99E+00	5.24E-01
Tl-208	0.99	583.19	*	85.00	6.02E-02	1.26E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.10E-01	2.37E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.91E-01	2.87E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 10-Sep-19-10011

L1-12205E-FSGS-107SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
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	2.22E-01	5.29E-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	0.995	7.99E+00	5.24E-01	
Tl-208	0.995	6.02E-02	1.26E-02	
Pb-212	1.000	1.10E-01	2.37E-02	

Analysis Report for 10-Sep-19-10011

L1-12205E-FSGS-107SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
Bi-214	1.000	1.91E-01	2.87E-02	
Ac-228	1.000	2.22E-01	5.29E-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 10-Sep-19-10011

L1-12205E-FSGS-107SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 10:23:26AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
2	295.42	7.48994E-02	19.77	Tol.	Eu-152 Pb-214

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	5.82E-02	5.12E-02	5.12E-02
	BE-7	477.60		10.44	4.56E-02	3.01E-01	3.01E-01
+	K-40	1460.82	*	10.66	7.99E+00	3.38E-01	3.38E-01
	Mn-54	834.85		99.98	-1.20E-02	3.93E-02	3.93E-02
	Co-60	1173.23		99.85	2.77E-02	4.38E-02	5.96E-02
		1332.49		99.98	1.83E-02		4.38E-02
	Nb-94	702.65		99.81	-1.01E-02	3.18E-02	3.72E-02
		871.09		99.89	-2.63E-02		3.18E-02
	Ag-108m	79.13		6.60	5.60E-01	3.41E-02	1.07E+00
		433.94		90.50	-5.97E-04		3.41E-02
		614.28		89.80	-1.74E-02		4.95E-02
		722.94		90.80	2.30E-02		4.45E-02
	Sb-125	176.31		6.84	3.51E-02	1.05E-01	4.87E-01
		380.45		1.52	-4.99E-01		2.20E+00
		427.87		29.60	6.38E-03		1.05E-01
		463.36		10.49	3.32E-02		2.94E-01
		600.60		17.65	7.72E-03		1.93E-01

Analysis Report for 10-Sep-19-10011

L1-12205E-FSGS-107SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	606.71	4.98	5.72E-02	1.05E-01	1.18E+00
	635.95	11.22	9.85E-02		3.02E-01
	671.44	1.79	6.27E-01		2.10E+00
Ba-133	79.61	2.65	4.44E-01	6.67E-02	2.49E+00
	81.00	32.90	-2.41E-01		1.62E-01
	276.40	7.16	6.80E-02		4.40E-01
	302.85	18.34	2.14E-02		1.65E-01
	356.01	62.05	-4.04E-04		6.67E-02
	383.85	8.94	7.68E-02		3.75E-01
Cs-134	475.36	1.48	-4.48E-01	5.07E-02	1.95E+00
	563.25	8.34	-6.21E-02		4.07E-01
	569.33	15.37	-4.42E-02		2.14E-01
	604.72	97.62	2.04E-03		5.07E-02
	795.86	85.46	2.64E-02		5.27E-02
	801.95	8.69	-2.11E-01		4.40E-01
	1038.61	0.99	-2.21E+00		4.57E+00
	1167.97	1.79	-4.05E-01		3.18E+00
	1365.19	3.02	-1.09E-01		1.41E+00
Cs-137	661.66	85.10	-4.66E-03	4.37E-02	4.37E-02
Eu-152	121.78	28.67	1.35E-02	1.06E-01	1.06E-01
	244.70	7.61	2.56E-02		4.34E-01
	295.94	0.45	8.61E+00		8.91E+00
	344.28	26.60	-1.31E-01		1.08E-01
	367.79	0.86	-7.98E-01		3.27E+00
	411.12	2.24	8.15E-01		1.47E+00
	443.96	2.83	-2.78E-01		1.06E+00
	488.68	0.42	2.69E+00		7.34E+00
	563.99	0.49	1.49E+00		7.16E+00
	586.26	0.46	-2.30E+00		1.08E+01
	678.62	0.47	-1.75E+00		7.04E+00
	688.67	0.86	-1.72E+00		4.39E+00
	719.35	0.28	3.84E+00		1.33E+01
	778.90	12.96	7.43E-02		2.89E-01
	810.45	0.32	-3.93E+00		1.12E+01
	867.37	4.26	-2.57E-01		8.50E-01
	919.33	0.43	1.58E+00		1.06E+01
	964.08	14.65	1.96E-03		3.32E-01
	1085.87	10.24	-3.84E-01		4.17E-01
	1089.74	1.73	-5.99E-01		2.56E+00
	1112.07	13.69	-3.88E-02		3.44E-01
	1212.95	1.43	4.59E-01		3.80E+00
	1249.94	0.19	1.06E+01		2.92E+01
	1299.14	1.63	-8.86E-01		3.05E+00
	1408.01	21.07	-7.74E-02		1.78E-01
	1457.64	0.50	-3.91E-01		4.06E+01
	1528.10	0.28	-2.89E+00		9.84E+00
Eu-154	123.07	40.40	-3.38E-03	7.23E-02	7.23E-02
	247.93	6.89	7.14E-02		4.25E-01
	591.76	4.95	5.57E-02		6.53E-01
	692.42	1.78	-1.24E-01		2.24E+00
	723.30	20.06	1.03E-01		2.01E-01

Analysis Report for 10-Sep-19-10011

L1-12205E-FSGS-107SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	756.80	4.52	-2.41E-01	7.23E-02	7.20E-01
	873.18	12.08	6.69E-02		2.95E-01
	996.29	10.48	-1.69E-01		3.79E-01
	1004.76	18.01	-5.03E-02		2.49E-01
	1274.43	34.80	8.72E-03		1.63E-01
	1596.48	1.80	4.54E-01		1.93E+00
Eu-155	45.30	1.31	-3.88E+00	1.66E-01	9.36E+00
	60.01	1.22	-7.53E+00		1.14E+01
	86.55	30.70	1.85E-02		1.66E-01
	105.31	21.10	4.63E-02		1.72E-01
Ra-226	186.21	3.64	5.31E-01	9.71E-01	9.71E-01
Pa-231	27.36	10.30	1.74E-02	9.60E-01	9.60E-01
	283.69	1.70	4.38E-01		1.91E+00
	300.07	2.47	-1.73E-01		1.20E+00
	302.65	2.20	1.78E-01		1.37E+00
	330.06	1.40	2.49E-01		2.44E+00
U-235	143.76	10.96	4.02E-02	6.14E-02	2.73E-01
	163.33	5.08	3.01E-01		6.51E-01
	185.71	57.20	2.54E-02		6.14E-02
	202.11	1.08	4.82E-01		2.97E+00
	205.31	5.01	-1.69E-01		6.18E-01
Am-241	59.54	35.90	-9.94E-02	4.12E-01	4.12E-01

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

Apex-Gamma

Analysis Report for 10-Sep-19-10012

L1-12205E-FSGS-108SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10012
Sample Description	: L1-12205E-FSGS-108SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.741E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:14:00PM
Acquisition Started	: 9/10/2019 10:08:41AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.3 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	: 1/29/2019
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79373
Fill Height	: 1741.32 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 10:23:45AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 9/10/19 - 1500

J Graham

Analysis Report for 10-Sep-19-10012

L1-12205E-FSGS-108SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.58	949 -	959	954.40	9.63E+01	14.08	4.27E+01	0.82
2	295.10	1175 -	1185	1180.31	2.91E+01	9.83	2.79E+01	0.77
3	351.76	1401 -	1415	1406.77	6.37E+01	12.20	2.93E+01	0.60
4	609.12	2428 -	2442	2435.64	5.25E+01	10.84	2.25E+01	1.45
5	727.13	2903 -	2913	2907.53	1.06E+01	5.81	9.40E+00	0.73
6	1460.18	5829 -	5852	5840.55	3.46E+02	18.60	0.00E+00	1.41

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.93	1460.82	*	10.66	8.33E+00	5.76E-01
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	2.55E-01	1.40E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.69E-01	2.82E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.64E-01	3.53E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 10-Sep-19-10012

L1-12205E-FSGS-108SS

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	1.36E-01	4.71E-02
		351.93	*	35.60	1.74E-01	3.61E-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	0.936	8.33E+00	5.76E-01	
X	Bi-211	0.927			
	Bi-212	0.996	2.55E-01	1.40E-01	
	Pb-212	1.000	1.69E-01	2.82E-02	
	Bi-214	0.997	1.64E-01	3.53E-02	
	Pb-214	0.997	1.60E-01	2.87E-02	

Analysis Report for 10-Sep-19-10012

L1-12205E-FSGS-108SS

? = 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 10-Sep-19-10012

L1-12205E-FSGS-108SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 10:23:45AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.38E-02	5.91E-02	5.91E-02
	BE-7	477.60		10.44	-1.69E-01	3.78E-01	3.78E-01
+	K-40	1460.82	*	10.66	8.33E+00	6.93E-02	6.93E-02
	Mn-54	834.85		99.98	-2.51E-02	4.46E-02	4.46E-02
	Co-60	1173.23		99.85	-9.38E-04	4.99E-02	6.43E-02
		1332.49		99.98	-4.09E-02		4.99E-02
	Nb-94	702.65		99.81	6.52E-03	4.77E-02	5.27E-02
		871.09		99.89	-3.07E-02		4.77E-02
	Ag-108m	79.13		6.60	3.94E-01	3.99E-02	1.82E+00
		433.94		90.50	-7.53E-02		3.99E-02
		614.28		89.80	-2.55E-02		6.02E-02
		722.94		90.80	-3.65E-02		6.10E-02
	Sb-125	176.31		6.84	-2.32E-01	1.22E-01	5.24E-01
		380.45		1.52	2.17E+00		2.82E+00
		427.87		29.60	-9.93E-03		1.22E-01
		463.36		10.49	-5.14E-03		4.02E-01
		600.60		17.65	-6.30E-02		2.53E-01
		606.71		4.98	1.85E+00		1.48E+00
		635.95		11.22	1.50E-01		3.81E-01

Analysis Report for 10-Sep-19-10012

L1-12205E-FSGS-108SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.46E-01	1.22E-01	1.97E+00
Ba-133	79.61	2.65	-1.78E+00	6.80E-02	4.23E+00
	81.00	32.90	-2.55E-01		3.00E-01
	276.40	7.16	4.63E-02		5.63E-01
	302.85	18.34	6.19E-02		1.95E-01
	356.01	62.05	5.31E-03		6.80E-02
	383.85	8.94	2.49E-01		4.74E-01
Cs-134	475.36	1.48	-2.31E-01	5.98E-02	2.73E+00
	563.25	8.34	3.64E-02		4.72E-01
	569.33	15.37	-1.03E-01		2.33E-01
	604.72	97.62	-8.68E-03		6.94E-02
	795.86	85.46	-2.11E-02		5.98E-02
	801.95	8.69	-1.48E-02		5.74E-01
	1038.61	0.99	1.90E+00		5.11E+00
	1167.97	1.79	6.69E-01		3.79E+00
	1365.19	3.02	-9.62E-01		1.52E+00
Cs-137	661.66	85.10	9.72E-03	4.75E-02	4.75E-02
Eu-152	121.78	28.67	2.77E-02	1.48E-01	1.68E-01
	244.70	7.61	1.92E-01		5.77E-01
	295.94	0.45	6.18E+00		9.53E+00
	344.28	26.60	-1.37E-01		1.48E-01
	367.79	0.86	-4.49E+00		3.74E+00
	411.12	2.24	-6.09E-01		1.87E+00
	443.96	2.83	-4.27E-01		1.46E+00
	488.68	0.42	2.20E-01		9.78E+00
	563.99	0.49	-1.12E+00		7.77E+00
	586.26	0.46	8.48E+00		1.28E+01
	678.62	0.47	1.93E+00		8.06E+00
	688.67	0.86	-1.26E+00		4.18E+00
	719.35	0.28	-1.71E+01		1.69E+01
	778.90	12.96	2.68E-01		3.83E-01
	810.45	0.32	-2.21E-01		1.59E+01
	867.37	4.26	4.51E-02		1.23E+00
	919.33	0.43	3.47E-01		1.28E+01
	964.08	14.65	6.90E-02		4.13E-01
	1085.87	10.24	-1.33E-01		4.63E-01
	1089.74	1.73	-2.96E-01		3.26E+00
	1112.07	13.69	-2.76E-01		4.46E-01
	1212.95	1.43	9.94E-01		5.06E+00
	1249.94	0.19	2.25E-01		3.14E+01
	1299.14	1.63	6.98E-01		3.68E+00
	1408.01	21.07	-2.27E-01		2.31E-01
	1457.64	0.50	1.77E+02		4.70E+01
	1528.10	0.28	6.60E+00		1.47E+01
Eu-154	123.07	40.40	2.70E-03	1.16E-01	1.16E-01
	247.93	6.89	-4.44E-01		5.30E-01
	591.76	4.95	6.06E-01		7.83E-01
	692.42	1.78	7.59E-01		2.43E+00
	723.30	20.06	-3.21E-03		2.79E-01
	756.80	4.52	5.33E-01		1.04E+00
	873.18	12.08	-1.99E-01		4.09E-01

Analysis Report for 10-Sep-19-10012

L1-12205E-FSGS-108SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.76E-01	1.16E-01	5.08E-01
	1004.76	18.01	6.72E-02		3.41E-01
	1274.43	34.80	7.71E-02		1.95E-01
	1596.48	1.80	1.07E+00		2.38E+00
Eu-155	45.30	1.31	4.27E+00	2.56E-01	3.22E+01
	60.01	1.22	4.37E+00		3.13E+01
	86.55	30.70	-1.11E-01		2.56E-01
	105.31	21.10	6.06E-02		2.69E-01
Ra-226	186.21	3.64	5.53E-01	1.11E+00	1.11E+00
Pa-231	27.36	10.30	3.39E+00	1.45E+00	3.48E+00
	283.69	1.70	4.09E-01		2.17E+00
	300.07	2.47	-4.01E-01		1.45E+00
	302.65	2.20	7.20E-01		1.65E+00
	330.06	1.40	-1.94E-01		2.84E+00
U-235	143.76	10.96	-7.00E-02	7.16E-02	4.00E-01
	163.33	5.08	-8.96E-02		7.69E-01
	185.71	57.20	3.94E-02		7.16E-02
	202.11	1.08	-1.62E+00		3.38E+00
	205.31	5.01	2.26E-02		7.45E-01
Am-241	59.54	35.90	-6.30E-01	1.07E+00	1.07E+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 10-Sep-19-10013

L1-12205E-FSGS-109SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10013
Sample Description	: L1-12205E-FSGS-109SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.770E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:16:00PM
Acquisition Started	: 9/10/2019 10:08:49AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
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	: 1/24/2019
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79374
Fill Height	: 1770.49 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 10:23:57AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 9/10/19 - 1500

J Graham

Analysis Report for 10-Sep-19-10013

L1-12205E-FSGS-109SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.80	948 -	960	954.78	1.00E+02	15.39	5.20E+01	0.89
2	352.08	1399 -	1415	1407.31	8.32E+01	11.37	1.48E+01	0.96
3	583.16	2325 -	2337	2330.75	2.99E+01	8.85	1.81E+01	0.41
4	609.26	2428 -	2442	2435.09	5.29E+01	9.22	1.11E+01	0.61
5	1119.92	4472 -	4483	4477.09	2.36E+01	5.76	3.37E+00	0.49
6	1460.25	5826 -	5850	5838.92	3.55E+02	19.16	3.04E+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	0.94	1460.82	*	10.66	7.67E+00	5.31E-01
Tl-208	1.00	583.19	*	85.00	4.37E-02	1.32E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.55E-01	2.70E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.49E-01	2.74E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	3.04E-01	7.51E-02
		1155.21		1.63		

Analysis Report for 10-Sep-19-10013

L1-12205E-FSGS-109SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.04E-01	3.23E-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	0.948	7.67E+00	5.31E-01	
Tl-208	1.000	4.37E-02	1.32E-02	
Pb-212	0.996	1.55E-01	2.70E-02	
Bi-214	0.997	1.67E-01	2.57E-02	
Pb-214	0.998	2.04E-01	3.23E-02	

Analysis Report for 10-Sep-19-10013

L1-12205E-FSGS-109SS

? = 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 10-Sep-19-10013

L1-12205E-FSGS-109SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 10:23:57AM
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	5.64E-02	5.40E-02	5.40E-02
	BE-7	477.60		10.44	6.01E-02	3.36E-01	3.36E-01
+	K-40	1460.82	*	10.66	7.67E+00	3.19E-01	3.19E-01
	Mn-54	834.85		99.98	2.37E-03	4.01E-02	4.01E-02
	Co-60	1173.23		99.85	2.09E-02	4.99E-02	5.60E-02
		1332.49		99.98	-4.96E-03		4.99E-02
	Nb-94	702.65		99.81	1.66E-02	3.95E-02	3.98E-02
		871.09		99.89	-3.38E-02		3.95E-02
	Ag-108m	79.13		6.60	-2.22E-01	3.84E-02	1.09E+00
		433.94		90.50	-1.10E-02		3.84E-02
		614.28		89.80	-4.45E-02		5.32E-02
		722.94		90.80	-7.23E-03		4.74E-02
	Sb-125	176.31		6.84	4.50E-02	1.22E-01	4.37E-01
		380.45		1.52	3.46E-01		2.00E+00
		427.87		29.60	3.65E-03		1.22E-01
		463.36		10.49	7.67E-02		3.92E-01
		600.60		17.65	3.81E-04		2.18E-01
		606.71		4.98	1.10E+00		1.19E+00
		635.95		11.22	-1.07E-01		3.15E-01

Analysis Report for 10-Sep-19-10013

L1-12205E-FSGS-109SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.07E-01	1.22E-01	2.12E+00
Ba-133	79.61	2.65	9.01E-01	6.34E-02	2.70E+00
	81.00	32.90	-1.98E-01		1.80E-01
	276.40	7.16	-3.47E-02		4.82E-01
	302.85	18.34	-1.23E-01		1.62E-01
	356.01	62.05	-2.00E-03		6.34E-02
	383.85	8.94	6.16E-02		3.57E-01
Cs-134	475.36	1.48	1.94E+00	4.89E-02	2.53E+00
	563.25	8.34	-9.64E-02		4.24E-01
	569.33	15.37	-1.89E-02		2.13E-01
	604.72	97.62	1.34E-02		5.22E-02
	795.86	85.46	2.69E-02		4.89E-02
	801.95	8.69	3.01E-01		4.49E-01
	1038.61	0.99	-9.24E-02		4.69E+00
	1167.97	1.79	7.26E-02		3.21E+00
	1365.19	3.02	-5.10E-01		1.60E+00
Cs-137	661.66	85.10	-2.50E-03	4.63E-02	4.63E-02
Eu-152	121.78	28.67	-2.67E-02	1.05E-01	1.05E-01
	244.70	7.61	-1.98E-02		4.44E-01
	295.94	0.45	1.38E+00		8.50E+00
	344.28	26.60	-4.64E-02		1.11E-01
	367.79	0.86	2.23E+00		3.51E+00
	411.12	2.24	-2.92E-01		1.53E+00
	443.96	2.83	-8.38E-01		1.18E+00
	488.68	0.42	-1.29E+00		7.39E+00
	563.99	0.49	-4.76E+00		6.87E+00
	586.26	0.46	-2.83E-01		1.16E+01
	678.62	0.47	7.06E-01		7.54E+00
	688.67	0.86	1.38E+00		4.26E+00
	719.35	0.28	1.11E+01		1.54E+01
	778.90	12.96	2.35E-01		3.59E-01
	810.45	0.32	7.59E+00		1.32E+01
	867.37	4.26	-5.74E-01		9.45E-01
	919.33	0.43	-1.97E+01		1.00E+01
	964.08	14.65	-3.87E-01		3.41E-01
	1085.87	10.24	5.87E-02		5.11E-01
	1089.74	1.73	2.37E+00		3.08E+00
	1112.07	13.69	2.92E-01		3.82E-01
	1212.95	1.43	2.63E+00		4.65E+00
	1249.94	0.19	1.22E+01		2.82E+01
	1299.14	1.63	3.32E-01		3.30E+00
	1408.01	21.07	-7.18E-02		1.56E-01
	1457.64	0.50	1.59E+02		4.29E+01
	1528.10	0.28	-6.13E+00		1.24E+01
Eu-154	123.07	40.40	-4.47E-02	7.48E-02	7.48E-02
	247.93	6.89	-1.29E-01		4.92E-01
	591.76	4.95	-3.62E-01		7.16E-01
	692.42	1.78	7.44E-01		2.32E+00
	723.30	20.06	-4.61E-04		2.12E-01
	756.80	4.52	-1.23E-01		9.09E-01
	873.18	12.08	2.12E-01		3.74E-01

Analysis Report for 10-Sep-19-10013

L1-12205E-FSGS-109SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.49E-01	7.48E-02	4.64E-01
	1004.76	18.01	1.24E-01		2.85E-01
	1274.43	34.80	9.15E-02		1.69E-01
	1596.48	1.80	6.86E-01		1.87E+00
Eu-155	45.30	1.31	2.20E+00	1.75E-01	1.11E+01
	60.01	1.22	5.47E+00		1.23E+01
	86.55	30.70	2.65E-02		1.75E-01
	105.31	21.10	-1.45E-02		1.83E-01
Ra-226	186.21	3.64	9.17E-01	9.45E-01	9.45E-01
Pa-231	27.36	10.30	1.22E+00	1.26E+00	1.34E+00
	283.69	1.70	-2.39E+00		1.67E+00
	300.07	2.47	-1.65E+00		1.26E+00
	302.65	2.20	-6.18E-01		1.35E+00
	330.06	1.40	6.53E-01		2.30E+00
U-235	143.76	10.96	-7.86E-02	5.90E-02	2.81E-01
	163.33	5.08	-4.52E-01		5.36E-01
	185.71	57.20	4.02E-02		5.90E-02
	202.11	1.08	-2.59E-01		2.68E+00
	205.31	5.01	-1.20E-01		5.62E-01
Am-241	59.54	35.90	1.92E-01	4.26E-01	4.26E-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 10-Sep-19-10014

L1-12205E-FQGS-109SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10014
Sample Description	: L1-12205E-FQGS-109SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.667E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:16:00PM
Acquisition Started	: 9/10/2019 10:27:15AM
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	: 1/24/2019
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79376
Fill Height	: 1666.66 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 10:42:18AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10014

L1-12205E-FQGS-109SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.92	948 -	961	955.27	1.00E+02	16.78	6.49E+01	1.12
2	295.24	1175 -	1187	1180.23	2.72E+01	10.06	2.78E+01	0.91
3	352.13	1400 -	1413	1407.53	5.08E+01	11.09	2.62E+01	1.03
4	583.08	2326 -	2338	2330.42	4.10E+01	8.05	8.98E+00	1.07
5	609.12	2430 -	2440	2434.54	2.95E+01	9.27	2.35E+01	0.55
6	1460.22	5827 -	5851	5838.83	3.34E+02	20.57	2.16E+01	1.72

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.94	1460.82	*	10.66	7.33E+00	5.52E-01
Tl-208	0.99	583.19	*	85.00	6.06E-02	1.24E-02
Pb-212	0.98	115.18		0.60		
		238.63	*	43.60	1.57E-01	2.92E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	8.38E-02	2.68E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 10-Sep-19-10014

L1-12205E-FQGS-109SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	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	1.14E-01	4.33E-02
		351.93	*	35.60	1.26E-01	2.93E-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	0.944	7.33E+00	5.52E-01	
Tl-208	0.998	6.06E-02	1.24E-02	
Pb-212	0.988	1.57E-01	2.92E-02	
Bi-214	0.997	8.38E-02	2.68E-02	
Pb-214	0.996	1.22E-01	2.42E-02	

Analysis Report for 10-Sep-19-10014

L1-12205E-FQGS-109SS

? = 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 10-Sep-19-10014

L1-12205E-FQGS-109SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 10:42:18AM
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	-1.05E-02	4.67E-02	4.67E-02
	BE-7	477.60		10.44	-1.11E-01	3.31E-01	3.31E-01
+	K-40	1460.82	*	10.66	7.33E+00	7.64E-01	7.64E-01
	Mn-54	834.85		99.98	-8.31E-03	4.22E-02	4.22E-02
	Co-60	1173.23		99.85	-2.05E-02	5.19E-02	5.85E-02
		1332.49		99.98	2.78E-02		5.19E-02
	Nb-94	702.65		99.81	1.52E-02	4.16E-02	4.16E-02
		871.09		99.89	7.35E-03		4.94E-02
	Ag-108m	79.13		6.60	3.32E-01	3.58E-02	1.07E+00
		433.94		90.50	-1.91E-02		3.58E-02
		614.28		89.80	-5.57E-02		5.23E-02
		722.94		90.80	3.47E-02		5.72E-02
	Sb-125	176.31		6.84	-1.52E-01	1.11E-01	4.48E-01
		380.45		1.52	6.93E-01		2.26E+00
		427.87		29.60	-4.97E-02		1.11E-01
		463.36		10.49	4.24E-02		2.98E-01
		600.60		17.65	1.04E-01		2.24E-01
		606.71		4.98	1.08E-01		1.20E+00
		635.95		11.22	-8.11E-02		3.07E-01

Analysis Report for 10-Sep-19-10014

L1-12205E-FQGS-109SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	6.18E-01	1.11E-01	2.15E+00
Ba-133	79.61	2.65	6.13E-01	6.48E-02	2.60E+00
	81.00	32.90	-9.11E-02		1.74E-01
	276.40	7.16	6.77E-04		4.56E-01
	302.85	18.34	3.24E-02		1.85E-01
	356.01	62.05	-4.09E-02		6.48E-02
	383.85	8.94	-2.20E-01		3.53E-01
Cs-134	475.36	1.48	8.05E-03	5.28E-02	2.42E+00
	563.25	8.34	-1.50E-01		4.94E-01
	569.33	15.37	9.00E-02		2.38E-01
	604.72	97.62	-4.95E-02		5.71E-02
	795.86	85.46	-2.10E-02		5.28E-02
	801.95	8.69	8.27E-02		5.30E-01
	1038.61	0.99	-2.15E+00		4.75E+00
	1167.97	1.79	1.28E+00		3.54E+00
	1365.19	3.02	7.14E-01		1.58E+00
Cs-137	661.66	85.10	1.53E-02	4.62E-02	4.62E-02
Eu-152	121.78	28.67	-5.57E-03	1.07E-01	1.07E-01
	244.70	7.61	3.38E-01		4.73E-01
	295.94	0.45	-2.46E+00		8.43E+00
	344.28	26.60	-6.21E-02		1.07E-01
	367.79	0.86	2.09E+00		3.81E+00
	411.12	2.24	1.79E-01		1.50E+00
	443.96	2.83	-8.48E-01		1.16E+00
	488.68	0.42	1.52E+00		7.94E+00
	563.99	0.49	-1.22E+01		7.71E+00
	586.26	0.46	1.23E+01		1.09E+01
	678.62	0.47	-2.44E+00		7.33E+00
	688.67	0.86	3.39E+00		4.77E+00
	719.35	0.28	4.38E-01		1.66E+01
	778.90	12.96	1.17E-01		3.22E-01
	810.45	0.32	-5.25E+00		1.19E+01
	867.37	4.26	4.40E-01		1.25E+00
	919.33	0.43	9.46E+00		1.13E+01
	964.08	14.65	2.40E-01		4.26E-01
	1085.87	10.24	-1.72E-01		4.82E-01
	1089.74	1.73	-1.76E-01		2.86E+00
	1112.07	13.69	-1.91E-01		3.52E-01
	1212.95	1.43	-5.39E+00		4.55E+00
	1249.94	0.19	-1.66E+01		3.07E+01
	1299.14	1.63	2.06E+00		3.35E+00
	1408.01	21.07	-2.97E-02		1.95E-01
	1457.64	0.50	1.70E+02		4.40E+01
	1528.10	0.28	6.86E+00		1.41E+01
Eu-154	123.07	40.40	9.19E-03	7.44E-02	7.44E-02
	247.93	6.89	-2.69E-01		4.30E-01
	591.76	4.95	-1.52E-01		5.50E-01
	692.42	1.78	5.16E-01		2.17E+00
	723.30	20.06	3.40E-02		2.54E-01
	756.80	4.52	1.25E-01		1.04E+00
	873.18	12.08	5.05E-02		4.15E-01

Analysis Report for 10-Sep-19-10014

L1-12205E-FQGS-109SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.43E-01	7.44E-02	3.47E-01
	1004.76	18.01	-3.52E-02		2.39E-01
	1274.43	34.80	1.12E-01		1.80E-01
	1596.48	1.80	-2.44E-01		2.04E+00
Eu-155	45.30	1.31	-2.06E+00	1.72E-01	1.08E+01
	60.01	1.22	3.76E+00		1.13E+01
	86.55	30.70	1.11E-01		1.72E-01
	105.31	21.10	1.39E-01		1.96E-01
Ra-226	186.21	3.64	1.77E-01	8.91E-01	8.91E-01
Pa-231	27.36	10.30	6.65E-01	1.20E+00	1.20E+00
	283.69	1.70	4.77E-01		1.89E+00
	300.07	2.47	4.93E-01		1.41E+00
	302.65	2.20	-2.63E-01		1.52E+00
	330.06	1.40	-9.46E-01		2.29E+00
U-235	143.76	10.96	9.49E-02	5.76E-02	3.17E-01
	163.33	5.08	-9.55E-02		6.45E-01
	185.71	57.20	2.12E-02		5.76E-02
	202.11	1.08	-1.49E+00		2.46E+00
	205.31	5.01	-2.62E-01		5.38E-01
Am-241	59.54	35.90	4.06E-03	4.01E-01	4.01E-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 10-Sep-19-10015

L1-12205E-FSGS-110SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10015
Sample Description	: L1-12205E-FSGS-110SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.768E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:18:00PM
Acquisition Started	: 9/10/2019 10:08:57AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79375
Fill Height	: 1768.27 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 10:24:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10015

L1-12205E-FSGS-110SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.77	951 -	961	955.56	7.18E+01	12.65	3.62E+01	1.32
2	295.53	1177 -	1186	1182.36	2.36E+01	9.14	2.64E+01	0.59
3	351.92	1402 -	1413	1407.66	4.10E+01	10.77	3.00E+01	0.42
4	583.05	2327 -	2338	2331.53	3.37E+01	8.19	1.33E+01	0.96
5	609.32	2429 -	2444	2436.56	5.54E+01	10.10	1.56E+01	0.51
6	911.30	3637 -	3650	3644.24	3.12E+01	7.46	8.81E+00	0.57
7	1460.82	5831 -	5854	5843.65	3.58E+02	20.45	1.50E+01	1.29

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	7.23E+00	5.19E-01
Tl-208	0.99	583.19	*	85.00	4.69E-02	1.17E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.10E-01	2.13E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.48E-01	2.84E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Sep-19-10015

L1-12205E-FSGS-110SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	9.61E-02	3.80E-02
		351.93	*	35.60	9.74E-02	2.68E-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	1.91E-01	4.64E-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 10-Sep-19-10015

L1-12205E-FSGS-110SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	7.23E+00	5.19E-01	
	Tl-208	0.997	4.69E-02	1.17E-02	
X	Bi-211	0.892			
	Pb-212	0.997	1.10E-01	2.13E-02	
	Bi-214	1.000	1.48E-01	2.84E-02	
	Pb-214	0.995	9.70E-02	2.19E-02	
	Ac-228	1.000	1.91E-01	4.64E-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 10-Sep-19-10015

L1-12205E-FSGS-110SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 10:24:00AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.55E-02	4.93E-02	4.93E-02
	BE-7	477.60		10.44	-3.96E-02	3.18E-01	3.18E-01
+	K-40	1460.82	*	10.66	7.23E+00	5.90E-01	5.90E-01
	Mn-54	834.85		99.98	-1.08E-02	4.22E-02	4.22E-02
	Co-60	1173.23		99.85	1.81E-02	4.06E-02	6.90E-02
		1332.49		99.98	1.30E-02		4.06E-02
	Nb-94	702.65		99.81	-7.72E-03	4.07E-02	4.07E-02
		871.09		99.89	3.03E-02		4.60E-02
	Ag-108m	79.13		6.60	-4.48E-01	3.36E-02	1.30E+00
		433.94		90.50	-3.15E-03		3.36E-02
		614.28		89.80	-6.81E-03		6.52E-02
		722.94		90.80	8.23E-03		4.23E-02
	Sb-125	176.31		6.84	2.60E-01	1.17E-01	4.89E-01
		380.45		1.52	8.24E-01		1.98E+00
		427.87		29.60	4.38E-02		1.17E-01
		463.36		10.49	6.89E-02		3.60E-01
		600.60		17.65	1.45E-01		2.27E-01
		606.71		4.98	1.84E+00		1.20E+00
		635.95		11.22	9.18E-02		3.20E-01

Analysis Report for 10-Sep-19-10015

L1-12205E-FSGS-110SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.14E-01	1.17E-01	1.98E+00
Ba-133	79.61	2.65	-1.87E+00	6.51E-02	3.15E+00
	81.00	32.90	-2.84E-01		2.40E-01
	276.40	7.16	-7.78E-02		4.78E-01
	302.85	18.34	4.83E-03		1.84E-01
	356.01	62.05	-3.20E-02		6.51E-02
	383.85	8.94	1.81E-01		3.56E-01
Cs-134	475.36	1.48	-8.03E-01	5.61E-02	2.10E+00
	563.25	8.34	1.98E-01		4.86E-01
	569.33	15.37	-1.43E-02		2.46E-01
	604.72	97.62	-3.13E-02		5.61E-02
	795.86	85.46	1.09E-02		5.99E-02
	801.95	8.69	-1.25E-01		5.23E-01
	1038.61	0.99	6.19E-01		4.58E+00
	1167.97	1.79	1.38E+00		3.40E+00
	1365.19	3.02	7.64E-02		1.23E+00
Cs-137	661.66	85.10	1.18E-03	4.65E-02	4.65E-02
Eu-152	121.78	28.67	9.03E-02	1.20E-01	1.34E-01
	244.70	7.61	-6.53E-03		4.38E-01
	295.94	0.45	8.50E+00		8.83E+00
	344.28	26.60	-2.28E-02		1.20E-01
	367.79	0.86	-1.73E+00		3.79E+00
	411.12	2.24	6.16E-01		1.70E+00
	443.96	2.83	-5.87E-01		1.20E+00
	488.68	0.42	3.26E+00		9.48E+00
	563.99	0.49	-5.21E-01		8.09E+00
	586.26	0.46	9.61E+00		1.09E+01
	678.62	0.47	-2.59E-01		7.81E+00
	688.67	0.86	1.96E+00		4.12E+00
	719.35	0.28	-3.33E+00		1.23E+01
	778.90	12.96	9.87E-02		3.25E-01
	810.45	0.32	3.26E+00		1.33E+01
	867.37	4.26	-1.77E-01		1.09E+00
	919.33	0.43	-1.87E+01		1.05E+01
	964.08	14.65	-1.91E-02		3.84E-01
	1085.87	10.24	-3.51E-01		4.55E-01
	1089.74	1.73	-1.98E+00		2.89E+00
	1112.07	13.69	-1.80E-01		4.40E-01
	1212.95	1.43	9.77E-01		5.15E+00
	1249.94	0.19	-4.86E+00		2.98E+01
	1299.14	1.63	9.72E-01		3.03E+00
	1408.01	21.07	4.25E-02		1.72E-01
	1457.64	0.50	1.64E+02		4.13E+01
	1528.10	0.28	-3.21E+00		9.85E+00
Eu-154	123.07	40.40	7.90E-03	9.21E-02	9.21E-02
	247.93	6.89	-4.83E-01		4.40E-01
	591.76	4.95	-4.73E-02		7.83E-01
	692.42	1.78	-1.29E+00		2.00E+00
	723.30	20.06	9.35E-02		1.92E-01
	756.80	4.52	7.74E-02		8.46E-01
	873.18	12.08	-3.15E-02		3.65E-01

Analysis Report for 10-Sep-19-10015

L1-12205E-FSGS-110SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.02E-01	9.21E-02	3.89E-01
	1004.76	18.01	-9.01E-02		2.42E-01
	1274.43	34.80	-1.56E-01		1.71E-01
	1596.48	1.80	-3.97E+00		1.43E+00
Eu-155	45.30	1.31	-4.42E+00	2.20E-01	1.89E+01
	60.01	1.22	-3.05E+00		2.14E+01
	86.55	30.70	-1.34E-01		2.22E-01
	105.31	21.10	8.60E-02		2.20E-01
Ra-226	186.21	3.64	1.24E-01	9.41E-01	9.41E-01
Pa-231	27.36	10.30	9.45E-01	1.48E+00	2.06E+00
	283.69	1.70	-2.44E+00		1.75E+00
	300.07	2.47	-1.80E+00		1.48E+00
	302.65	2.20	-8.19E-01		1.50E+00
	330.06	1.40	-1.02E+00		2.40E+00
U-235	143.76	10.96	-1.17E-01	5.96E-02	3.32E-01
	163.33	5.08	1.64E-01		6.33E-01
	185.71	57.20	2.35E-02		5.96E-02
	202.11	1.08	7.63E-01		3.23E+00
	205.31	5.01	-3.15E-01		6.76E-01
Am-241	59.54	35.90	-3.05E-01	7.47E-01	7.47E-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 10-Sep-19-10016

L1-12205E-FSGS-111SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10016
Sample Description	: L1-12205E-FSGS-111SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.799E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:20:00PM
Acquisition Started	: 9/10/2019 10:27:23AM
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	: 9/29/2018
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79377
Fill Height	: 1799.49 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 10:42:28AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10016

L1-12205E-FSGS-111SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.63	473 -	481	477.45	1.01E+02	19.72	1.30E+02	1.26
2	295.20	586 -	595	590.45	4.68E+01	13.25	5.72E+01	1.05
3	352.00	699 -	708	703.94	7.16E+01	12.62	3.74E+01	0.79
4	583.17	1160 -	1171	1165.95	5.73E+01	10.45	2.07E+01	1.28
5	609.32	1212 -	1223	1218.22	6.44E+01	10.31	1.66E+01	1.69
6	911.14	1817 -	1826	1821.73	3.82E+01	8.94	1.78E+01	1.38
7	1460.67	2913 -	2928	2921.39	4.34E+02	21.13	4.12E+00	1.72

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.84E+00	5.11E-01
Tl-208	1.00	583.19	*	85.00	7.15E-02	1.37E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.38E-01	2.92E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.55E-01	2.64E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Sep-19-10016

L1-12205E-FSGS-111SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.71E-01	5.03E-02
		351.93	*	35.60	1.53E-01	2.96E-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	2.10E-01	4.99E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Sep-19-10016

L1-12205E-FSGS-111SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.996	7.84E+00	5.11E-01	
	Tl-208	1.000	7.15E-02	1.37E-02	
X	Bi-211	0.872			
	Pb-212	1.000	1.38E-01	2.92E-02	
	Bi-214	1.000	1.55E-01	2.64E-02	
	Pb-214	1.000	1.57E-01	2.55E-02	
	Ac-228	1.000	2.10E-01	4.99E-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 10-Sep-19-10016

L1-12205E-FSGS-111SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 10:42:28AM
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	5.86E-02	4.96E-02	4.96E-02
	BE-7	477.60		10.44	6.86E-02	3.16E-01	3.16E-01
+	K-40	1460.82	*	10.66	7.84E+00	2.70E-01	2.70E-01
	Mn-54	834.85		99.98	-2.78E-02	3.85E-02	3.85E-02
	Co-60	1173.23		99.85	1.28E-02	3.75E-02	4.92E-02
		1332.49		99.98	-1.98E-02		3.75E-02
	Nb-94	702.65		99.81	3.00E-04	3.35E-02	4.12E-02
		871.09		99.89	-1.74E-03		3.35E-02
	Ag-108m	79.13		6.60	5.06E-01	3.02E-02	1.09E+00
		433.94		90.50	-5.46E-03		3.02E-02
		614.28		89.80	-2.37E-02		4.46E-02
		722.94		90.80	7.92E-03		4.25E-02
	Sb-125	176.31		6.84	-7.21E-02	1.02E-01	4.50E-01
		380.45		1.52	1.01E+00		2.15E+00
		427.87		29.60	-2.26E-02		1.02E-01
		463.36		10.49	5.88E-02		2.86E-01
		600.60		17.65	-1.37E-03		1.97E-01
		606.71		4.98	1.26E-02		1.08E+00
		635.95		11.22	-1.18E-01		3.05E-01

Analysis Report for 10-Sep-19-10016

L1-12205E-FSGS-111SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	4.14E-01	1.02E-01	1.89E+00
Ba-133	79.61	2.65	1.60E+00	6.39E-02	2.60E+00
	81.00	32.90	-1.85E-01		1.68E-01
	276.40	7.16	-9.64E-02		3.97E-01
	302.85	18.34	-1.27E-02		1.55E-01
	356.01	62.05	-1.20E-02		6.39E-02
	383.85	8.94	-2.96E-03		3.44E-01
Cs-134	475.36	1.48	1.79E-01	4.43E-02	2.23E+00
	563.25	8.34	7.17E-02		3.58E-01
	569.33	15.37	2.15E-02		2.23E-01
	604.72	97.62	-6.50E-03		4.63E-02
	795.86	85.46	1.67E-02		4.43E-02
	801.95	8.69	-2.19E-01		3.89E-01
	1038.61	0.99	-9.73E-01		4.25E+00
	1167.97	1.79	3.01E-01		2.78E+00
	1365.19	3.02	-1.67E-02		1.10E+00
Cs-137	661.66	85.10	3.59E-02	4.84E-02	4.84E-02
Eu-152	121.78	28.67	8.07E-03	1.07E-01	1.07E-01
	244.70	7.61	-2.18E-02		4.70E-01
	295.94	0.45	5.00E+00		8.33E+00
	344.28	26.60	-4.80E-02		1.14E-01
	367.79	0.86	2.76E-01		3.31E+00
	411.12	2.24	-2.77E-01		1.45E+00
	443.96	2.83	-4.56E-01		9.93E-01
	488.68	0.42	3.54E-01		7.89E+00
	563.99	0.49	1.65E+00		6.07E+00
	586.26	0.46	4.98E-01		1.11E+01
	678.62	0.47	2.79E+00		7.76E+00
	688.67	0.86	-6.54E-01		4.47E+00
	719.35	0.28	-3.39E+00		1.19E+01
	778.90	12.96	-1.88E-01		2.70E-01
	810.45	0.32	3.79E+00		1.08E+01
	867.37	4.26	-4.76E-01		7.47E-01
	919.33	0.43	-7.64E+00		8.62E+00
	964.08	14.65	-1.46E-01		3.25E-01
	1085.87	10.24	-2.16E-01		4.57E-01
	1089.74	1.73	2.31E-01		2.83E+00
	1112.07	13.69	-2.10E-01		3.04E-01
	1212.95	1.43	-2.44E+00		3.81E+00
	1249.94	0.19	-2.84E+00		2.82E+01
	1299.14	1.63	1.93E+00		2.88E+00
	1408.01	21.07	2.84E-02		1.73E-01
	1457.64	0.50	-1.72E+00		3.96E+01
	1528.10	0.28	-3.00E+00		6.82E+00
Eu-154	123.07	40.40	2.57E-02	7.59E-02	7.59E-02
	247.93	6.89	-6.52E-02		4.37E-01
	591.76	4.95	3.10E-01		7.43E-01
	692.42	1.78	4.16E-01		2.27E+00
	723.30	20.06	-4.96E-02		1.88E-01
	756.80	4.52	1.96E-01		8.57E-01
	873.18	12.08	5.03E-02		3.01E-01

Analysis Report for 10-Sep-19-10016

L1-12205E-FSGS-111SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.35E-01	7.59E-02	4.59E-01
	1004.76	18.01	-1.83E-01		2.25E-01
	1274.43	34.80	-7.28E-02		1.55E-01
	1596.48	1.80	-8.94E-01		1.43E+00
Eu-155	45.30	1.31	2.14E-01	1.67E-01	1.03E+01
	60.01	1.22	-3.73E+00		1.13E+01
	86.55	30.70	1.18E-01		1.67E-01
	105.31	21.10	-4.59E-02		1.74E-01
Ra-226	186.21	3.64	3.30E-01	9.80E-01	9.80E-01
Pa-231	27.36	10.30	8.42E-01	1.19E+00	1.21E+00
	283.69	1.70	-2.29E-01		1.70E+00
	300.07	2.47	-7.69E-02		1.19E+00
	302.65	2.20	-1.06E-01		1.29E+00
	330.06	1.40	1.14E+00		2.40E+00
U-235	143.76	10.96	-1.72E-02	6.13E-02	2.77E-01
	163.33	5.08	-4.01E-02		6.50E-01
	185.71	57.20	3.16E-03		6.13E-02
	202.11	1.08	1.12E+00		2.89E+00
	205.31	5.01	-6.03E-01		5.77E-01
Am-241	59.54	35.90	-5.29E-02	4.01E-01	4.01E-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 10-Sep-19-10017

L1-12205E-FSGS-112SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10017
Sample Description	: L1-12205E-FSGS-112SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.520E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:22:00PM
Acquisition Started	: 9/10/2019 10:27:35AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.3 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	: 1/29/2019
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79378
Fill Height	: 1520.18 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 10:42:47AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10017

L1-12205E-FSGS-112SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.55	948 -	960	954.28	7.24E+01	15.95	6.86E+01	1.23
2	351.92	1401 -	1416	1407.42	7.17E+01	11.38	1.93E+01	0.69
3	608.99	2429 -	2442	2435.15	4.15E+01	8.54	1.15E+01	0.65
4	968.52	3868 -	3879	3873.05	1.95E+01	5.55	4.48E+00	0.68
5	1460.24	5827 -	5853	5840.77	3.52E+02	19.15	3.40E+00	1.89

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.94	1460.82	*	10.66	8.78E+00	6.12E-01
Bi-211	0.89	351.07	*	13.02	5.49E-01	9.78E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.30E-01	3.04E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.34E-01	2.86E-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 10-Sep-19-10017

L1-12205E-FSGS-112SS

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	2.01E-01	3.57E-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		
		964.77		4.99		
		968.97	*	15.80	2.48E-01	7.14E-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

Analysis Report for 10-Sep-19-10017

L1-12205E-FSGS-112SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.946	8.78E+00	6.12E-01	
?	Bi-211	0.890	5.49E-01	9.78E-02	
	Pb-212	0.999	1.30E-01	3.04E-02	
	Bi-214	0.993	1.34E-01	2.86E-02	
?	Pb-214	1.000	2.01E-01	3.57E-02	
	Ac-228	0.994	2.48E-01	7.14E-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 10-Sep-19-10017

L1-12205E-FSGS-112SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 10:42:47AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.45E-02	6.00E-02	6.00E-02
	BE-7	477.60		10.44	2.90E-01	4.37E-01	4.37E-01
+	K-40	1460.82	*	10.66	8.78E+00	4.00E-01	4.00E-01
	Mn-54	834.85		99.98	2.37E-02	5.60E-02	5.60E-02
	Co-60	1173.23		99.85	-8.28E-03	5.56E-02	5.56E-02
		1332.49		99.98	1.06E-02		5.62E-02
	Nb-94	702.65		99.81	1.71E-02	4.78E-02	4.78E-02
		871.09		99.89	1.03E-02		5.27E-02
	Ag-108m	79.13		6.60	6.70E-01	4.10E-02	1.81E+00
		433.94		90.50	-1.98E-02		4.10E-02
		614.28		89.80	-1.28E-02		5.19E-02
		722.94		90.80	-3.30E-04		5.81E-02
	Sb-125	176.31		6.84	-6.33E-02	1.23E-01	5.39E-01
		380.45		1.52	-3.13E-01		2.44E+00
		427.87		29.60	-1.32E-01		1.23E-01
		463.36		10.49	1.54E-01		4.21E-01
		600.60		17.65	1.42E-01		2.29E-01
		606.71		4.98	1.69E+00		1.27E+00
		635.95		11.22	-6.95E-03		3.92E-01

Analysis Report for 10-Sep-19-10017

L1-12205E-FSGS-112SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-6.09E-01	1.23E-01	2.39E+00
Ba-133	79.61	2.65	-2.43E+00	7.77E-02	4.23E+00
	81.00	32.90	-2.37E-01		3.06E-01
	276.40	7.16	1.35E-01		6.05E-01
	302.85	18.34	2.37E-02		2.24E-01
	356.01	62.05	-1.36E-02		7.77E-02
	383.85	8.94	-6.13E-02		4.33E-01
Cs-134	475.36	1.48	-3.78E-01	5.11E-02	3.02E+00
	563.25	8.34	-2.47E-01		5.00E-01
	569.33	15.37	-4.55E-02		2.73E-01
	604.72	97.62	-4.86E-02		6.16E-02
	795.86	85.46	1.41E-02		5.11E-02
	801.95	8.69	-7.52E-02		5.05E-01
	1038.61	0.99	1.09E+00		6.47E+00
	1167.97	1.79	1.37E-01		3.02E+00
	1365.19	3.02	9.10E-01		1.95E+00
Cs-137	661.66	85.10	-2.95E-02	5.31E-02	5.31E-02
Eu-152	121.78	28.67	1.71E-02	1.45E-01	1.65E-01
	244.70	7.61	-3.40E-01		5.54E-01
	295.94	0.45	4.77E+00		1.06E+01
	344.28	26.60	6.87E-02		1.45E-01
	367.79	0.86	1.04E+00		5.04E+00
	411.12	2.24	1.12E+00		1.85E+00
	443.96	2.83	-7.13E-01		1.38E+00
	488.68	0.42	5.00E+00		1.03E+01
	563.99	0.49	-5.39E-01		8.84E+00
	586.26	0.46	1.05E+01		1.35E+01
	678.62	0.47	7.73E+00		9.44E+00
	688.67	0.86	-1.18E+00		4.89E+00
	719.35	0.28	-8.66E+00		1.71E+01
	778.90	12.96	1.63E-01		3.52E-01
	810.45	0.32	-8.72E+00		1.43E+01
	867.37	4.26	2.27E-01		1.40E+00
	919.33	0.43	-2.04E+00		1.05E+01
	964.08	14.65	-2.02E-01		4.79E-01
	1085.87	10.24	-1.89E-01		5.78E-01
	1089.74	1.73	1.75E+00		3.71E+00
	1112.07	13.69	2.60E-01		5.02E-01
	1212.95	1.43	-1.74E+00		5.73E+00
	1249.94	0.19	1.89E+00		3.50E+01
	1299.14	1.63	-7.93E-01		3.40E+00
	1408.01	21.07	6.42E-02		2.31E-01
	1457.64	0.50	1.89E+02		4.97E+01
	1528.10	0.28	-1.83E-01		1.22E+01
Eu-154	123.07	40.40	3.51E-03	1.15E-01	1.15E-01
	247.93	6.89	-2.28E-01		5.67E-01
	591.76	4.95	2.16E-01		9.06E-01
	692.42	1.78	-2.60E-01		2.54E+00
	723.30	20.06	8.20E-02		2.63E-01
	756.80	4.52	1.31E-01		9.90E-01
	873.18	12.08	-3.02E-01		4.00E-01

Analysis Report for 10-Sep-19-10017

L1-12205E-FSGS-112SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.04E-01	1.15E-01	3.81E-01
	1004.76	18.01	8.58E-02		3.07E-01
	1274.43	34.80	5.24E-02		1.76E-01
	1596.48	1.80	6.35E-01		1.98E+00
Eu-155	45.30	1.31	2.03E+00	2.63E-01	3.12E+01
	60.01	1.22	-5.03E-02		3.11E+01
	86.55	30.70	-1.30E-02		2.85E-01
	105.31	21.10	-1.20E-01		2.63E-01
Ra-226	186.21	3.64	-7.24E-02	1.08E+00	1.08E+00
Pa-231	27.36	10.30	1.49E+00	1.71E+00	3.30E+00
	283.69	1.70	-2.60E-02		2.23E+00
	300.07	2.47	-6.26E-01		1.71E+00
	302.65	2.20	6.82E-01		1.88E+00
	330.06	1.40	-1.68E-01		2.70E+00
U-235	143.76	10.96	-1.92E-01	6.74E-02	3.90E-01
	163.33	5.08	4.31E-02		8.23E-01
	185.71	57.20	-2.00E-02		6.74E-02
	202.11	1.08	-1.22E-01		3.67E+00
	205.31	5.01	-2.02E-01		7.60E-01
Am-241	59.54	35.90	1.82E-01	1.11E+00	1.11E+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 10-Sep-19-10018

L1-12205E-FSGS-113SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10018
Sample Description	: L1-12205E-FSGS-113SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.767E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:24:00PM
Acquisition Started	: 9/10/2019 10:27:46AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79379
Fill Height	: 1766.97 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 10:42:50AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10018

L1-12205E-FSGS-113SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	947 -	960	955.07	1.12E+02	16.23	5.51E+01	0.92
2	295.23	1177 -	1185	1181.12	2.93E+01	8.86	2.27E+01	1.04
3	338.34	1347 -	1359	1353.41	4.19E+01	9.50	1.81E+01	0.68
4	351.94	1400 -	1415	1407.74	7.28E+01	11.41	1.82E+01	1.10
5	609.39	2430 -	2445	2436.84	6.06E+01	9.08	7.43E+00	1.24
6	911.58	3639 -	3652	3645.38	2.79E+01	8.58	1.61E+01	0.43
7	969.29	3871 -	3882	3876.22	1.66E+01	5.49	5.36E+00	0.90
8	1460.75	5831 -	5855	5843.37	3.52E+02	20.64	1.83E+01	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	0.99	1460.82	*	10.66	7.10E+00	5.19E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.72E-01	2.85E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.62E-01	2.61E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Sep-19-10018

L1-12205E-FSGS-113SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.19E-01	3.73E-02
		351.93	*	35.60	1.73E-01	3.04E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.06E-01	7.38E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.71E-01	5.31E-02
		964.77		4.99		
		968.97	*	15.80	1.73E-01	5.77E-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 10-Sep-19-10018

L1-12205E-FSGS-113SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	7.10E+00	5.19E-01	
X	Bi-211	0.887			
	Pb-212	1.000	1.72E-01	2.85E-02	
	Bi-214	1.000	1.62E-01	2.61E-02	
	Pb-214	1.000	1.51E-01	2.36E-02	
	Ac-228	0.990	2.01E-01	3.45E-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 10-Sep-19-10018

L1-12205E-FSGS-113SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 10:42:50AM
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	5.92E-02	5.31E-02	5.31E-02
	BE-7	477.60		10.44	1.30E-01	3.80E-01	3.80E-01
+	K-40	1460.82	*	10.66	7.10E+00	6.49E-01	6.49E-01
	Mn-54	834.85		99.98	-2.95E-02	4.85E-02	4.85E-02
	Co-60	1173.23		99.85	-7.31E-02	5.88E-02	5.88E-02
		1332.49		99.98	7.86E-03		6.13E-02
	Nb-94	702.65		99.81	5.90E-04	4.54E-02	4.96E-02
		871.09		99.89	9.97E-03		4.54E-02
	Ag-108m	79.13		6.60	2.13E-01	3.65E-02	1.43E+00
		433.94		90.50	-1.63E-02		3.65E-02
		614.28		89.80	-1.19E-02		6.59E-02
		722.94		90.80	-3.56E-02		4.80E-02
	Sb-125	176.31		6.84	-1.56E-01	1.17E-01	4.72E-01
		380.45		1.52	-3.45E-01		2.15E+00
		427.87		29.60	8.18E-02		1.17E-01
		463.36		10.49	-5.01E-02		3.54E-01
		600.60		17.65	1.00E-01		2.35E-01
		606.71		4.98	1.17E+00		1.15E+00
		635.95		11.22	-8.17E-02		3.53E-01

Analysis Report for 10-Sep-19-10018

L1-12205E-FSGS-113SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-5.11E-01	1.17E-01	2.29E+00
Ba-133	79.61	2.65	9.00E-01	6.99E-02	3.45E+00
	81.00	32.90	-4.67E-01		2.33E-01
	276.40	7.16	4.43E-03		4.86E-01
	302.85	18.34	8.56E-02		2.04E-01
	356.01	62.05	-2.48E-02		6.99E-02
	383.85	8.94	1.92E-01		3.96E-01
Cs-134	475.36	1.48	1.05E+00	5.01E-02	2.65E+00
	563.25	8.34	5.45E-03		3.92E-01
	569.33	15.37	-4.43E-02		2.49E-01
	604.72	97.62	-5.40E-02		5.34E-02
	795.86	85.46	6.83E-04		5.01E-02
	801.95	8.69	4.18E-02		4.57E-01
	1038.61	0.99	2.30E+00		4.75E+00
	1167.97	1.79	-9.50E-01		3.51E+00
	1365.19	3.02	9.52E-01		1.42E+00
Cs-137	661.66	85.10	-2.13E-02	4.46E-02	4.46E-02
Eu-152	121.78	28.67	3.55E-02	1.28E-01	1.35E-01
	244.70	7.61	4.09E-02		4.76E-01
	295.94	0.45	7.73E+00		9.29E+00
	344.28	26.60	-1.73E-03		1.28E-01
	367.79	0.86	-5.36E-01		3.72E+00
	411.12	2.24	1.52E-01		1.50E+00
	443.96	2.83	-5.06E-01		1.16E+00
	488.68	0.42	2.84E+00		8.04E+00
	563.99	0.49	-1.31E+00		6.66E+00
	586.26	0.46	6.33E+00		1.15E+01
	678.62	0.47	7.53E+00		9.69E+00
	688.67	0.86	-1.28E+00		4.26E+00
	719.35	0.28	-1.33E+01		1.30E+01
	778.90	12.96	-1.07E-01		3.25E-01
	810.45	0.32	9.10E+00		1.35E+01
	867.37	4.26	-7.91E-01		1.08E+00
	919.33	0.43	-3.13E+00		1.15E+01
	964.08	14.65	-1.91E-01		3.88E-01
	1085.87	10.24	2.80E-01		4.95E-01
	1089.74	1.73	-2.64E-01		2.85E+00
	1112.07	13.69	6.55E-02		4.20E-01
	1212.95	1.43	3.38E+00		5.07E+00
	1249.94	0.19	4.60E+00		3.07E+01
	1299.14	1.63	1.51E+00		3.15E+00
	1408.01	21.07	9.70E-02		2.31E-01
	1457.64	0.50	1.60E+02		4.14E+01
	1528.10	0.28	-1.51E+00		1.15E+01
Eu-154	123.07	40.40	2.39E-02	9.65E-02	9.65E-02
	247.93	6.89	-2.07E-01		4.40E-01
	591.76	4.95	-5.20E-02		8.63E-01
	692.42	1.78	-2.50E+00		2.14E+00
	723.30	20.06	-7.92E-02		2.17E-01
	756.80	4.52	3.44E-01		9.68E-01
	873.18	12.08	9.53E-02		3.81E-01

Analysis Report for 10-Sep-19-10018

L1-12205E-FSGS-113SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.43E-01	9.65E-02	4.86E-01
	1004.76	18.01	1.52E-01		2.96E-01
	1274.43	34.80	-1.46E-01		1.66E-01
	1596.48	1.80	-1.47E+00		1.74E+00
Eu-155	45.30	1.31	-1.60E+01	2.13E-01	1.76E+01
	60.01	1.22	7.67E+00		2.11E+01
	86.55	30.70	-5.17E-02		2.16E-01
	105.31	21.10	6.18E-02		2.13E-01
Ra-226	186.21	3.64	7.97E-01	9.38E-01	9.38E-01
Pa-231	27.36	10.30	2.64E+00	1.55E+00	2.59E+00
	283.69	1.70	-1.48E+00		1.77E+00
	300.07	2.47	-1.45E+00		1.55E+00
	302.65	2.20	1.03E+00		1.72E+00
	330.06	1.40	-1.58E+00		2.30E+00
U-235	143.76	10.96	-3.80E-01	5.96E-02	3.27E-01
	163.33	5.08	-3.27E-02		6.82E-01
	185.71	57.20	2.14E-02		5.96E-02
	202.11	1.08	-1.11E+00		3.19E+00
	205.31	5.01	3.17E-01		7.01E-01
Am-241	59.54	35.90	4.76E-02	7.27E-01	7.27E-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 10-Sep-19-10019

L1-12205E-FSGS-114SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10019
Sample Description	: L1-12205E-FSGS-114SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.708E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:26:00PM
Acquisition Started	: 9/10/2019 10:48:19AM
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	: 9/29/2018
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79380
Fill Height	: 1708.28 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 11:03:22AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10019

L1-12205E-FSGS-114SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.62	474 -	481	477.41	1.33E+02	19.96	1.23E+02	1.02
2	295.08	586 -	594	590.21	6.49E+01	12.76	4.61E+01	1.12
3	352.05	699 -	708	704.05	1.10E+02	13.39	3.05E+01	1.44
4	583.22	1160 -	1171	1166.04	6.14E+01	10.86	2.26E+01	0.97
5	609.26	1212 -	1223	1218.09	8.41E+01	12.34	2.69E+01	1.37
6	911.18	1818 -	1826	1821.82	4.18E+01	8.36	1.32E+01	1.93
7	1460.66	2914 -	2928	2921.37	5.13E+02	23.01	5.61E+00	1.90

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	9.38E+00	5.85E-01
Tl-208	1.00	583.19	*	85.00	7.75E-02	1.45E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.83E-01	3.13E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.04E-01	3.23E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Sep-19-10019

L1-12205E-FSGS-114SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.38E-01	5.06E-02
		351.93	*	35.60	2.38E-01	3.45E-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	2.32E-01	4.75E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Sep-19-10019

L1-12205E-FSGS-114SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.996	9.38E+00	5.85E-01	
	Tl-208	1.000	7.75E-02	1.45E-02	
X	Bi-211	0.857			
	Pb-212	1.000	1.83E-01	3.13E-02	
	Bi-214	1.000	2.04E-01	3.23E-02	
	Pb-214	0.998	2.38E-01	2.85E-02	
	Ac-228	1.000	2.32E-01	4.75E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Sep-19-10019

L1-12205E-FSGS-114SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 11:03:22AM
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	5.87E-02	5.19E-02	5.19E-02
	BE-7	477.60		10.44	-1.57E-01	2.77E-01	2.77E-01
+	K-40	1460.82	*	10.66	9.38E+00	3.01E-01	3.01E-01
	Mn-54	834.85		99.98	-8.75E-03	3.95E-02	3.95E-02
	Co-60	1173.23		99.85	-2.73E-02	4.02E-02	5.65E-02
		1332.49		99.98	5.24E-03		4.02E-02
	Nb-94	702.65		99.81	-8.45E-03	4.11E-02	4.25E-02
		871.09		99.89	1.67E-02		4.11E-02
	Ag-108m	79.13		6.60	8.84E-01	3.62E-02	1.19E+00
		433.94		90.50	1.32E-02		3.62E-02
		614.28		89.80	-1.34E-02		5.52E-02
		722.94		90.80	-1.59E-02		4.29E-02
	Sb-125	176.31		6.84	-2.15E-01	1.07E-01	4.90E-01
		380.45		1.52	1.40E-02		2.15E+00
		427.87		29.60	-3.38E-02		1.07E-01
		463.36		10.49	2.50E-01		3.20E-01
		600.60		17.65	-8.51E-02		2.06E-01
		606.71		4.98	-2.44E-01		1.21E+00
		635.95		11.22	-1.68E-01		3.43E-01

Analysis Report for 10-Sep-19-10019

L1-12205E-FSGS-114SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	4.02E-01	1.07E-01	2.23E+00
Ba-133	79.61	2.65	9.86E-01	6.67E-02	2.78E+00
	81.00	32.90	-1.91E-01		1.86E-01
	276.40	7.16	1.28E-01		4.68E-01
	302.85	18.34	2.54E-02		1.67E-01
	356.01	62.05	-5.49E-02		6.67E-02
	383.85	8.94	9.73E-02		3.78E-01
Cs-134	475.36	1.48	5.21E-01	4.92E-02	2.13E+00
	563.25	8.34	-2.09E-02		3.49E-01
	569.33	15.37	1.03E-01		2.15E-01
	604.72	97.62	-1.01E-02		5.41E-02
	795.86	85.46	3.08E-02		4.92E-02
	801.95	8.69	-1.66E-01		4.55E-01
	1038.61	0.99	1.30E+00		5.46E+00
	1167.97	1.79	-1.25E-01		3.38E+00
	1365.19	3.02	-2.72E-02		1.24E+00
Cs-137	661.66	85.10	-2.89E-02	3.61E-02	3.61E-02
Eu-152	121.78	28.67	3.77E-03	1.15E-01	1.15E-01
	244.70	7.61	2.20E-01		5.03E-01
	295.94	0.45	1.04E+01		8.81E+00
	344.28	26.60	-9.49E-02		1.24E-01
	367.79	0.86	-1.46E+00		3.69E+00
	411.12	2.24	3.63E-01		1.58E+00
	443.96	2.83	5.31E-01		1.23E+00
	488.68	0.42	-2.74E-01		7.45E+00
	563.99	0.49	1.96E+00		6.22E+00
	586.26	0.46	-1.62E+00		1.20E+01
	678.62	0.47	3.77E+00		8.23E+00
	688.67	0.86	-1.97E+00		4.34E+00
	719.35	0.28	-1.07E+01		1.20E+01
	778.90	12.96	-2.14E-01		2.68E-01
	810.45	0.32	-2.56E+00		1.00E+01
	867.37	4.26	-4.85E-01		9.62E-01
	919.33	0.43	-3.37E+00		1.01E+01
	964.08	14.65	1.14E-01		3.25E-01
	1085.87	10.24	-2.77E-01		4.82E-01
	1089.74	1.73	7.60E-01		2.86E+00
	1112.07	13.69	-4.01E-01		3.13E-01
	1212.95	1.43	-1.27E+00		4.42E+00
	1249.94	0.19	3.32E+00		2.89E+01
	1299.14	1.63	1.95E-01		2.91E+00
	1408.01	21.07	7.88E-02		1.93E-01
	1457.64	0.50	-2.22E+00		4.35E+01
	1528.10	0.28	1.25E+00		1.04E+01
Eu-154	123.07	40.40	6.67E-03	8.21E-02	8.21E-02
	247.93	6.89	1.34E-01		4.70E-01
	591.76	4.95	7.18E-02		7.97E-01
	692.42	1.78	3.37E-02		2.21E+00
	723.30	20.06	1.02E-01		2.09E-01
	756.80	4.52	-5.33E-01		8.30E-01
	873.18	12.08	-6.05E-02		3.25E-01

Analysis Report for 10-Sep-19-10019

L1-12205E-FSGS-114SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.07E-03	8.21E-02	4.09E-01
	1004.76	18.01	-5.50E-02		2.27E-01
	1274.43	34.80	-6.55E-02		1.37E-01
	1596.48	1.80	-7.91E-01		2.00E+00
Eu-155	45.30	1.31	-1.76E-01	1.82E-01	1.17E+01
	60.01	1.22	-2.22E+00		1.20E+01
	86.55	30.70	6.28E-02		1.82E-01
	105.31	21.10	2.38E-02		1.82E-01
Ra-226	186.21	3.64	2.56E-01	1.02E+00	1.02E+00
Pa-231	27.36	10.30	4.10E-01	1.07E+00	1.07E+00
	283.69	1.70	-2.88E-01		1.80E+00
	300.07	2.47	-1.16E+00		1.22E+00
	302.65	2.20	2.11E-01		1.39E+00
	330.06	1.40	6.64E-01		2.38E+00
U-235	143.76	10.96	1.52E-02	6.35E-02	2.87E-01
	163.33	5.08	-9.98E-02		6.92E-01
	185.71	57.20	-1.79E-03		6.35E-02
	202.11	1.08	1.77E+00		3.22E+00
	205.31	5.01	-1.69E-01		6.88E-01
Am-241	59.54	35.90	4.37E-02	4.32E-01	4.32E-01

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

Apex-Gamma

Analysis Report for 10-Sep-19-10020

L1-12205E-FSGS-115SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10020
Sample Description	: L1-12205E-FSGS-115SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.620E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:28:00PM
Acquisition Started	: 9/10/2019 10:48:26AM
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	: 1/29/2019
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79381
Fill Height	: 1620.00 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 11:03:29AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10020

L1-12205E-FSGS-115SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.53	947 -	959	954.22	1.08E+02	16.11	5.76E+01	0.86
2	351.80	1400 -	1412	1406.93	5.64E+01	11.37	2.76E+01	1.03
3	582.95	2326 -	2336	2331.03	3.35E+01	8.25	1.45E+01	0.63
4	609.17	2428 -	2442	2435.84	5.55E+01	8.44	5.50E+00	1.23
5	910.95	3637 -	3649	3642.78	2.91E+01	7.61	1.09E+01	0.64
6	968.49	3867 -	3879	3872.93	1.96E+01	7.04	1.14E+01	0.70
7	1460.18	5828 -	5851	5840.54	3.38E+02	19.40	9.33E+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	0.93	1460.82	*	10.66	8.28E+00	5.96E-01
Tl-208	0.99	583.19	*	85.00	5.52E-02	1.40E-02
Bi-211	0.91	351.07	*	13.02	4.26E-01	9.26E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.92E-01	3.24E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.76E-01	2.88E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 10-Sep-19-10020

L1-12205E-FSGS-115SS

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		
		351.93	*	35.60	1.56E-01	3.38E-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	2.14E-01	5.66E-02
		964.77		4.99		
		968.97	*	15.80	2.45E-01	8.86E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Sep-19-10020

L1-12205E-FSGS-115SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.936	8.28E+00	5.96E-01	
	Tl-208	0.991	5.52E-02	1.40E-02	
?	Bi-211	0.918	4.26E-01	9.26E-02	
	Pb-212	0.999	1.92E-01	3.24E-02	
	Bi-214	0.998	1.76E-01	2.88E-02	
?	Pb-214	0.998	1.56E-01	3.38E-02	
	Ac-228	0.990	2.23E-01	4.77E-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 10-Sep-19-10020

L1-12205E-FSGS-115SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 11:03:29AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	2.23E-02	5.37E-02	5.37E-02
	BE-7	477.60		10.44	3.02E-01	4.58E-01	4.58E-01
+	K-40	1460.82	*	10.66	8.28E+00	5.87E-01	5.87E-01
	Mn-54	834.85		99.98	-1.10E-02	4.25E-02	4.25E-02
	Co-60	1173.23		99.85	-4.52E-02	5.67E-02	7.71E-02
		1332.49		99.98	-1.83E-02		5.67E-02
	Nb-94	702.65		99.81	-2.85E-02	4.43E-02	4.43E-02
		871.09		99.89	1.35E-02		4.93E-02
	Ag-108m	79.13		6.60	1.63E+00	4.73E-02	2.06E+00
		433.94		90.50	-1.94E-03		4.73E-02
		614.28		89.80	-1.32E-02		5.72E-02
		722.94		90.80	4.24E-02		6.44E-02
	Sb-125	176.31		6.84	-4.12E-01	1.34E-01	5.57E-01
		380.45		1.52	2.38E-01		2.69E+00
		427.87		29.60	-7.59E-02		1.34E-01
		463.36		10.49	-2.09E-02		3.65E-01
		600.60		17.65	7.86E-02		2.66E-01
		606.71		4.98	1.50E+00		1.33E+00
		635.95		11.22	4.19E-01		4.50E-01

Analysis Report for 10-Sep-19-10020

L1-12205E-FSGS-115SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	9.90E-01	1.34E-01	2.55E+00
Ba-133	79.61	2.65	1.35E+00	7.67E-02	4.78E+00
	81.00	32.90	-1.92E-01		3.28E-01
	276.40	7.16	-3.43E-01		5.22E-01
	302.85	18.34	-7.51E-03		2.16E-01
	356.01	62.05	9.67E-03		7.67E-02
	383.85	8.94	2.39E-02		4.55E-01
Cs-134	475.36	1.48	-1.05E-02	5.98E-02	2.95E+00
	563.25	8.34	-3.11E-01		4.85E-01
	569.33	15.37	-1.85E-01		2.84E-01
	604.72	97.62	-4.48E-02		6.45E-02
	795.86	85.46	3.01E-02		5.98E-02
	801.95	8.69	-5.41E-01		4.86E-01
	1038.61	0.99	3.82E+00		6.10E+00
	1167.97	1.79	1.59E+00		4.38E+00
	1365.19	3.02	6.18E-01		1.66E+00
Cs-137	661.66	85.10	-1.50E-02	4.90E-02	4.90E-02
Eu-152	121.78	28.67	1.66E-02	1.34E-01	1.68E-01
	244.70	7.61	3.38E-01		5.64E-01
	295.94	0.45	2.77E+00		9.74E+00
	344.28	26.60	1.28E-02		1.34E-01
	367.79	0.86	-1.83E+00		4.22E+00
	411.12	2.24	-5.62E-01		1.94E+00
	443.96	2.83	-9.84E-01		1.45E+00
	488.68	0.42	1.49E+00		1.02E+01
	563.99	0.49	-3.19E+00		8.48E+00
	586.26	0.46	-5.65E+00		1.31E+01
	678.62	0.47	4.12E+00		9.14E+00
	688.67	0.86	-4.30E-01		4.34E+00
	719.35	0.28	-4.63E+00		1.76E+01
	778.90	12.96	1.80E-01		3.77E-01
	810.45	0.32	-1.92E+00		1.49E+01
	867.37	4.26	-1.41E+00		1.23E+00
	919.33	0.43	1.96E+00		1.08E+01
	964.08	14.65	1.81E-01		4.94E-01
	1085.87	10.24	1.92E-01		6.83E-01
	1089.74	1.73	-3.79E+00		3.70E+00
	1112.07	13.69	5.46E-02		4.01E-01
	1212.95	1.43	8.01E-01		5.02E+00
	1249.94	0.19	6.04E+00		3.91E+01
	1299.14	1.63	3.35E+00		4.17E+00
	1408.01	21.07	1.27E-01		2.94E-01
	1457.64	0.50	1.84E+02		4.83E+01
	1528.10	0.28	-2.40E+00		1.20E+01
Eu-154	123.07	40.40	2.95E-02	1.17E-01	1.17E-01
	247.93	6.89	-1.55E-01		5.16E-01
	591.76	4.95	4.50E-01		8.93E-01
	692.42	1.78	-2.80E-01		2.06E+00
	723.30	20.06	2.29E-01		2.97E-01
	756.80	4.52	-7.30E-01		1.08E+00
	873.18	12.08	1.14E-01		4.16E-01

Analysis Report for 10-Sep-19-10020

L1-12205E-FSGS-115SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.08E-01	1.17E-01	5.43E-01
	1004.76	18.01	-8.68E-02		2.96E-01
	1274.43	34.80	1.49E-01		1.92E-01
	1596.48	1.80	8.44E-02		2.28E+00
Eu-155	45.30	1.31	-9.81E+00	2.57E-01	2.82E+01
	60.01	1.22	-2.30E+01		3.25E+01
	86.55	30.70	3.34E-02		2.96E-01
	105.31	21.10	-1.11E-01		2.57E-01
Ra-226	186.21	3.64	1.47E+00	1.27E+00	1.27E+00
Pa-231	27.36	10.30	3.18E+00	1.56E+00	3.63E+00
	283.69	1.70	1.38E+00		2.44E+00
	300.07	2.47	-1.76E+00		1.56E+00
	302.65	2.20	7.22E-01		1.81E+00
	330.06	1.40	1.45E+00		2.95E+00
U-235	143.76	10.96	-8.85E-02	8.03E-02	3.79E-01
	163.33	5.08	4.19E-02		7.87E-01
	185.71	57.20	6.60E-02		8.03E-02
	202.11	1.08	-3.23E+00		3.48E+00
	205.31	5.01	-1.77E-01		7.82E-01
Am-241	59.54	35.90	-2.62E-01	1.18E+00	1.18E+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 10-Sep-19-10021
L1-12205E-FSGS-116SS

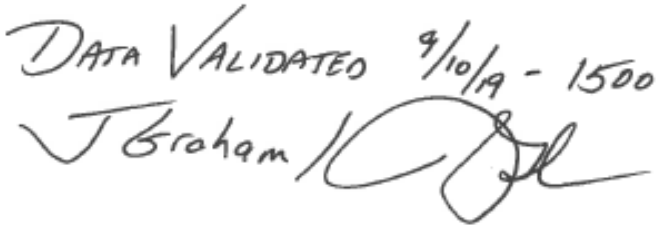
GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10021
Sample Description	: L1-12205E-FSGS-116SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.497E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:30:00PM
Acquisition Started	: 9/10/2019 10:48:33AM
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	: 1/24/2019
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79382
Fill Height	: 1496.60 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 11:03:52AM

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



Analysis Report for 10-Sep-19-10021

L1-12205E-FSGS-116SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.79	949 -	962	954.74	1.04E+02	16.30	5.62E+01	1.01
2	338.60	1348 -	1359	1353.47	2.90E+01	8.61	1.80E+01	0.97
3	352.02	1402 -	1412	1407.08	6.02E+01	10.12	1.78E+01	0.53
4	1460.34	5827 -	5851	5839.31	3.72E+02	20.21	9.05E+00	2.08

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	8.40E+00	5.84E-01
Bi-211	0.86	351.07	*	13.02	4.16E-01	7.76E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.66E-01	2.92E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.52E-01	2.84E-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		

Analysis Report for 10-Sep-19-10021

L1-12205E-FSGS-116SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Ac-228	0.99	338.32	*	11.27	2.25E-01	6.93E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.964	8.40E+00	5.84E-01	
?	Bi-211	0.866	4.16E-01	7.76E-02	
	Pb-212	0.996	1.66E-01	2.92E-02	
?	Pb-214	0.999	1.52E-01	2.84E-02	
	Ac-228	0.998	2.25E-01	6.93E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Sep-19-10021

L1-12205E-FSGS-116SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 11:03:52AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

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	4.78E-02	5.00E-02	5.00E-02
	BE-7	477.60		10.44	4.24E-02	3.60E-01	3.60E-01
+	K-40	1460.82	*	10.66	8.40E+00	5.29E-01	5.29E-01
	Mn-54	834.85		99.98	2.77E-02	4.86E-02	4.86E-02
	Co-60	1173.23		99.85	-1.73E-03	5.09E-02	5.65E-02
		1332.49		99.98	9.54E-03		5.09E-02
	Nb-94	702.65		99.81	-2.20E-02	3.86E-02	3.86E-02
		871.09		99.89	2.00E-03		4.62E-02
	Ag-108m	79.13		6.60	5.41E-01	2.99E-02	1.10E+00
		433.94		90.50	-1.48E-02		2.99E-02
		614.28		89.80	-5.22E-02		5.66E-02
		722.94		90.80	3.23E-02		5.26E-02
	Sb-125	176.31		6.84	-1.32E-01	1.05E-01	4.09E-01
		380.45		1.52	3.20E-01		2.33E+00
		427.87		29.60	3.09E-02		1.05E-01
		463.36		10.49	1.33E-01		3.55E-01
		600.60		17.65	-2.04E-02		2.14E-01
		606.71		4.98	9.33E-01		1.15E+00
		635.95		11.22	-1.22E-01		3.49E-01

Analysis Report for 10-Sep-19-10021

L1-12205E-FSGS-116SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-4.29E-01	1.05E-01	1.93E+00
Ba-133	79.61	2.65	1.21E+00	6.46E-02	2.67E+00
	81.00	32.90	-2.41E-01		1.74E-01
	276.40	7.16	-1.40E-01		4.38E-01
	302.85	18.34	8.46E-02		1.80E-01
	356.01	62.05	-7.33E-02		6.46E-02
	383.85	8.94	7.24E-02		3.88E-01
Cs-134	475.36	1.48	6.45E-01	4.62E-02	2.48E+00
	563.25	8.34	-8.43E-01		3.97E-01
	569.33	15.37	1.17E-01		2.36E-01
	604.72	97.62	-6.30E-02		5.11E-02
	795.86	85.46	-2.89E-02		4.62E-02
	801.95	8.69	-2.63E-02		5.20E-01
	1038.61	0.99	-6.21E+00		5.08E+00
	1167.97	1.79	1.18E+00		3.86E+00
	1365.19	3.02	9.86E-01		1.53E+00
Cs-137	661.66	85.10	-1.59E-02	4.01E-02	4.01E-02
Eu-152	121.78	28.67	-4.98E-02	1.06E-01	1.06E-01
	244.70	7.61	2.91E-01		4.76E-01
	295.94	0.45	6.85E+00		9.26E+00
	344.28	26.60	4.72E-02		1.21E-01
	367.79	0.86	2.96E+00		3.86E+00
	411.12	2.24	1.10E+00		1.51E+00
	443.96	2.83	-3.32E-01		1.25E+00
	488.68	0.42	2.46E+00		8.57E+00
	563.99	0.49	-1.62E+01		6.36E+00
	586.26	0.46	8.70E+00		1.19E+01
	678.62	0.47	2.77E+00		8.54E+00
	688.67	0.86	4.14E-01		4.34E+00
	719.35	0.28	-1.38E+01		1.35E+01
	778.90	12.96	-1.14E-01		3.07E-01
	810.45	0.32	-6.51E+00		1.42E+01
	867.37	4.26	1.67E-01		1.15E+00
	919.33	0.43	-3.63E+00		9.98E+00
	964.08	14.65	2.83E-01		4.25E-01
	1085.87	10.24	-1.69E-01		5.75E-01
	1089.74	1.73	3.12E-01		3.69E+00
	1112.07	13.69	3.49E-02		3.91E-01
	1212.95	1.43	-3.79E+00		5.24E+00
	1249.94	0.19	5.92E+00		3.46E+01
	1299.14	1.63	1.50E-01		3.78E+00
	1408.01	21.07	-1.72E-01		2.00E-01
	1457.64	0.50	1.81E+02		4.65E+01
	1528.10	0.28	-7.52E-01		1.20E+01
Eu-154	123.07	40.40	-1.54E-03	7.51E-02	7.51E-02
	247.93	6.89	-2.08E-01		4.36E-01
	591.76	4.95	5.12E-01		8.52E-01
	692.42	1.78	-1.67E+00		2.11E+00
	723.30	20.06	1.55E-01		2.41E-01
	756.80	4.52	6.29E-01		1.03E+00
	873.18	12.08	-3.88E-02		3.76E-01

Analysis Report for 10-Sep-19-10021

L1-12205E-FSGS-116SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.57E-01	7.51E-02	4.83E-01
	1004.76	18.01	4.93E-02		2.57E-01
	1274.43	34.80	-8.05E-03		1.77E-01
	1596.48	1.80	5.74E-01		1.79E+00
Eu-155	45.30	1.31	-3.34E+00	1.69E-01	1.09E+01
	60.01	1.22	-2.15E-01		1.19E+01
	86.55	30.70	-3.11E-02		1.69E-01
	105.31	21.10	7.32E-02		1.90E-01
Ra-226	186.21	3.64	1.92E-01	8.60E-01	8.60E-01
Pa-231	27.36	10.30	9.50E-01	1.21E+00	1.21E+00
	283.69	1.70	-1.09E+00		1.72E+00
	300.07	2.47	-2.37E+00		1.36E+00
	302.65	2.20	4.79E-02		1.47E+00
	330.06	1.40	6.19E-01		2.50E+00
U-235	143.76	10.96	7.30E-02	5.61E-02	2.97E-01
	163.33	5.08	2.31E-01		6.35E-01
	185.71	57.20	4.80E-02		5.61E-02
	202.11	1.08	1.25E-01		2.70E+00
	205.31	5.01	-2.87E-01		6.10E-01
Am-241	59.54	35.90	-1.57E-01	4.10E-01	4.10E-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 10-Sep-19-10022

L1-12205E-FSGS-117SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Sep-19-10022
Sample Description	: L1-12205E-FSGS-117SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.557E+03 grams
Facility	: Default
Sample Taken On	: 9/9/2019 1:32:00PM
Acquisition Started	: 9/10/2019 10:48:40AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/10/2019
Efficiency Calibration Description	:
Sample Number	: 79383
Fill Height	: 1556.85 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/10/2019 11:03:44AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/10/19 - 1500
J Graham

Analysis Report for 10-Sep-19-10022

L1-12205E-FSGS-117SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.67	949 -	963	955.13	8.32E+01	17.49	7.48E+01	0.96
2	295.31	1174 -	1189	1181.44	5.26E+01	13.01	3.84E+01	1.16
3	338.23	1348 -	1358	1352.95	2.31E+01	9.10	2.49E+01	0.35
4	351.88	1401 -	1414	1407.51	5.89E+01	12.49	3.51E+01	0.54
5	609.33	2429 -	2443	2436.57	5.73E+01	8.61	5.74E+00	1.11
6	911.47	3638 -	3651	3644.91	3.20E+01	6.76	5.03E+00	0.96
7	1460.66	5831 -	5855	5843.02	4.12E+02	21.52	1.25E+01	1.88

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.57E+00	5.83E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.30E-01	2.93E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.57E-01	2.54E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 10-Sep-19-10022

L1-12205E-FSGS-117SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.18E-01	5.67E-02
		351.93	*	35.60	1.43E-01	3.24E-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	1.72E-01	6.92E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.01E-01	4.34E-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 10-Sep-19-10022

L1-12205E-FSGS-117SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.996	8.57E+00	5.83E-01	
X	Bi-211	0.901			
	Pb-212	1.000	1.30E-01	2.93E-02	
	Bi-214	1.000	1.57E-01	2.54E-02	
	Pb-214	0.999	1.61E-01	2.81E-02	
	Ac-228	0.996	1.93E-01	3.68E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Sep-19-10022

L1-12205E-FSGS-117SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/10/2019 11:03:44AM
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	4.21E-02	4.92E-02	4.92E-02
	BE-7	477.60		10.44	1.03E-02	3.49E-01	3.49E-01
+	K-40	1460.82	*	10.66	8.57E+00	5.68E-01	5.68E-01
	Mn-54	834.85		99.98	-1.94E-02	4.54E-02	4.54E-02
	Co-60	1173.23		99.85	3.79E-02	4.70E-02	6.84E-02
		1332.49		99.98	5.71E-03		4.70E-02
	Nb-94	702.65		99.81	-5.48E-03	4.61E-02	4.61E-02
		871.09		99.89	4.96E-03		4.86E-02
	Ag-108m	79.13		6.60	1.05E-01	4.05E-02	1.42E+00
		433.94		90.50	-1.28E-02		4.05E-02
		614.28		89.80	-1.90E-02		6.31E-02
		722.94		90.80	8.42E-03		5.16E-02
	Sb-125	176.31		6.84	1.61E-01	1.12E-01	4.85E-01
		380.45		1.52	1.27E-01		2.19E+00
		427.87		29.60	1.71E-02		1.12E-01
		463.36		10.49	-6.91E-02		3.55E-01
		600.60		17.65	6.14E-02		2.22E-01
		606.71		4.98	1.20E+00		1.13E+00
		635.95		11.22	-1.72E-01		3.57E-01

Analysis Report for 10-Sep-19-10022

L1-12205E-FSGS-117SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.78E-01	1.12E-01	2.16E+00
Ba-133	79.61	2.65	1.36E+00	7.43E-02	3.48E+00
	81.00	32.90	-4.42E-01		2.38E-01
	276.40	7.16	-2.08E-01		4.96E-01
	302.85	18.34	8.11E-02		1.95E-01
	356.01	62.05	-2.71E-02		7.43E-02
	383.85	8.94	8.52E-02		3.78E-01
Cs-134	475.36	1.48	-1.59E+00	5.40E-02	2.49E+00
	563.25	8.34	-1.36E-01		4.20E-01
	569.33	15.37	1.67E-01		2.61E-01
	604.72	97.62	-5.74E-02		5.40E-02
	795.86	85.46	5.59E-02		6.03E-02
	801.95	8.69	4.92E-02		5.23E-01
	1038.61	0.99	3.76E+00		5.93E+00
	1167.97	1.79	-1.53E+00		3.54E+00
	1365.19	3.02	3.96E-01		1.37E+00
Cs-137	661.66	85.10	2.09E-02	4.90E-02	4.90E-02
Eu-152	121.78	28.67	3.70E-03	1.23E-01	1.35E-01
	244.70	7.61	1.20E-01		4.72E-01
	295.94	0.45	9.71E+00		1.00E+01
	344.28	26.60	-8.79E-02		1.23E-01
	367.79	0.86	-4.00E+00		3.87E+00
	411.12	2.24	5.08E-01		1.61E+00
	443.96	2.83	-1.59E-01		1.30E+00
	488.68	0.42	-3.50E+00		8.32E+00
	563.99	0.49	2.29E+00		7.54E+00
	586.26	0.46	1.09E+01		1.18E+01
	678.62	0.47	2.38E+00		8.98E+00
	688.67	0.86	-2.63E-01		4.79E+00
	719.35	0.28	-2.28E+01		1.52E+01
	778.90	12.96	-3.86E-01		3.39E-01
	810.45	0.32	7.14E+00		1.42E+01
	867.37	4.26	-1.01E-01		1.14E+00
	919.33	0.43	-6.38E+00		1.06E+01
	964.08	14.65	-1.40E-01		4.42E-01
	1085.87	10.24	4.18E-01		5.10E-01
	1089.74	1.73	4.30E-01		2.93E+00
	1112.07	13.69	2.08E-01		4.21E-01
	1212.95	1.43	-1.60E+00		4.85E+00
	1249.94	0.19	-3.02E+01		3.29E+01
	1299.14	1.63	3.87E-01		3.37E+00
	1408.01	21.07	5.56E-02		2.38E-01
	1457.64	0.50	1.88E+02		4.51E+01
	1528.10	0.28	-6.72E+00		1.27E+01
Eu-154	123.07	40.40	-4.07E-02	9.19E-02	9.19E-02
	247.93	6.89	-1.40E-01		4.54E-01
	591.76	4.95	5.67E-01		8.02E-01
	692.42	1.78	-6.41E-01		2.26E+00
	723.30	20.06	1.53E-01		2.31E-01
	756.80	4.52	7.03E-01		1.10E+00
	873.18	12.08	2.53E-01		4.33E-01

Analysis Report for 10-Sep-19-10022

L1-12205E-FSGS-117SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	8.27E-02	9.19E-02	5.99E-01
	1004.76	18.01	-6.73E-02		3.33E-01
	1274.43	34.80	-4.16E-02		1.74E-01
	1596.48	1.80	4.62E-01		2.17E+00
Eu-155	45.30	1.31	-6.74E+00	2.10E-01	1.80E+01
	60.01	1.22	2.10E+00		2.11E+01
	86.55	30.70	1.10E-01		2.25E-01
	105.31	21.10	9.34E-02		2.10E-01
Ra-226	186.21	3.64	8.01E-01	1.03E+00	1.03E+00
Pa-231	27.36	10.30	3.09E+00	1.62E+00	2.56E+00
	283.69	1.70	5.56E-01		2.04E+00
	300.07	2.47	7.45E-01		1.62E+00
	302.65	2.20	7.41E-01		1.63E+00
	330.06	1.40	9.16E-01		2.79E+00
U-235	143.76	10.96	2.13E-02	6.60E-02	3.47E-01
	163.33	5.08	1.62E-01		6.51E-01
	185.71	57.20	6.28E-02		6.60E-02
	202.11	1.08	1.91E-01		3.27E+00
	205.31	5.01	-4.03E-01		6.73E-01
Am-241	59.54	35.90	4.73E-01	7.38E-01	7.38E-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 18-Sep-19-10035

L1-12205E-FSGS-106SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Sep-19-10035
Sample Description	: L1-12205E-FSGS-106SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.643E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 1:30:00PM
Acquisition Started	: 9/18/2019 11:12:08AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.3 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	: 1/29/2019
Efficiency Calibration Used Done On	: 9/18/2019
Efficiency Calibration Description	:
Sample Number	: 79632
Fill Height	: 1642.99 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2019 11:27:12AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 9-19-19

Analysis Report for 18-Sep-19-10035

L1-12205E-FSGS-106SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.69	946 -	960	954.86	9.32E+01	16.72	6.48E+01	0.95
2	295.06	1175 -	1184	1180.15	4.07E+01	9.57	2.23E+01	0.89
3	338.28	1347 -	1357	1352.90	1.68E+01	9.99	3.22E+01	0.56
4	351.70	1402 -	1414	1406.53	8.30E+01	11.66	2.00E+01	0.90
5	510.44	2036 -	2048	2041.10	2.72E+01	8.97	1.98E+01	1.08
6	582.82	2325 -	2337	2330.49	3.67E+01	9.04	1.63E+01	0.98
7	609.02	2429 -	2440	2435.26	5.30E+01	9.12	1.20E+01	0.75
8	1460.33	5828 -	5852	5841.15	3.14E+02	17.72	0.00E+00	1.85

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	0.95	511.00	*	100.00	3.55E-02	1.20E-02
K-40	0.96	1460.82	*	10.66	7.67E+00	5.46E-01
Tl-208	0.97	583.19	*	85.00	6.02E-02	1.53E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.65E-01	3.24E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.67E-01	3.05E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 18-Sep-19-10035

L1-12205E-FSGS-106SB

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	1.91E-01	4.75E-02
		351.93	*	35.60	2.29E-01	3.70E-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	1.43E-01	8.55E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 18-Sep-19-10035

L1-12205E-FSGS-106SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.951	3.55E-02	1.20E-02	
	K-40	0.962	7.67E+00	5.46E-01	
	Tl-208	0.979	6.02E-02	1.53E-02	
X	Bi-211	0.939			
	Pb-212	0.999	1.65E-01	3.24E-02	
	Bi-214	0.994	1.67E-01	3.05E-02	
	Pb-214	0.994	2.15E-01	2.92E-02	
	Ac-228	1.000	1.43E-01	8.55E-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 18-Sep-19-10035

L1-12205E-FSGS-106SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2019 11:27:12AM
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	3.55E-02	3.62E-02	3.62E-02
	BE-7	477.60		10.44	1.14E-01	3.97E-01	3.97E-01
+	K-40	1460.82	*	10.66	7.67E+00	7.03E-02	7.03E-02
	Mn-54	834.85		99.98	8.85E-03	4.71E-02	4.71E-02
	Co-60	1173.23		99.85	-1.96E-02	5.22E-02	6.32E-02
		1332.49		99.98	-6.08E-03		5.22E-02
	Nb-94	702.65		99.81	-2.42E-02	4.34E-02	4.34E-02
		871.09		99.89	-3.14E-03		5.09E-02
	Ag-108m	79.13		6.60	1.46E+00	4.28E-02	2.08E+00
		433.94		90.50	-3.21E-02		4.28E-02
		614.28		89.80	-8.82E-02		5.41E-02
		722.94		90.80	3.39E-02		5.63E-02
	Sb-125	176.31		6.84	-2.43E-01	1.15E-01	5.22E-01
		380.45		1.52	1.35E+00		2.87E+00
		427.87		29.60	2.79E-02		1.15E-01
		463.36		10.49	2.65E-02		3.95E-01
		600.60		17.65	1.84E-01		2.59E-01
		606.71		4.98	1.10E+00		1.37E+00
		635.95		11.22	1.80E-01		3.85E-01

Analysis Report for 18-Sep-19-10035

L1-12205E-FSGS-106SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	7.12E-01	1.15E-01	2.43E+00
Ba-133	79.61	2.65	1.68E+00	6.73E-02	4.83E+00
	81.00	32.90	-1.51E-01		3.39E-01
	276.40	7.16	-5.83E-04		5.34E-01
	302.85	18.34	8.29E-03		2.14E-01
	356.01	62.05	-1.64E-02		6.73E-02
	383.85	8.94	2.28E-01		4.65E-01
Cs-134	475.36	1.48	-7.57E-01	6.06E-02	2.64E+00
	563.25	8.34	5.10E-01		5.74E-01
	569.33	15.37	6.51E-02		2.83E-01
	604.72	97.62	-3.89E-02		6.80E-02
	795.86	85.46	2.54E-02		6.06E-02
	801.95	8.69	-1.44E-01		5.16E-01
	1038.61	0.99	3.60E+00		5.99E+00
	1167.97	1.79	-1.49E+00		3.41E+00
	1365.19	3.02	5.68E-01		1.60E+00
Cs-137	661.66	85.10	-1.36E-02	5.52E-02	5.52E-02
Eu-152	121.78	28.67	-3.72E-02	1.47E-01	1.47E-01
	244.70	7.61	2.04E-02		5.71E-01
	295.94	0.45	4.25E-01		1.01E+01
	344.28	26.60	-1.01E-01		1.50E-01
	367.79	0.86	-1.33E+00		4.13E+00
	411.12	2.24	-1.56E-01		1.77E+00
	443.96	2.83	-4.83E-01		1.53E+00
	488.68	0.42	-8.37E-01		9.10E+00
	563.99	0.49	7.12E+00		9.55E+00
	586.26	0.46	-3.14E+00		1.30E+01
	678.62	0.47	3.46E+00		8.81E+00
	688.67	0.86	-3.88E+00		4.80E+00
	719.35	0.28	1.25E+01		1.73E+01
	778.90	12.96	7.57E-02		3.64E-01
	810.45	0.32	-1.19E+01		1.29E+01
	867.37	4.26	5.51E-01		1.13E+00
	919.33	0.43	9.24E+00		1.21E+01
	964.08	14.65	8.71E-02		3.85E-01
	1085.87	10.24	1.10E-01		5.95E-01
	1089.74	1.73	-2.85E+00		3.53E+00
	1112.07	13.69	8.63E-02		4.15E-01
	1212.95	1.43	-2.30E+00		4.60E+00
	1249.94	0.19	-3.78E+01		3.31E+01
	1299.14	1.63	6.54E-01		3.88E+00
	1408.01	21.07	4.57E-02		2.58E-01
	1457.64	0.50	1.60E+02		4.57E+01
	1528.10	0.28	5.74E+00		1.40E+01
Eu-154	123.07	40.40	5.04E-02	1.09E-01	1.09E-01
	247.93	6.89	-8.25E-02		5.75E-01
	591.76	4.95	5.18E-01		7.79E-01
	692.42	1.78	-1.04E+00		2.57E+00
	723.30	20.06	1.97E-01		2.58E-01
	756.80	4.52	3.06E-01		1.06E+00
	873.18	12.08	8.34E-02		4.29E-01

Analysis Report for 18-Sep-19-10035

L1-12205E-FSGS-106SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.90E-01	1.09E-01	5.05E-01
	1004.76	18.01	1.48E-01		2.60E-01
	1274.43	34.80	7.54E-02		1.82E-01
	1596.48	1.80	1.33E+00		3.13E+00
Eu-155	45.30	1.31	-1.06E+01	2.72E-01	2.76E+01
	60.01	1.22	9.40E+00		2.99E+01
	86.55	30.70	1.06E-01		2.72E-01
	105.31	21.10	8.29E-02		2.75E-01
Ra-226	186.21	3.64	8.49E-01	1.16E+00	1.16E+00
Pa-231	27.36	10.30	3.85E+00	1.62E+00	3.77E+00
	283.69	1.70	3.45E-02		2.36E+00
	300.07	2.47	-1.49E-02		1.62E+00
	302.65	2.20	-2.96E-01		1.78E+00
	330.06	1.40	-1.39E+00		2.84E+00
U-235	143.76	10.96	-1.28E-01	7.38E-02	4.06E-01
	163.33	5.08	-6.54E-01		7.65E-01
	185.71	57.20	3.87E-02		7.38E-02
	202.11	1.08	2.18E-01		3.77E+00
	205.31	5.01	-4.90E-01		7.73E-01
Am-241	59.54	35.90	7.44E-01	1.13E+00	1.13E+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 18-Sep-19-10037

L1-12205E-FSGS-117SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Sep-19-10037
Sample Description	: L1-12205E-FSGS-117SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.862E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 1:45:00PM
Acquisition Started	: 9/18/2019 11:12:32AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
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	: 1/24/2019
Efficiency Calibration Used Done On	: 9/18/2019
Efficiency Calibration Description	:
Sample Number	: 79633
Fill Height	: 1861.79 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2019 11:27:35AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 9-19-19

Analysis Report for 18-Sep-19-10037

L1-12205E-FSGS-117SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.83	948 -	962	954.90	1.30E+02	17.10	5.63E+01	1.09
2	351.99	1400 -	1413	1406.97	6.60E+01	11.96	2.80E+01	0.73
3	583.20	2326 -	2336	2330.92	2.57E+01	6.81	8.34E+00	1.15
4	609.18	2428 -	2442	2434.77	6.90E+01	10.89	1.70E+01	1.37
5	1460.26	5827 -	5851	5839.00	3.83E+02	20.21	6.25E+00	1.47

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	8.18E+00	5.59E-01
Tl-208	1.00	583.19	*	85.00	3.72E-02	1.01E-02
Bi-211	0.87	351.07	*	13.02	4.39E-01	8.71E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.00E-01	3.09E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.92E-01	3.25E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 18-Sep-19-10037

L1-12205E-FSGS-117SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.61E-01	3.18E-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	0.951	8.18E+00	5.59E-01	
	Tl-208	1.000	3.72E-02	1.01E-02	
?	Bi-211	0.874	4.39E-01	8.71E-02	
	Pb-212	0.994	2.00E-01	3.09E-02	
	Bi-214	0.999	1.92E-01	3.25E-02	
?	Pb-214	1.000	1.61E-01	3.18E-02	

Analysis Report for 18-Sep-19-10037

L1-12205E-FSGS-117SB

? = 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 18-Sep-19-10037

L1-12205E-FSGS-117SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2019 11:27:35AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.87E-02	5.34E-02	5.34E-02
	BE-7	477.60		10.44	1.49E-01	3.46E-01	3.46E-01
+	K-40	1460.82	*	10.66	8.18E+00	4.30E-01	4.30E-01
	Mn-54	834.85		99.98	-1.57E-02	4.64E-02	4.64E-02
	Co-60	1173.23		99.85	-3.27E-02	4.15E-02	5.07E-02
		1332.49		99.98	-5.58E-02		4.15E-02
	Nb-94	702.65		99.81	7.28E-03	3.92E-02	4.07E-02
		871.09		99.89	1.21E-03		3.92E-02
	Ag-108m	79.13		6.60	1.18E-01	3.89E-02	1.11E+00
		433.94		90.50	-3.25E-02		3.89E-02
		614.28		89.80	-3.86E-02		5.72E-02
		722.94		90.80	1.62E-02		4.89E-02
	Sb-125	176.31		6.84	-4.38E-02	1.28E-01	4.26E-01
		380.45		1.52	1.35E-01		2.10E+00
		427.87		29.60	6.39E-02		1.28E-01
		463.36		10.49	8.79E-02		3.92E-01
		600.60		17.65	-2.10E-01		1.95E-01
		606.71		4.98	1.78E+00		1.32E+00
		635.95		11.22	4.86E-02		3.29E-01

Analysis Report for 18-Sep-19-10037

L1-12205E-FSGS-117SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	3.91E-01	1.28E-01	2.33E+00
Ba-133	79.61	2.65	7.06E-01	6.53E-02	2.72E+00
	81.00	32.90	-2.30E-01		1.81E-01
	276.40	7.16	1.23E-01		4.54E-01
	302.85	18.34	1.02E-01		1.78E-01
	356.01	62.05	-4.93E-02		6.53E-02
	383.85	8.94	-2.58E-03		3.47E-01
Cs-134	475.36	1.48	-1.90E+00	5.40E-02	2.27E+00
	563.25	8.34	-4.34E-01		4.80E-01
	569.33	15.37	-1.38E-02		2.33E-01
	604.72	97.62	-2.12E-02		5.60E-02
	795.86	85.46	3.99E-03		5.40E-02
	801.95	8.69	4.83E-01		5.34E-01
	1038.61	0.99	8.51E-01		4.65E+00
	1167.97	1.79	1.47E+00		3.04E+00
	1365.19	3.02	-1.87E-01		1.67E+00
Cs-137	661.66	85.10	2.40E-02	4.23E-02	4.23E-02
Eu-152	121.78	28.67	-2.03E-02	1.07E-01	1.07E-01
	244.70	7.61	-1.25E-01		4.04E-01
	295.94	0.45	1.57E+00		8.66E+00
	344.28	26.60	6.91E-02		1.24E-01
	367.79	0.86	1.73E+00		3.89E+00
	411.12	2.24	9.51E-01		1.56E+00
	443.96	2.83	-6.91E-01		1.20E+00
	488.68	0.42	-7.36E+00		7.68E+00
	563.99	0.49	-6.42E+00		7.46E+00
	586.26	0.46	5.19E+00		1.01E+01
	678.62	0.47	-4.33E+00		7.62E+00
	688.67	0.86	3.51E+00		5.07E+00
	719.35	0.28	-7.93E+00		1.24E+01
	778.90	12.96	3.87E-02		2.74E-01
	810.45	0.32	-1.78E+00		1.21E+01
	867.37	4.26	2.07E-01		1.03E+00
	919.33	0.43	1.76E+00		1.08E+01
	964.08	14.65	6.29E-02		3.95E-01
	1085.87	10.24	-1.45E-01		5.97E-01
	1089.74	1.73	-1.80E+00		3.28E+00
	1112.07	13.69	-7.48E-02		3.57E-01
	1212.95	1.43	1.75E-01		4.55E+00
	1249.94	0.19	2.70E+00		3.00E+01
	1299.14	1.63	1.54E-01		3.27E+00
	1408.01	21.07	-5.00E-02		1.73E-01
	1457.64	0.50	1.78E+02		4.44E+01
	1528.10	0.28	-8.57E+00		9.35E+00
Eu-154	123.07	40.40	5.13E-03	7.63E-02	7.63E-02
	247.93	6.89	2.42E-01		4.25E-01
	591.76	4.95	2.88E-01		8.44E-01
	692.42	1.78	4.10E-01		2.23E+00
	723.30	20.06	1.84E-01		2.30E-01
	756.80	4.52	2.58E-01		8.55E-01
	873.18	12.08	-8.23E-02		3.45E-01

Analysis Report for 18-Sep-19-10037

L1-12205E-FSGS-117SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.12E-01	7.63E-02	4.83E-01
	1004.76	18.01	-1.29E-01		2.69E-01
	1274.43	34.80	-6.76E-02		1.44E-01
	1596.48	1.80	-2.11E+00		1.52E+00
Eu-155	45.30	1.31	-1.55E+00	1.79E-01	1.03E+01
	60.01	1.22	2.07E+00		1.21E+01
	86.55	30.70	3.28E-02		1.79E-01
	105.31	21.10	1.23E-01		1.91E-01
Ra-226	186.21	3.64	-1.10E-01	8.69E-01	8.69E-01
Pa-231	27.36	10.30	9.08E-01	1.31E+00	1.31E+00
	283.69	1.70	-1.47E+00		1.73E+00
	300.07	2.47	-1.55E+00		1.38E+00
	302.65	2.20	9.87E-01		1.50E+00
	330.06	1.40	2.99E-01		2.39E+00
U-235	143.76	10.96	2.26E-01	5.47E-02	3.18E-01
	163.33	5.08	1.79E-01		5.91E-01
	185.71	57.20	-3.11E-03		5.47E-02
	202.11	1.08	-1.91E+00		2.72E+00
	205.31	5.01	-2.94E-02		5.75E-01
Am-241	59.54	35.90	1.21E-01	4.28E-01	4.28E-01

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

Apex-Gamma

Analysis Report for 12-Sep-19-10027
L1-12205E-FIGS-101SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 12-Sep-19-10027
Sample Description	: L1-12205E-FIGS-101SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.737E+03 grams
Facility	: Default
Sample Taken On	: 9/11/2019 9:00:00AM
Acquisition Started	: 9/12/2019 11:34:51AM
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	: 1/24/2019
Efficiency Calibration Used Done On	: 9/12/2019
Efficiency Calibration Description	:
Sample Number	: 79489
Fill Height	: 1737.02 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/12/2019 11:50:05AM

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

Data Validated
1530 9/16/19

Analysis Report for 12-Sep-19-10027

L1-12205E-FIGS-101SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.72	946 -	962	954.44	1.19E+02	17.91	6.33E+01	0.56
2	351.84	1399 -	1415	1406.36	7.68E+01	11.46	1.72E+01	0.90
3	583.30	2325 -	2337	2331.31	3.55E+01	8.44	1.35E+01	1.00
4	609.07	2425 -	2440	2434.32	6.29E+01	10.27	1.41E+01	1.11
5	1460.18	5827 -	5851	5838.64	3.85E+02	19.91	2.93E+00	2.10

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	0.93	1460.82	*	10.66	8.35E+00	5.64E-01
Tl-208	0.99	583.19	*	85.00	5.20E-02	1.28E-02
Bi-211	0.91	351.07	*	13.02	5.16E-01	8.76E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.85E-01	3.16E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.77E-01	3.09E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 12-Sep-19-10027

L1-12205E-FIGS-101SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	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	1.89E-01	3.20E-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	0.935	8.35E+00	5.64E-01	
	Tl-208	0.998	5.20E-02	1.28E-02	
?	Bi-211	0.910	5.16E-01	8.76E-02	
	Pb-212	0.999	1.85E-01	3.16E-02	
	Bi-214	0.996	1.77E-01	3.09E-02	
?	Pb-214	0.999	1.89E-01	3.20E-02	

Analysis Report for 12-Sep-19-10027

L1-12205E-FIGS-101SS

? = 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 12-Sep-19-10027

L1-12205E-FIGS-101SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/12/2019 11:50:05AM
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	4.71E-02	5.28E-02	5.28E-02
	BE-7	477.60		10.44	4.75E-02	3.95E-01	3.95E-01
+	K-40	1460.82	*	10.66	8.35E+00	3.12E-01	3.12E-01
	Mn-54	834.85		99.98	-1.17E-02	4.49E-02	4.49E-02
	Co-60	1173.23		99.85	-9.25E-02	5.25E-02	5.25E-02
		1332.49		99.98	3.55E-02		5.48E-02
	Nb-94	702.65		99.81	-1.73E-02	3.21E-02	3.21E-02
		871.09		99.89	1.59E-02		3.97E-02
	Ag-108m	79.13		6.60	4.85E-01	3.46E-02	1.11E+00
		433.94		90.50	-3.74E-02		3.46E-02
		614.28		89.80	-4.60E-02		5.52E-02
		722.94		90.80	1.87E-02		4.69E-02
	Sb-125	176.31		6.84	-4.30E-02	1.16E-01	4.23E-01
		380.45		1.52	-1.83E-01		2.08E+00
		427.87		29.60	-6.52E-03		1.16E-01
		463.36		10.49	1.39E-01		3.66E-01
		600.60		17.65	-1.36E-01		2.16E-01
		606.71		4.98	1.66E+00		1.29E+00
		635.95		11.22	-2.36E-01		2.80E-01

Analysis Report for 12-Sep-19-10027

L1-12205E-FIGS-101SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.20E-01	1.16E-01	2.23E+00
Ba-133	79.61	2.65	1.79E+00	6.12E-02	2.71E+00
	81.00	32.90	-2.39E-01		1.87E-01
	276.40	7.16	-6.00E-02		4.52E-01
	302.85	18.34	1.57E-02		1.76E-01
	356.01	62.05	-1.69E-02		6.12E-02
	383.85	8.94	-1.51E-01		3.39E-01
Cs-134	475.36	1.48	4.58E-01	5.97E-02	2.70E+00
	563.25	8.34	-7.27E-02		4.96E-01
	569.33	15.37	-8.80E-02		2.25E-01
	604.72	97.62	-1.10E-02		6.20E-02
	795.86	85.46	1.99E-02		5.97E-02
	801.95	8.69	-1.07E-01		5.77E-01
	1038.61	0.99	-6.85E-01		5.16E+00
	1167.97	1.79	1.53E+00		3.28E+00
	1365.19	3.02	3.91E-01		1.69E+00
Cs-137	661.66	85.10	-8.20E-03	3.79E-02	3.79E-02
Eu-152	121.78	28.67	-5.98E-02	1.04E-01	1.04E-01
	244.70	7.61	1.16E-01		5.00E-01
	295.94	0.45	5.24E+00		8.53E+00
	344.28	26.60	-2.24E-02		1.29E-01
	367.79	0.86	3.06E-02		3.56E+00
	411.12	2.24	1.91E-01		1.55E+00
	443.96	2.83	-1.33E+00		1.27E+00
	488.68	0.42	4.32E+00		8.62E+00
	563.99	0.49	2.89E-01		8.14E+00
	586.26	0.46	-2.46E-01		1.13E+01
	678.62	0.47	-2.59E+00		8.40E+00
	688.67	0.86	8.92E-01		4.36E+00
	719.35	0.28	-1.70E+01		1.10E+01
	778.90	12.96	-2.27E-02		3.60E-01
	810.45	0.32	1.21E+01		1.30E+01
	867.37	4.26	1.13E-01		9.07E-01
	919.33	0.43	-2.65E+00		1.00E+01
	964.08	14.65	1.99E-02		4.01E-01
	1085.87	10.24	6.19E-02		5.21E-01
	1089.74	1.73	-2.54E+00		3.19E+00
	1112.07	13.69	-2.47E-01		3.70E-01
	1212.95	1.43	2.85E+00		5.28E+00
	1249.94	0.19	7.72E-01		3.33E+01
	1299.14	1.63	-2.91E+00		3.38E+00
	1408.01	21.07	1.61E-01		2.60E-01
	1457.64	0.50	1.80E+02		4.50E+01
	1528.10	0.28	-3.65E+00		1.16E+01
Eu-154	123.07	40.40	2.42E-02	7.68E-02	7.68E-02
	247.93	6.89	-4.44E-01		4.54E-01
	591.76	4.95	-2.54E-01		7.07E-01
	692.42	1.78	-2.06E-01		1.96E+00
	723.30	20.06	1.62E-01		2.15E-01
	756.80	4.52	-4.08E-01		9.13E-01
	873.18	12.08	-3.25E-01		3.29E-01

Analysis Report for 12-Sep-19-10027

L1-12205E-FIGS-101SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.21E-01	7.68E-02	4.33E-01
	1004.76	18.01	-3.46E-01		2.08E-01
	1274.43	34.80	8.64E-02		1.70E-01
	1596.48	1.80	-1.56E+00		2.15E+00
Eu-155	45.30	1.31	6.43E+00	1.75E-01	1.17E+01
	60.01	1.22	1.54E+00		1.22E+01
	86.55	30.70	6.42E-02		1.87E-01
	105.31	21.10	-3.26E-02		1.75E-01
Ra-226	186.21	3.64	7.98E-02	8.98E-01	8.98E-01
Pa-231	27.36	10.30	1.51E+00	1.25E+00	1.40E+00
	283.69	1.70	-6.54E-01		1.91E+00
	300.07	2.47	-2.71E+00		1.25E+00
	302.65	2.20	5.72E-02		1.45E+00
	330.06	1.40	4.15E-01		2.10E+00
U-235	143.76	10.96	-9.89E-02	5.80E-02	2.88E-01
	163.33	5.08	-2.87E-01		5.76E-01
	185.71	57.20	3.85E-02		5.80E-02
	202.11	1.08	-1.31E+00		2.69E+00
	205.31	5.01	1.51E-01		6.46E-01
Am-241	59.54	35.90	1.44E-01	4.35E-01	4.35E-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 12-Sep-19-10028
L1-12205E-QIGS-101SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 12-Sep-19-10028
Sample Description	: L1-12205E-QIGS-101SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.543E+03 grams
Facility	: Default
Sample Taken On	: 9/11/2019 9:00:00AM
Acquisition Started	: 9/12/2019 12:27:00PM
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	: 1/24/2019
Efficiency Calibration Used Done On	: 9/12/2019
Efficiency Calibration Description	:
Sample Number	: 79491
Fill Height	: 1543.15 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/12/2019 12:42:02PM

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

Data Validated
1530 9/16/19

Analysis Report for 12-Sep-19-10028

L1-12205E-QIGS-101SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.66	949 -	961	954.21	1.23E+02	17.52	6.72E+01	1.08
2	295.41	1175 -	1186	1180.93	5.90E+01	10.87	2.30E+01	0.47
3	351.95	1401 -	1413	1406.82	6.64E+01	11.44	2.35E+01	0.75
4	609.25	2429 -	2441	2435.04	4.38E+01	9.30	1.63E+01	1.28
5	968.66	3868 -	3877	3872.04	1.51E+01	5.97	8.93E+00	0.43
6	1460.23	5826 -	5851	5838.84	3.66E+02	19.48	3.23E+00	1.76

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	8.19E+00	5.62E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.95E-01	3.19E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.26E-01	2.79E-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 12-Sep-19-10028

L1-12205E-QIGS-101SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.52E-01	5.06E-02
		351.93	*	35.60	1.67E-01	3.17E-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		
		964.77		4.99		
		968.97	*	15.80	1.72E-01	6.86E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

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

Analysis Report for 12-Sep-19-10028

L1-12205E-QIGS-101SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.945	8.19E+00	5.62E-01	
X	Bi-211	0.883			
	Pb-212	1.000	1.95E-01	3.19E-02	
	Bi-214	1.000	1.26E-01	2.79E-02	
	Pb-214	0.998	1.91E-01	2.69E-02	
	Ac-228	0.997	1.72E-01	6.86E-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 12-Sep-19-10028

L1-12205E-QIGS-101SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/12/2019 12:42:02PM
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	5.53E-02	5.60E-02	5.60E-02
	BE-7	477.60		10.44	1.75E-01	3.67E-01	3.67E-01
+	K-40	1460.82	*	10.66	8.19E+00	3.45E-01	3.45E-01
	Mn-54	834.85		99.98	2.57E-02	4.46E-02	4.46E-02
	Co-60	1173.23		99.85	3.92E-02	4.63E-02	6.57E-02
		1332.49		99.98	-3.97E-02		4.63E-02
	Nb-94	702.65		99.81	8.35E-03	4.23E-02	4.23E-02
		871.09		99.89	2.47E-02		4.50E-02
	Ag-108m	79.13		6.60	8.01E-01	3.98E-02	1.14E+00
		433.94		90.50	-2.78E-02		3.98E-02
		614.28		89.80	-1.20E-02		5.62E-02
		722.94		90.80	3.25E-03		5.59E-02
	Sb-125	176.31		6.84	1.97E-02	1.19E-01	4.36E-01
		380.45		1.52	7.84E-01		2.46E+00
		427.87		29.60	4.30E-02		1.19E-01
		463.36		10.49	7.78E-02		3.37E-01
		600.60		17.65	6.92E-02		2.19E-01
		606.71		4.98	1.76E+00		1.28E+00
		635.95		11.22	6.03E-02		3.25E-01

Analysis Report for 12-Sep-19-10028

L1-12205E-QIGS-101SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	6.16E-01	1.19E-01	2.39E+00
Ba-133	79.61	2.65	1.17E+00	6.17E-02	2.73E+00
	81.00	32.90	-1.57E-01		1.78E-01
	276.40	7.16	4.22E-02		4.41E-01
	302.85	18.34	-5.05E-02		1.92E-01
	356.01	62.05	-2.65E-02		6.17E-02
	383.85	8.94	-1.07E-01		3.81E-01
Cs-134	475.36	1.48	-1.31E+00	5.46E-02	2.35E+00
	563.25	8.34	-4.59E-01		4.09E-01
	569.33	15.37	1.17E-01		2.20E-01
	604.72	97.62	-1.97E-02		5.62E-02
	795.86	85.46	2.85E-02		5.46E-02
	801.95	8.69	8.21E-02		4.90E-01
	1038.61	0.99	-4.67E+00		4.85E+00
	1167.97	1.79	-1.18E+00		3.27E+00
	1365.19	3.02	5.13E-01		1.52E+00
Cs-137	661.66	85.10	-1.15E-02	4.91E-02	4.91E-02
Eu-152	121.78	28.67	1.46E-02	1.13E-01	1.13E-01
	244.70	7.61	-3.32E-02		4.82E-01
	295.94	0.45	5.20E+00		9.66E+00
	344.28	26.60	4.51E-02		1.38E-01
	367.79	0.86	-1.42E+00		3.76E+00
	411.12	2.24	-2.22E-01		1.57E+00
	443.96	2.83	5.98E-02		1.36E+00
	488.68	0.42	4.33E-01		8.51E+00
	563.99	0.49	-1.81E+01		6.04E+00
	586.26	0.46	5.97E+00		1.12E+01
	678.62	0.47	-9.75E-01		8.20E+00
	688.67	0.86	2.12E+00		5.00E+00
	719.35	0.28	-6.86E+00		1.54E+01
	778.90	12.96	9.06E-02		3.65E-01
	810.45	0.32	-1.55E-01		1.31E+01
	867.37	4.26	3.21E-01		1.23E+00
	919.33	0.43	-7.63E+00		8.73E+00
	964.08	14.65	-4.01E-01		4.26E-01
	1085.87	10.24	1.73E-01		5.19E-01
	1089.74	1.73	9.36E-01		3.38E+00
	1112.07	13.69	2.31E-01		4.01E-01
	1212.95	1.43	-5.73E-01		4.40E+00
	1249.94	0.19	4.23E+00		3.43E+01
	1299.14	1.63	3.03E-01		2.89E+00
	1408.01	21.07	-3.03E-02		1.99E-01
	1457.64	0.50	1.73E+02		4.53E+01
	1528.10	0.28	7.01E+00		1.44E+01
Eu-154	123.07	40.40	1.92E-02	8.07E-02	8.07E-02
	247.93	6.89	-4.61E-02		4.67E-01
	591.76	4.95	4.95E-01		7.93E-01
	692.42	1.78	6.06E-02		2.36E+00
	723.30	20.06	1.05E-01		2.58E-01
	756.80	4.52	6.52E-01		1.05E+00
	873.18	12.08	-3.90E-01		3.45E-01

Analysis Report for 12-Sep-19-10028

L1-12205E-QIGS-101SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.14E-01	8.07E-02	5.04E-01
	1004.76	18.01	-1.06E-01		2.44E-01
	1274.43	34.80	1.49E-01		1.64E-01
	1596.48	1.80	8.54E-01		2.08E+00
Eu-155	45.30	1.31	2.11E+00	1.82E-01	1.15E+01
	60.01	1.22	-2.42E+00		1.23E+01
	86.55	30.70	8.02E-02		1.82E-01
	105.31	21.10	1.93E-02		1.93E-01
Ra-226	186.21	3.64	5.88E-01	8.98E-01	8.98E-01
Pa-231	27.36	10.30	1.01E+00	1.29E+00	1.29E+00
	283.69	1.70	-4.69E-01		1.78E+00
	300.07	2.47	-5.44E-01		1.38E+00
	302.65	2.20	-1.09E+00		1.55E+00
	330.06	1.40	-8.65E-01		2.44E+00
U-235	143.76	10.96	9.26E-02	5.78E-02	2.98E-01
	163.33	5.08	-3.70E-01		5.76E-01
	185.71	57.20	5.26E-02		5.78E-02
	202.11	1.08	-1.48E-01		2.57E+00
	205.31	5.01	-1.91E-01		5.87E-01
Am-241	59.54	35.90	-8.14E-02	4.28E-01	4.28E-01

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

Apex-Gamma

Analysis Report for 12-Sep-19-10029

L1-12205E-FIGS-102SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 12-Sep-19-10029
Sample Description	: L1-12205E-FIGS-102SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.747E+03 grams
Facility	: Default
Sample Taken On	: 9/11/2019 9:02:00AM
Acquisition Started	: 9/12/2019 11:34:59AM
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	: 9/29/2018
Efficiency Calibration Used Done On	: 9/12/2019
Efficiency Calibration Description	:
Sample Number	: 79490
Fill Height	: 1746.69 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/12/2019 11:50:04AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated
1530 9/16/19

Analysis Report for 12-Sep-19-10029

L1-12205E-FIGS-102SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.17	739 -	750	745.41	3.03E+01	11.95	4.37E+01	1.18
2	238.64	949 -	961	955.04	9.25E+01	16.10	6.25E+01	0.93
3	295.19	1173 -	1185	1181.00	4.75E+01	9.41	1.55E+01	0.85
4	338.17	1348 -	1358	1352.73	2.35E+01	9.05	2.45E+01	0.62
5	351.88	1400 -	1414	1407.51	7.63E+01	11.41	1.88E+01	1.05
6	583.28	2326 -	2339	2332.43	4.34E+01	8.36	9.59E+00	0.67
7	609.47	2430 -	2444	2437.15	5.82E+01	8.68	5.80E+00	0.78
8	911.23	3636 -	3651	3643.97	3.71E+01	7.39	5.86E+00	0.40
9	1460.82	5830 -	5855	5843.66	3.66E+02	20.20	9.75E+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	1.00	1460.82	*	10.66	7.42E+00	5.21E-01
Tl-208	0.99	583.19	*	85.00	6.05E-02	1.22E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.42E-01	2.73E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.56E-01	2.51E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 12-Sep-19-10029

L1-12205E-FIGS-102SS

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	1.00	241.99		7.25		
		295.22	*	18.42	1.94E-01	4.13E-02
		351.93	*	35.60	1.81E-01	3.08E-02
		785.96		1.06		
Ra-226	1.00	186.21	*	3.64	5.00E-01	2.01E-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	1.72E-01	6.76E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.28E-01	4.64E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.97	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.18E-02	1.28E-02
		202.11		1.08		
		205.31		5.01		

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

Analysis Report for 12-Sep-19-10029

L1-12205E-FIGS-102SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	7.42E+00	5.21E-01	
	Tl-208	0.999	6.05E-02	1.22E-02	
X	Bi-211	0.901			
	Pb-212	1.000	1.42E-01	2.73E-02	
	Bi-214	0.999	1.56E-01	2.51E-02	
	Pb-214	1.000	1.86E-01	2.47E-02	
?	Ra-226	1.000	5.00E-01	2.01E-01	
	Ac-228	0.999	2.10E-01	3.83E-02	
?	U-235	0.976	3.18E-02	1.28E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 12-Sep-19-10029

L1-12205E-FIGS-102SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/12/2019 11:50:04AM
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	5.55E-02	4.93E-02	4.93E-02
	BE-7	477.60		10.44	2.88E-01	3.68E-01	3.68E-01
+	K-40	1460.82	*	10.66	7.42E+00	5.02E-01	5.02E-01
	Mn-54	834.85		99.98	3.26E-02	4.43E-02	4.43E-02
	Co-60	1173.23		99.85	-2.42E-03	4.46E-02	6.19E-02
		1332.49		99.98	-1.83E-02		4.46E-02
	Nb-94	702.65		99.81	6.20E-03	4.60E-02	4.60E-02
		871.09		99.89	2.66E-02		4.80E-02
	Ag-108m	79.13		6.60	4.12E-01	3.62E-02	1.47E+00
		433.94		90.50	-2.45E-02		3.62E-02
		614.28		89.80	-1.96E-02		6.28E-02
		722.94		90.80	7.69E-03		4.56E-02
	Sb-125	176.31		6.84	-2.75E-01	1.18E-01	4.84E-01
		380.45		1.52	1.91E+00		2.36E+00
		427.87		29.60	3.51E-02		1.18E-01
		463.36		10.49	-9.67E-03		3.51E-01
		600.60		17.65	1.46E-01		2.52E-01
		606.71		4.98	1.13E+00		1.14E+00
		635.95		11.22	1.09E-02		3.26E-01

Analysis Report for 12-Sep-19-10029

L1-12205E-FIGS-102SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.03E-01	1.18E-01	2.02E+00
Ba-133	79.61	2.65	-1.31E-01	7.03E-02	3.53E+00
	81.00	32.90	-3.35E-01		2.46E-01
	276.40	7.16	6.36E-02		4.63E-01
	302.85	18.34	6.64E-02		1.86E-01
	356.01	62.05	5.88E-05		7.03E-02
	383.85	8.94	1.41E-01		3.87E-01
Cs-134	475.36	1.48	-7.59E-01	5.39E-02	2.33E+00
	563.25	8.34	2.75E-01		4.40E-01
	569.33	15.37	-6.31E-02		2.04E-01
	604.72	97.62	-5.62E-02		5.39E-02
	795.86	85.46	2.29E-02		5.44E-02
	801.95	8.69	-5.15E-02		5.17E-01
	1038.61	0.99	2.81E+00		5.58E+00
	1167.97	1.79	-4.54E+00		3.40E+00
	1365.19	3.02	-2.22E-01		1.28E+00
Cs-137	661.66	85.10	4.04E-02	4.91E-02	4.91E-02
Eu-152	121.78	28.67	-5.98E-02	1.31E-01	1.31E-01
	244.70	7.61	2.55E-01		4.78E-01
	295.94	0.45	6.63E+00		9.12E+00
	344.28	26.60	6.21E-02		1.32E-01
	367.79	0.86	1.14E+00		3.83E+00
	411.12	2.24	1.42E+00		1.66E+00
	443.96	2.83	-1.65E-01		1.33E+00
	488.68	0.42	2.59E+00		8.44E+00
	563.99	0.49	1.00E+00		7.38E+00
	586.26	0.46	1.53E+01		1.16E+01
	678.62	0.47	-9.07E+00		7.95E+00
	688.67	0.86	3.43E-01		4.48E+00
	719.35	0.28	5.11E+00		1.48E+01
	778.90	12.96	2.11E-03		3.40E-01
	810.45	0.32	-6.33E+00		1.41E+01
	867.37	4.26	-3.53E-01		1.12E+00
	919.33	0.43	-5.43E+00		1.00E+01
	964.08	14.65	9.69E-02		4.38E-01
	1085.87	10.24	2.29E-01		5.27E-01
	1089.74	1.73	-2.68E+00		2.81E+00
	1112.07	13.69	-3.87E-01		4.00E-01
	1212.95	1.43	5.90E+00		5.25E+00
	1249.94	0.19	1.22E+01		3.40E+01
	1299.14	1.63	1.72E+00		3.82E+00
	1408.01	21.07	1.50E-01		2.14E-01
	1457.64	0.50	1.64E+02		4.16E+01
	1528.10	0.28	-3.40E+00		1.08E+01
Eu-154	123.07	40.40	1.43E-02	9.46E-02	9.46E-02
	247.93	6.89	-2.71E-01		4.52E-01
	591.76	4.95	0.00E+00		8.30E-01
	692.42	1.78	-1.89E+00		2.04E+00
	723.30	20.06	-4.84E-02		2.07E-01
	756.80	4.52	-1.70E-01		9.31E-01
	873.18	12.08	3.67E-01		4.03E-01

Analysis Report for 12-Sep-19-10029

L1-12205E-FIGS-102SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	3.40E-01	9.46E-02	5.38E-01
		1004.76		18.01	-3.66E-02		3.11E-01
		1274.43		34.80	2.88E-02		1.78E-01
		1596.48		1.80	-6.74E-01		2.32E+00
	Eu-155	45.30		1.31	8.35E+00	2.13E-01	1.99E+01
		60.01		1.22	-1.45E+01		2.05E+01
		86.55		30.70	8.30E-02		2.27E-01
		105.31		21.10	8.12E-03		2.13E-01
+	Ra-226	186.21	*	3.64	5.00E-01	6.41E-01	6.41E-01
	Pa-231	27.36		10.30	6.58E-01	1.41E+00	2.14E+00
		283.69		1.70	4.74E-01		2.04E+00
		300.07		2.47	-1.12E+00		1.41E+00
		302.65		2.20	7.53E-01		1.57E+00
		330.06		1.40	-4.08E-01		2.47E+00
+	U-235	143.76		10.96	9.10E-02	4.08E-02	3.33E-01
		163.33		5.08	1.90E-01		6.75E-01
		185.71	*	57.20	3.18E-02		4.08E-02
		202.11		1.08	-1.36E+00		3.05E+00
		205.31		5.01	-3.01E-01		6.30E-01
	Am-241	59.54		35.90	5.73E-02	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 12-Sep-19-10030
L1-12205E-FIGS-103SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 12-Sep-19-10030
Sample Description	: L1-12205E-FIGS-103SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.662E+03 grams
Facility	: Default
Sample Taken On	: 9/11/2019 9:04:00AM
Acquisition Started	: 9/12/2019 12:27:06PM
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	: 9/29/2018
Efficiency Calibration Used Done On	: 9/12/2019
Efficiency Calibration Description	:
Sample Number	: 79492
Fill Height	: 1662.04 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/12/2019 12:42:08PM

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

Date Validated
1530 9/17/19

Analysis Report for 12-Sep-19-10030

L1-12205E-FIGS-103SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.63	474 -	481	477.44	1.30E+02	17.73	8.93E+01	1.09
2	295.24	586 -	595	590.54	5.56E+01	12.39	4.34E+01	1.08
3	351.83	698 -	708	703.60	7.28E+01	13.71	4.82E+01	1.12
4	583.26	1160 -	1170	1166.13	5.43E+01	9.32	1.37E+01	0.74
5	609.25	1212 -	1223	1218.08	6.92E+01	11.60	2.58E+01	1.39
6	910.89	1816 -	1827	1821.23	4.26E+01	7.99	8.41E+00	1.08
7	1460.68	2913 -	2928	2921.42	4.66E+02	22.01	6.08E+00	2.18

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	8.57E+00	5.50E-01
Tl-208	0.99	583.19	*	85.00	6.88E-02	1.25E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.79E-01	2.85E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.69E-01	3.00E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 12-Sep-19-10030

L1-12205E-FIGS-103SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.05E-01	4.86E-02
		351.93	*	35.60	1.57E-01	3.21E-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	2.38E-01	4.58E-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 12-Sep-19-10030

L1-12205E-FIGS-103SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	8.57E+00	5.50E-01	
	Tl-208	0.999	6.88E-02	1.25E-02	
X	Bi-211	0.912			
	Pb-212	1.000	1.79E-01	2.85E-02	
	Bi-214	1.000	1.69E-01	3.00E-02	
	Pb-214	0.999	1.72E-01	2.68E-02	
	Ac-228	0.995	2.38E-01	4.58E-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 12-Sep-19-10030

L1-12205E-FIGS-103SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/12/2019 12:42:08PM
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	5.58E-02	5.14E-02	5.14E-02
	BE-7	477.60		10.44	-3.77E-02	3.18E-01	3.18E-01
+	K-40	1460.82	*	10.66	8.57E+00	3.21E-01	3.21E-01
	Mn-54	834.85		99.98	9.12E-03	3.72E-02	3.72E-02
	Co-60	1173.23		99.85	2.75E-02	4.56E-02	5.75E-02
		1332.49		99.98	1.30E-02		4.56E-02
	Nb-94	702.65		99.81	1.41E-02	3.55E-02	3.71E-02
		871.09		99.89	1.83E-03		3.55E-02
	Ag-108m	79.13		6.60	-1.56E-01	3.40E-02	9.88E-01
		433.94		90.50	9.06E-04		3.40E-02
		614.28		89.80	-3.53E-02		5.12E-02
		722.94		90.80	9.10E-03		4.92E-02
	Sb-125	176.31		6.84	-1.43E-01	9.85E-02	4.73E-01
		380.45		1.52	-4.36E-01		1.89E+00
		427.87		29.60	-2.71E-02		9.85E-02
		463.36		10.49	7.78E-02		3.22E-01
		600.60		17.65	1.60E-01		2.23E-01
		606.71		4.98	1.26E-01		1.19E+00
		635.95		11.22	1.56E-01		3.30E-01

Analysis Report for 12-Sep-19-10030

L1-12205E-FIGS-103SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.79E-01	9.85E-02	2.11E+00
Ba-133	79.61	2.65	-9.26E-02	6.58E-02	2.35E+00
	81.00	32.90	-1.64E-01		1.66E-01
	276.40	7.16	1.40E-01		4.43E-01
	302.85	18.34	1.36E-03		1.64E-01
	356.01	62.05	4.68E-04		6.58E-02
	383.85	8.94	-1.45E-01		3.17E-01
Cs-134	475.36	1.48	1.39E+00	4.50E-02	2.32E+00
	563.25	8.34	7.47E-02		3.63E-01
	569.33	15.37	5.69E-02		2.24E-01
	604.72	97.62	7.98E-03		5.24E-02
	795.86	85.46	-5.20E-03		4.50E-02
	801.95	8.69	-1.79E-01		4.51E-01
	1038.61	0.99	1.03E+00		3.93E+00
	1167.97	1.79	-1.21E+00		2.98E+00
	1365.19	3.02	-2.38E-02		1.25E+00
Cs-137	661.66	85.10	1.74E-02	4.57E-02	4.57E-02
Eu-152	121.78	28.67	-2.62E-02	1.04E-01	1.04E-01
	244.70	7.61	-8.82E-02		4.56E-01
	295.94	0.45	4.62E+00		7.98E+00
	344.28	26.60	-1.01E-01		1.11E-01
	367.79	0.86	-1.12E+00		3.25E+00
	411.12	2.24	1.46E-01		1.27E+00
	443.96	2.83	2.14E-01		1.15E+00
	488.68	0.42	-2.35E+00		6.65E+00
	563.99	0.49	1.73E+00		6.16E+00
	586.26	0.46	-2.31E+00		1.09E+01
	678.62	0.47	2.50E+00		7.97E+00
	688.67	0.86	1.31E+00		4.13E+00
	719.35	0.28	1.30E+00		1.35E+01
	778.90	12.96	-5.09E-02		2.92E-01
	810.45	0.32	3.54E-01		1.28E+01
	867.37	4.26	-6.43E-01		7.95E-01
	919.33	0.43	-4.72E+00		7.86E+00
	964.08	14.65	1.02E-01		3.50E-01
	1085.87	10.24	3.25E-01		4.91E-01
	1089.74	1.73	-1.24E+00		2.72E+00
	1112.07	13.69	-1.58E-01		3.43E-01
	1212.95	1.43	-2.02E+00		3.88E+00
	1249.94	0.19	-5.56E+00		2.95E+01
	1299.14	1.63	-2.57E+00		2.58E+00
	1408.01	21.07	-1.20E-01		1.49E-01
	1457.64	0.50	-5.84E-01		4.19E+01
	1528.10	0.28	2.90E+00		1.12E+01
Eu-154	123.07	40.40	3.42E-02	7.80E-02	7.80E-02
	247.93	6.89	-2.25E-01		4.59E-01
	591.76	4.95	-5.34E-03		6.87E-01
	692.42	1.78	-6.04E-01		1.82E+00
	723.30	20.06	5.79E-02		2.29E-01
	756.80	4.52	-2.65E-01		8.23E-01
	873.18	12.08	-1.18E-01		2.75E-01

Analysis Report for 12-Sep-19-10030

L1-12205E-FIGS-103SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.85E-02	7.80E-02	3.69E-01
	1004.76	18.01	1.47E-01		2.59E-01
	1274.43	34.80	5.16E-02		1.37E-01
	1596.48	1.80	7.87E-01		2.35E+00
Eu-155	45.30	1.31	1.18E+00	1.65E-01	1.04E+01
	60.01	1.22	-8.02E+00		1.10E+01
	86.55	30.70	1.31E-01		1.78E-01
	105.31	21.10	-1.11E-02		1.65E-01
Ra-226	186.21	3.64	7.81E-01	9.46E-01	9.46E-01
Pa-231	27.36	10.30	4.88E-01	1.15E+00	1.15E+00
	283.69	1.70	-8.10E-02		1.83E+00
	300.07	2.47	-3.79E-01		1.16E+00
	302.65	2.20	1.14E-02		1.37E+00
	330.06	1.40	5.82E-01		2.43E+00
U-235	143.76	10.96	1.07E-01	5.94E-02	2.70E-01
	163.33	5.08	2.92E-01		7.00E-01
	185.71	57.20	4.62E-02		5.94E-02
	202.11	1.08	1.65E-01		3.08E+00
	205.31	5.01	-3.25E-01		6.35E-01
Am-241	59.54	35.90	-1.73E-01	3.93E-01	3.93E-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 17-Sep-19-10041
L1-12205E-FIGS-104SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10041
Sample Description	: L1-12205E-FIGS-104SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.672E+03 grams
Facility	: Default
Sample Taken On	: 9/11/2019 1:00:00PM
Acquisition Started	: 9/17/2019 12:37:30PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79583
Fill Height	: 1671.73 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 12:52:47PM

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

Data Validated
1602 9-17-19

Analysis Report for 17-Sep-19-10041

L1-12205E-FIGS-104SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.72	949 -	961	954.45	9.65E+01	17.64	7.75E+01	0.90
2	338.55	1349 -	1359	1353.29	2.88E+01	7.61	1.22E+01	0.56
3	352.14	1401 -	1413	1407.58	6.31E+01	12.02	3.09E+01	0.37
4	609.23	2428 -	2443	2434.96	6.46E+01	9.53	8.37E+00	0.66
5	911.16	3637 -	3648	3642.09	2.90E+01	7.21	9.00E+00	0.53
6	1460.28	5825 -	5851	5839.05	4.00E+02	20.35	3.32E+00	1.88

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.95	1460.82	*	10.66	8.75E+00	5.86E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.51E-01	3.02E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.84E-01	2.92E-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 17-Sep-19-10041

L1-12205E-FIGS-104SS

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	1.56E-01	3.23E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.19E-01	6.05E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.91E-01	4.81E-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 17-Sep-19-10041

L1-12205E-FIGS-104SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.954	8.75E+00	5.86E-01	
Pb-212	0.999	1.51E-01	3.02E-02	
Bi-214	0.999	1.84E-01	2.92E-02	
Pb-214	0.996	1.56E-01	3.23E-02	
Ac-228	0.999	2.02E-01	3.77E-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 17-Sep-19-10041

L1-12205E-FIGS-104SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 12:52:47PM
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	5.86E-02	5.43E-02	5.43E-02
	BE-7	477.60		10.44	1.61E-01	3.54E-01	3.54E-01
+	K-40	1460.82	*	10.66	8.75E+00	3.45E-01	3.45E-01
	Mn-54	834.85		99.98	8.90E-03	4.42E-02	4.42E-02
	Co-60	1173.23		99.85	-2.54E-02	4.40E-02	6.20E-02
		1332.49		99.98	-3.09E-02		4.40E-02
	Nb-94	702.65		99.81	7.58E-03	4.26E-02	4.34E-02
		871.09		99.89	-1.10E-02		4.26E-02
	Ag-108m	79.13		6.60	1.62E+00	3.67E-02	1.21E+00
		433.94		90.50	1.27E-02		3.67E-02
		614.28		89.80	-1.83E-02		5.32E-02
		722.94		90.80	1.34E-02		4.79E-02
	Sb-125	176.31		6.84	-1.67E-01	1.09E-01	4.17E-01
		380.45		1.52	5.85E-02		2.00E+00
		427.87		29.60	4.75E-02		1.09E-01
		463.36		10.49	1.34E-01		3.20E-01
		600.60		17.65	-4.37E-02		2.15E-01
		606.71		4.98	-4.17E-01		1.24E+00
		635.95		11.22	5.86E-02		2.90E-01

Analysis Report for 17-Sep-19-10041

L1-12205E-FIGS-104SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.31E+00	1.09E-01	2.29E+00
Ba-133	79.61	2.65	4.28E+00	6.71E-02	2.92E+00
	81.00	32.90	-3.24E-01		1.76E-01
	276.40	7.16	-6.59E-02		4.54E-01
	302.85	18.34	-3.20E-02		1.73E-01
	356.01	62.05	-3.43E-02		6.71E-02
	383.85	8.94	-5.02E-03		3.68E-01
Cs-134	475.36	1.48	1.06E+00	5.38E-02	2.49E+00
	563.25	8.34	-5.40E-01		5.12E-01
	569.33	15.37	1.25E-01		2.49E-01
	604.72	97.62	-3.27E-02		5.38E-02
	795.86	85.46	-1.37E-02		5.61E-02
	801.95	8.69	8.76E-02		5.24E-01
	1038.61	0.99	-7.99E-01		4.77E+00
	1167.97	1.79	2.30E+00		3.37E+00
	1365.19	3.02	7.78E-01		1.63E+00
Cs-137	661.66	85.10	-2.57E-02	4.16E-02	4.16E-02
Eu-152	121.78	28.67	-4.42E-02	1.10E-01	1.16E-01
	244.70	7.61	2.29E-01		4.99E-01
	295.94	0.45	6.38E+00		9.16E+00
	344.28	26.60	6.29E-03		1.10E-01
	367.79	0.86	-6.94E-01		3.63E+00
	411.12	2.24	2.20E-01		1.43E+00
	443.96	2.83	6.23E-01		1.21E+00
	488.68	0.42	1.69E+00		7.94E+00
	563.99	0.49	-1.33E+01		7.60E+00
	586.26	0.46	2.07E+00		1.06E+01
	678.62	0.47	1.36E+00		7.17E+00
	688.67	0.86	-5.25E+00		4.15E+00
	719.35	0.28	9.92E+00		1.37E+01
	778.90	12.96	-1.88E-01		2.67E-01
	810.45	0.32	-8.54E-01		1.29E+01
	867.37	4.26	1.35E-01		1.02E+00
	919.33	0.43	-1.31E+00		1.07E+01
	964.08	14.65	1.84E-01		4.39E-01
	1085.87	10.24	-4.19E-02		4.91E-01
	1089.74	1.73	-3.87E-01		2.69E+00
	1112.07	13.69	-2.44E-02		3.52E-01
	1212.95	1.43	1.25E+00		5.14E+00
	1249.94	0.19	1.81E+01		3.46E+01
	1299.14	1.63	5.25E-01		3.41E+00
	1408.01	21.07	-1.13E-01		1.86E-01
	1457.64	0.50	1.87E+02		4.61E+01
	1528.10	0.28	2.57E+00		9.60E+00
Eu-154	123.07	40.40	-3.02E-02	8.17E-02	8.17E-02
	247.93	6.89	-1.78E-02		4.60E-01
	591.76	4.95	4.10E-01		7.69E-01
	692.42	1.78	7.54E-01		2.28E+00
	723.30	20.06	6.57E-02		2.20E-01
	756.80	4.52	-1.55E+00		7.88E-01
	873.18	12.08	2.28E-01		3.85E-01

Analysis Report for 17-Sep-19-10041

L1-12205E-FIGS-104SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-9.25E-02	8.17E-02	3.80E-01
	1004.76	18.01	4.78E-02		2.22E-01
	1274.43	34.80	6.90E-02		2.04E-01
	1596.48	1.80	1.25E+00		2.41E+00
Eu-155	45.30	1.31	1.58E+00	1.81E-01	1.14E+01
	60.01	1.22	9.66E+00		1.29E+01
	86.55	30.70	1.34E-01		1.81E-01
	105.31	21.10	1.97E-02		1.96E-01
Ra-226	186.21	3.64	5.83E-01	9.23E-01	9.23E-01
Pa-231	27.36	10.30	1.24E+00	1.33E+00	1.33E+00
	283.69	1.70	2.05E-01		1.70E+00
	300.07	2.47	-1.84E+00		1.41E+00
	302.65	2.20	-1.90E-01		1.45E+00
	330.06	1.40	1.46E+00		2.60E+00
U-235	143.76	10.96	5.39E-03	5.89E-02	3.06E-01
	163.33	5.08	1.03E-01		5.97E-01
	185.71	57.20	3.86E-02		5.89E-02
	202.11	1.08	1.67E+00		2.67E+00
	205.31	5.01	-4.29E-01		5.45E-01
Am-241	59.54	35.90	1.78E-01	4.48E-01	4.48E-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 18-Sep-19-10036
L1-12205E-FIGS-101SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Sep-19-10036
Sample Description	: L1-12205E-FIGS-101SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.549E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 1:20:00PM
Acquisition Started	: 9/18/2019 11:10:59AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.5 seconds
Dead Time	: 0.05 %
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	: 9/29/2018
Efficiency Calibration Used Done On	: 9/18/2019
Efficiency Calibration Description	:
Sample Number	: 79631
Fill Height	: 1548.67 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/18/2019 11:26:01AM

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

Data Validated
0830 9-19-19

Analysis Report for 18-Sep-19-10036

L1-12205E-FIGS-101SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.12	151 -	158	154.83	1.95E+02	26.52	2.50E+02	0.99
2	186.07	368 -	376	372.45	1.23E+02	21.88	1.67E+02	1.32
3	238.67	473 -	481	477.51	2.98E+02	28.05	2.19E+02	1.27
4	295.28	585 -	595	590.61	1.53E+02	19.63	9.55E+01	1.21
5	338.30	673 -	681	676.57	6.37E+01	14.85	7.33E+01	1.08
6	351.93	698 -	708	703.80	2.23E+02	19.74	7.02E+01	1.44
7	583.20	1162 -	1171	1166.01	1.52E+02	15.11	3.36E+01	1.45
8	609.43	1212 -	1224	1218.43	2.15E+02	17.22	3.09E+01	1.94
9	727.17	1449 -	1458	1453.83	2.00E+01	10.50	4.00E+01	0.98
10	911.49	1816 -	1827	1822.43	7.00E+01	12.35	3.30E+01	1.68
11	969.19	1933 -	1941	1937.84	4.00E+01	10.73	3.30E+01	0.86
12	1120.38	2234 -	2247	2240.31	3.31E+01	12.47	4.39E+01	1.60
13	1460.80	2914 -	2928	2921.65	7.61E+02	28.16	1.13E+01	1.80
14	1764.53	3523 -	3535	3529.92	4.13E+01	6.77	1.68E+00	2.09

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	1.00	1460.82	*	10.66	1.43E+01	8.13E-01
Tl-208	1.00	583.19	*	85.00	1.96E-01	2.27E-02
Bi-212	0.99	39.86		1.06		

Analysis Report for 18-Sep-19-10036

L1-12205E-FIGS-101SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-212	0.99	727.33	*	6.67	3.79E-01	2.00E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	4.17E-01	5.17E-02
		300.09		3.30		
Pb212-XR	0.53	74.82		10.28		
		77.11	*	17.10	1.28E+00	2.18E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	5.32E-01	5.32E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	3.71E-01	1.41E-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	6.21E-01	1.05E-01
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	5.73E-01	8.65E-02
		351.93	*	35.60	4.87E-01	5.82E-02
		785.96		1.06		
Pb214-XR	0.53	74.82		5.80		
		77.11	*	9.70	2.25E+00	3.97E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.99	186.21	*	3.64	1.82E+00	3.57E-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	4.28E-01	1.06E-01
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.98E-01	7.22E-02
		964.77		4.99		
		968.97	*	15.80	3.86E-01	1.05E-01
		1588.20		3.22		
U-235	0.98	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	1.16E-01	2.27E-02
		202.11		1.08		

Analysis Report for 18-Sep-19-10036

L1-12205E-FIGS-101SB

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
U-235	0.98	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	1.000	1.43E+01	8.13E-01	
	Tl-208	1.000	1.96E-01	2.27E-02	
X	Bi-211	0.888			
	Bi-212	0.997	3.79E-01	2.00E-01	
	Pb-212	1.000	4.17E-01	5.17E-02	
?	Pb212-XR	0.530	1.28E+00	2.18E-01	
	Bi-214	0.999	5.32E-01	4.50E-02	
	Pb-214	1.000	5.14E-01	4.83E-02	
?	Pb214-XR	0.531	2.25E+00	3.97E-01	
?	Ra-226	0.997	1.82E+00	3.57E-01	
	Ac-228	0.995	4.02E-01	5.18E-02	
?	U-235	0.986	1.16E-01	2.27E-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 18-Sep-19-10036

L1-12205E-FIGS-101SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/18/2019 11:26:01AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.07E-02	6.01E-02	6.01E-02
	BE-7	477.60		10.44	1.78E-01	3.88E-01	3.88E-01
+	K-40	1460.82	*	10.66	1.43E+01	4.15E-01	4.15E-01
	Mn-54	834.85		99.98	-2.60E-02	5.72E-02	5.72E-02
	Co-60	1173.23		99.85	9.35E-03	5.68E-02	7.21E-02
		1332.49		99.98	-1.02E-02		5.68E-02
	Nb-94	702.65		99.81	1.14E-02	4.38E-02	4.76E-02
		871.09		99.89	-2.31E-02		4.38E-02
	Ag-108m	79.13		6.60	-8.67E-01	4.70E-02	1.60E+00
		433.94		90.50	-7.43E-03		4.70E-02
		614.28		89.80	-5.94E-02		7.78E-02
		722.94		90.80	2.16E-03		6.53E-02
	Sb-125	176.31		6.84	1.84E-03	1.40E-01	6.16E-01
		380.45		1.52	-4.88E-01		2.71E+00
		427.87		29.60	-3.92E-02		1.40E-01
		463.36		10.49	2.63E-01		4.49E-01
		600.60		17.65	9.85E-03		2.45E-01
		606.71		4.98	-1.20E-01		1.81E+00
		635.95		11.22	1.39E-02		3.83E-01

Analysis Report for 18-Sep-19-10036

L1-12205E-FIGS-101SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	4.67E-01	1.40E-01	2.60E+00
Ba-133	79.61	2.65	-2.43E+00	9.42E-02	3.72E+00
	81.00	32.90	-3.75E-01		2.36E-01
	276.40	7.16	-8.41E-02		5.69E-01
	302.85	18.34	9.27E-02		2.22E-01
	356.01	62.05	-6.98E-02		9.42E-02
	383.85	8.94	1.04E-02		4.70E-01
Cs-134	475.36	1.48	-5.45E-01	5.67E-02	2.53E+00
	563.25	8.34	1.53E-01		5.94E-01
	569.33	15.37	2.23E-01		3.43E-01
	604.72	97.62	-7.32E-03		7.39E-02
	795.86	85.46	-2.47E-02		5.67E-02
	801.95	8.69	-7.47E-02		5.87E-01
	1038.61	0.99	-7.11E-01		5.59E+00
	1167.97	1.79	-2.51E-02		4.01E+00
	1365.19	3.02	-9.24E-02		1.57E+00
Cs-137	661.66	85.10	1.25E-03	5.80E-02	5.80E-02
Eu-152	121.78	28.67	-4.43E-02	1.43E-01	1.43E-01
	244.70	7.61	-3.90E-02		6.46E-01
	295.94	0.45	-2.35E+00		1.24E+01
	344.28	26.60	-3.53E-02		1.51E-01
	367.79	0.86	5.52E-01		4.67E+00
	411.12	2.24	6.54E-01		2.05E+00
	443.96	2.83	-2.32E-01		1.46E+00
	488.68	0.42	-2.55E-01		9.68E+00
	563.99	0.49	1.52E+00		9.91E+00
	586.26	0.46	-3.34E+00		1.74E+01
	678.62	0.47	-2.16E+00		9.24E+00
	688.67	0.86	2.09E+00		5.50E+00
	719.35	0.28	-8.20E-01		1.73E+01
	778.90	12.96	-3.13E-01		3.68E-01
	810.45	0.32	-9.54E-01		1.51E+01
	867.37	4.26	-3.96E-01		1.10E+00
	919.33	0.43	-7.85E+00		1.21E+01
	964.08	14.65	4.17E-02		4.80E-01
	1085.87	10.24	5.51E-02		6.10E-01
	1089.74	1.73	-1.37E+00		3.56E+00
	1112.07	13.69	1.67E-01		5.02E-01
	1212.95	1.43	1.14E+00		5.47E+00
	1249.94	0.19	-1.61E+01		3.07E+01
	1299.14	1.63	1.65E+00		4.12E+00
	1408.01	21.07	3.19E-03		2.29E-01
	1457.64	0.50	-4.26E+00		5.43E+01
	1528.10	0.28	-4.41E+00		1.38E+01
Eu-154	123.07	40.40	-2.39E-02	1.02E-01	1.02E-01
	247.93	6.89	1.12E-01		6.04E-01
	591.76	4.95	2.60E-01		8.86E-01
	692.42	1.78	2.56E-01		2.58E+00
	723.30	20.06	-6.28E-03		3.04E-01
	756.80	4.52	-3.39E-01		1.02E+00
	873.18	12.08	5.59E-02		3.82E-01

Analysis Report for 18-Sep-19-10036

L1-12205E-FIGS-101SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	2.80E-02	1.02E-01	5.79E-01
		1004.76		18.01	-4.72E-02		3.16E-01
		1274.43		34.80	-1.00E-01		1.97E-01
		1596.48		1.80	-3.22E-01		2.32E+00
	Eu-155	45.30		1.31	4.49E+00	2.31E-01	1.47E+01
		60.01		1.22	-7.25E+00		1.53E+01
		86.55		30.70	5.71E-02		2.31E-01
		105.31		21.10	1.40E-01		2.40E-01
+	Ra-226	186.21	*	3.64	1.82E+00	9.94E-01	9.94E-01
	Pa-231	27.36		10.30	1.14E+00	1.44E+00	1.44E+00
		283.69		1.70	8.44E-01		2.38E+00
		300.07		2.47	1.41E-02		1.65E+00
		302.65		2.20	7.72E-01		1.85E+00
		330.06		1.40	8.75E-01		3.24E+00
+	U-235	143.76		10.96	1.86E-01	6.33E-02	3.74E-01
		163.33		5.08	-1.31E-01		8.87E-01
		185.71	*	57.20	1.16E-01		6.33E-02
		202.11		1.08	2.70E+00		4.17E+00
		205.31		5.01	-6.82E-01		8.81E-01
	Am-241	59.54		35.90	-1.43E-01	5.39E-01	5.39E-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

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-46635

January 23, 2020

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

CASE NARRATIVE
Work Order # 19-10094-OR

SAMPLE RECEIPT

This work order contains twelve soil samples received 10/21/2019. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-12205-E-FSGS-104-SS-A	19-10094-04	L1-12111-A-FJGS-003-SS-A	19-10094-10
L1-12205-E-QIGS-101-SS-A	19-10094-05	L1-12205-B-FSGS-105-SS-A	19-10094-11
L1-12205-D-FSGS-117-SS-A	19-10094-06	L1-12106-A-FSGS-009-SS-A	19-10094-12
L1-12205-E-FSGS-117-SS-A	19-10094-07	L1-12205-A-FSGS-104-SS-A	19-10094-13
L1-12205-A-FSGS-116-SS-A	19-10094-08	L1-12205-A-FSGS-109-SS-A	19-10094-14
L1-12111-A-QJGS-001-SS-A	19-10094-09	L1-12106-A-FSGS-013-SS-A	19-10094-15

ANALYTICAL METHODS

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

Laboratory qualifiers are as follows:

U - Result is less than the MDA.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

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

ANALYTICAL RESULTS CONTINUED

TOTAL STRONTIUM

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

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

TRITIUM

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

Samples demonstrated acceptable results for all Tritium analyses. The Tritium method blank demonstrated an acceptable result. Results for the Tritium duplicate demonstrated an acceptable relative percent difference and normalized difference. 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 replicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the 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: 1/23/2020

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	11/27/2019	19-10094	Tritium	LANL ER-210 Modified	2.05E+02	7.37E+00				pCi/g
19-10094-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	11/27/2019	19-10094	Tritium	LANL ER-210 Modified	2.03E+02	5.41E+00	1.26E+01	3.83E+00		pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	11/27/2019	19-10094	Tritium	LANL ER-210 Modified	9.38E-01	2.26E+00	2.26E+00	3.84E+00	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	11/27/2019	19-10094	Tritium	LANL ER-210 Modified	1.65E+00	2.22E+00	2.22E+00	3.75E+00	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	11/27/2019	19-10094	Tritium	LANL ER-210 Modified	1.66E+00	2.24E+00	2.24E+00	3.77E+00	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	11/27/2019	19-10094	Tritium	LANL ER-210 Modified	9.45E-01	2.28E+00	2.28E+00	3.87E+00	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	11/28/2019	19-10094	Tritium	LANL ER-210 Modified	7.40E-01	2.23E+00	2.23E+00	3.79E+00	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	11/28/2019	19-10094	Tritium	LANL ER-210 Modified	3.62E-01	2.17E+00	2.17E+00	3.71E+00	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	11/28/2019	19-10094	Tritium	LANL ER-210 Modified	1.64E+00	2.21E+00	2.22E+00	3.73E+00	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	11/28/2019	19-10094	Tritium	LANL ER-210 Modified	-1.59E+00	2.06E+00	2.06E+00	3.62E+00	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	11/28/2019	19-10094	Tritium	LANL ER-210 Modified	0.00E+00	2.23E+00	2.23E+00	3.83E+00	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	11/28/2019	19-10094	Tritium	LANL ER-210 Modified	1.49E+00	2.26E+00	2.27E+00	3.83E+00	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	11/28/2019	19-10094	Tritium	LANL ER-210 Modified	5.40E-01	2.16E+00	2.16E+00	3.69E+00	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	11/28/2019	19-10094	Tritium	LANL ER-210 Modified	-1.80E-01	2.14E+00	2.14E+00	3.69E+00	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	11/28/2019	19-10094	Tritium	LANL ER-210 Modified	-1.12E+00	2.20E+00	2.20E+00	3.83E+00	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	11/28/2019	19-10094	Tritium	LANL ER-210 Modified	-7.36E-01	2.17E+00	2.17E+00	3.77E+00	U	pCi/g
19-10094-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	1.53E+03	4.59E+01				pCi/g
19-10094-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	1.56E+03	1.34E+01	9.29E+01	3.39E+00		pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	-1.67E+00	1.90E+00	1.91E+00	3.36E+00	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	-1.83E+00	1.80E+00	1.80E+00	3.19E+00	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	8.92E-01	2.01E+00	2.01E+00	3.41E+00	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	-1.55E-01	1.72E+00	1.72E+00	2.98E+00	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	-1.81E-01	2.01E+00	2.01E+00	3.47E+00	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	-7.10E-01	1.95E+00	1.95E+00	3.40E+00	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	-1.16E+00	1.95E+00	1.95E+00	3.42E+00	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	1.61E-01	1.80E+00	1.80E+00	3.09E+00	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	-1.31E+00	1.91E+00	1.91E+00	3.35E+00	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	-7.50E-01	2.06E+00	2.06E+00	3.59E+00	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	5.95E-01	1.91E+00	1.91E+00	3.25E+00	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	-9.69E-01	1.93E+00	1.93E+00	3.37E+00	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	-3.51E-01	1.94E+00	1.94E+00	3.37E+00	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	1/4/2020	19-10094	Nickel-63	ASTM 3500-Ni Modified	-5.06E-01	1.86E+00	1.86E+00	3.23E+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

0019

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	5.03E+01	2.82E-01				pCi/g
19-10094-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	5.19E+01	1.44E+00	1.81E+01	7.56E-01		pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	2.61E-01	3.65E-01	3.76E-01	7.51E-01	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	9.34E-02	3.46E-01	3.48E-01	7.30E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	1.90E-01	3.03E-01	3.10E-01	6.27E-01	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	3.57E-01	2.80E-01	3.06E-01	5.58E-01	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	5.07E-02	3.08E-01	3.09E-01	6.53E-01	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	9.84E-02	2.98E-01	3.00E-01	6.27E-01	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	2.25E-01	3.15E-01	3.24E-01	6.48E-01	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	-9.48E-02	2.75E-01	2.77E-01	6.02E-01	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	3.15E-01	3.01E-01	3.20E-01	6.09E-01	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	1.21E-01	2.66E-01	2.69E-01	5.55E-01	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	6.17E-01	3.66E-01	4.24E-01	7.11E-01	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	-1.37E-01	2.81E-01	2.86E-01	6.27E-01	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	2.55E-01	3.70E-01	3.81E-01	7.63E-01	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	11/22/2019	19-10094	Strontium-90	ElChroM SRW01 Modified	5.70E-02	3.69E-01	3.69E-01	7.86E-01	U	pCi/g
19-10094-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
19-10094-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
19-10094-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Cobalt-60	EPA 901.1 Modified	1.32E+02	7.64E+00	1.02E+01	8.45E-01		pCi/g
19-10094-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Cesium-137	EPA 901.1 Modified	8.37E+01	7.17E+00	8.36E+00	1.03E+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

0020

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Actinium-228	EPA 901.1 Modified	2.05E-02	2.34E-02	2.35E-02	7.34E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Silver-108m	EPA 901.1 Modified	1.87E-03	1.95E-02	1.95E-02	2.65E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Americium-241	EPA 901.1 Modified	-7.35E-02	4.70E-02	4.71E-02	6.52E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Barium-133	EPA 901.1 Modified	-3.27E-02	2.89E-02	2.90E-02	3.57E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Bismuth-214	EPA 901.1 Modified	3.94E-02	4.32E-02	4.32E-02	8.10E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Cobalt-60	EPA 901.1 Modified	6.46E-03	1.93E-02	1.93E-02	3.71E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Cesium-134	EPA 901.1 Modified	1.42E-02	2.00E-02	2.00E-02	2.97E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Cesium-137	EPA 901.1 Modified	2.21E-02	1.92E-02	1.93E-02	4.00E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Europium-152	EPA 901.1 Modified	4.66E-02	7.52E-02	7.52E-02	1.03E-01	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Europium-154	EPA 901.1 Modified	-7.12E-03	5.13E-02	5.13E-02	4.96E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Europium-155	EPA 901.1 Modified	-4.80E-03	5.10E-02	5.10E-02	7.37E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Holmium-166m	EPA 901.1 Modified	0.00E+00	3.60E-02	3.60E-02	2.97E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Iodine-129	EPA 901.1 Modified	3.54E-02	1.27E-01	1.27E-01	2.10E-01	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.76E-01	2.77E-01	2.77E-01	5.23E-01	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Manganese-54	EPA 901.1 Modified	-2.08E-03	1.97E-02	1.97E-02	3.19E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	2.99E-03	1.36E-02	1.36E-02	2.49E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Niobium-94	EPA 901.1 Modified	-8.19E-03	2.37E-02	2.37E-02	3.55E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Lead-210	EPA 901.1 Modified	5.04E-01	4.72E-01	4.73E-01	8.24E-01	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Lead-212	EPA 901.1 Modified	8.83E-03	3.42E-02	3.42E-02	5.40E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Lead-214	EPA 901.1 Modified	1.66E-02	4.11E-02	4.11E-02	6.77E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Promethium-145	EPA 901.1 Modified	-9.32E-02	8.40E-02	8.41E-02	1.23E-01	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Radium-226	EPA 901.1 Modified	3.94E-02	4.32E-02	4.32E-02	8.10E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Antimony-125	EPA 901.1 Modified	-4.75E-03	6.05E-02	6.05E-02	9.32E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Thorium-234	EPA 901.1 Modified	6.36E-01	3.93E-01	3.94E-01	6.97E-01	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Thallium-208	EPA 901.1 Modified	1.15E-02	5.59E-02	5.59E-02	9.43E-02	U	pCi/g
19-10094-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10094	Uranium-235	EPA 901.1 Modified	6.16E-02	1.12E-01	1.12E-01	1.80E-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

0021

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Actinium-228	EPA 901.1 Modified	1.95E-01	2.13E-01	2.13E-01	3.80E-01	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Silver-108m	EPA 901.1 Modified	-3.43E-02	5.63E-02	5.64E-02	6.19E-02	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Americium-241	EPA 901.1 Modified	-4.34E-02	7.58E-02	7.59E-02	1.07E-01	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Barium-133	EPA 901.1 Modified	1.64E-02	2.37E-02	2.37E-02	1.10E-01	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Bismuth-214	EPA 901.1 Modified	2.36E-01	9.33E-02	9.41E-02	9.18E-02		pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Cobalt-60	EPA 901.1 Modified	-3.00E-02	7.92E-02	7.92E-02	9.02E-02	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Cesium-134	EPA 901.1 Modified	-1.12E-01	7.73E-02	7.75E-02	8.06E-02	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Cesium-137	EPA 901.1 Modified	5.70E-02	5.06E-02	5.07E-02	8.74E-02	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Europium-152	EPA 901.1 Modified	5.55E-02	7.68E-02	7.68E-02	1.68E-01	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Europium-154	EPA 901.1 Modified	8.97E-02	1.68E-01	1.69E-01	8.41E-02	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Europium-155	EPA 901.1 Modified	4.72E-02	7.88E-02	7.88E-02	1.20E-01	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Holmium-166m	EPA 901.1 Modified	-7.05E-03	9.19E-02	9.19E-02	5.69E-02	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Iodine-129	EPA 901.1 Modified	6.99E-02	1.31E-01	1.31E-01	2.00E-01	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Potassium-40	EPA 901.1 Modified	8.91E+00	1.54E+00	1.61E+00	8.07E-01		pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Manganese-54	EPA 901.1 Modified	2.74E-03	5.59E-02	5.59E-02	9.24E-02	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	6.41E-02	4.01E-02	4.02E-02	7.08E-02	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Niobium-94	EPA 901.1 Modified	-3.37E-03	4.62E-02	4.62E-02	7.46E-02	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Lead-210	EPA 901.1 Modified	8.57E-01	5.94E-01	5.96E-01	1.04E+00	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Lead-212	EPA 901.1 Modified	2.93E-01	1.29E-01	1.29E-01	1.61E-01		pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Lead-214	EPA 901.1 Modified	2.24E-01	1.09E-01	1.10E-01	1.64E-01		pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Promethium-145	EPA 901.1 Modified	-4.45E-02	7.95E-02	7.95E-02	1.51E-01	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Radium-226	EPA 901.1 Modified	2.36E-01	9.33E-02	9.41E-02	9.18E-02		pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Antimony-125	EPA 901.1 Modified	-3.47E-02	1.34E-01	1.34E-01	1.81E-01	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Thorium-234	EPA 901.1 Modified	9.14E-01	6.72E-01	6.74E-01	1.05E+00	U	pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Thallium-208	EPA 901.1 Modified	2.42E-01	1.29E-01	1.29E-01	1.74E-01		pCi/g
19-10094-03	DUP	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Uranium-235	EPA 901.1 Modified	2.24E-02	1.68E-01	1.68E-01	3.23E-01	U	pCi/g

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

0022

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Jeffrey Graham	SDG:	19-10094
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Actinium-228	EPA 901.1 Modified	4.02E-01	1.65E-01	1.67E-01	2.99E-01		pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Silver-108m	EPA 901.1 Modified	4.18E-04	5.19E-02	5.19E-02	6.01E-02	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Americium-241	EPA 901.1 Modified	-3.36E-02	7.30E-02	7.30E-02	1.02E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Barium-133	EPA 901.1 Modified	-1.32E-02	2.20E-02	2.20E-02	1.08E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Bismuth-214	EPA 901.1 Modified	2.34E-01	1.10E-01	1.10E-01	4.47E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Cobalt-60	EPA 901.1 Modified	-2.95E-02	7.10E-02	7.10E-02	1.05E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Cesium-134	EPA 901.1 Modified	-1.03E-03	3.16E-02	3.16E-02	7.07E-02	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Cesium-137	EPA 901.1 Modified	5.60E-02	5.35E-02	5.36E-02	8.82E-02	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Europium-152	EPA 901.1 Modified	5.02E-02	1.31E-01	1.31E-01	1.55E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Europium-154	EPA 901.1 Modified	1.10E-01	1.52E-01	1.52E-01	7.89E-02	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Europium-155	EPA 901.1 Modified	9.95E-03	8.23E-02	8.23E-02	1.21E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Holmium-166m	EPA 901.1 Modified	-2.33E-02	8.61E-02	8.61E-02	6.31E-02	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Iodine-129	EPA 901.1 Modified	-3.92E-02	1.04E-01	1.04E-01	1.94E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.07E+01	1.67E+00	1.76E+00	1.18E-01		pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Manganese-54	EPA 901.1 Modified	-5.87E-03	6.37E-02	6.37E-02	1.02E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	-4.82E-02	3.90E-02	3.91E-02	5.88E-02	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Niobium-94	EPA 901.1 Modified	-4.84E-03	4.73E-02	4.73E-02	7.66E-02	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Lead-210	EPA 901.1 Modified	6.10E-01	7.06E-01	7.07E-01	1.09E+00	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Lead-212	EPA 901.1 Modified	2.86E-01	1.33E-01	1.33E-01	1.73E-01		pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Lead-214	EPA 901.1 Modified	2.45E-01	1.30E-01	1.30E-01	1.64E-01		pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Promethium-145	EPA 901.1 Modified	6.79E-04	1.04E-01	1.04E-01	1.52E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Radium-226	EPA 901.1 Modified	2.34E-01	1.10E-01	1.10E-01	4.47E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Antimony-125	EPA 901.1 Modified	1.47E-02	1.32E-01	1.32E-01	1.88E-01	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Thorium-234	EPA 901.1 Modified	6.67E-01	6.52E-01	6.53E-01	1.01E+00	U	pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Thallium-208	EPA 901.1 Modified	3.38E-01	1.11E-01	1.12E-01	1.26E-01		pCi/g
19-10094-04	DO	L1-12205-E-FSGS-104-SS-A	09/09/19 13:06	10/21/2019	10/23/2019	19-10094	Uranium-235	EPA 901.1 Modified	-2.67E-02	2.26E-01	2.26E-01	3.30E-01	U	pCi/g

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

EBERLINE ANALYTICAL

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Actinium-228	EPA 901.1 Modified	2.28E-01	1.44E-01	1.45E-01	2.16E-01		pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Silver-108m	EPA 901.1 Modified	-1.38E-02	4.66E-02	4.66E-02	4.93E-02	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Americium-241	EPA 901.1 Modified	-6.88E-02	8.22E-02	8.22E-02	1.23E-01	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Barium-133	EPA 901.1 Modified	-9.71E-03	2.44E-02	2.44E-02	8.08E-02	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Bismuth-214	EPA 901.1 Modified	2.78E-01	1.12E-01	1.13E-01	1.92E-01		pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Cobalt-60	EPA 901.1 Modified	2.69E-02	4.79E-02	4.79E-02	7.86E-02	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Cesium-134	EPA 901.1 Modified	-7.34E-03	1.98E-02	1.98E-02	6.55E-02	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Cesium-137	EPA 901.1 Modified	-4.84E-02	4.80E-02	4.81E-02	6.19E-02	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Europium-152	EPA 901.1 Modified	1.04E-01	1.51E-01	1.51E-01	1.92E-01	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Europium-154	EPA 901.1 Modified	-4.34E-02	1.35E-01	1.35E-01	9.61E-02	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Europium-155	EPA 901.1 Modified	3.61E-02	9.54E-02	9.55E-02	1.42E-01	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Holmium-166m	EPA 901.1 Modified	1.66E-02	7.43E-02	7.43E-02	6.14E-02	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Iodine-129	EPA 901.1 Modified	5.47E-03	1.94E-01	1.94E-01	3.17E-01	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.04E+01	1.59E+00	1.68E+00	1.03E+00		pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Manganese-54	EPA 901.1 Modified	3.85E-02	4.32E-02	4.32E-02	7.10E-02	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	-1.36E-02	4.14E-02	4.14E-02	4.83E-02	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Niobium-94	EPA 901.1 Modified	-1.63E-02	4.13E-02	4.13E-02	5.92E-02	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Lead-210	EPA 901.1 Modified	3.32E+00	1.89E+00	1.89E+00	3.05E+00		pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Lead-212	EPA 901.1 Modified	3.05E-01	1.12E-01	1.13E-01	1.60E-01		pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Lead-214	EPA 901.1 Modified	2.57E-01	9.31E-02	9.40E-02	1.67E-01		pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Promethium-145	EPA 901.1 Modified	-1.09E-02	6.78E-02	6.78E-02	2.14E-01	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Radium-226	EPA 901.1 Modified	2.78E-01	1.12E-01	1.13E-01	1.92E-01		pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Antimony-125	EPA 901.1 Modified	7.07E-02	9.68E-02	9.68E-02	1.64E-01	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Thorium-234	EPA 901.1 Modified	8.35E-01	7.19E-01	7.21E-01	1.21E+00	U	pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Thallium-208	EPA 901.1 Modified	2.73E-01	1.23E-01	1.24E-01	5.14E-02		pCi/g
19-10094-05	TRG	L1-12205-E-QIGS-101-SS-A	09/11/19 09:00	10/21/2019	10/23/2019	19-10094	Uranium-235	EPA 901.1 Modified	4.93E-02	2.35E-01	2.35E-01	3.52E-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

0024

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Actinium-228	EPA 901.1 Modified	2.93E-01	2.16E-01	2.17E-01	3.95E-01	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Silver-108m	EPA 901.1 Modified	-4.71E-02	6.01E-02	6.01E-02	6.36E-02	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Americium-241	EPA 901.1 Modified	-3.58E-03	7.44E-02	7.44E-02	1.09E-01	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Barium-133	EPA 901.1 Modified	6.15E-03	3.24E-02	3.24E-02	1.09E-01	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Bismuth-214	EPA 901.1 Modified	1.77E-01	1.00E-01	1.01E-01	2.12E-01	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Cobalt-60	EPA 901.1 Modified	2.76E-03	6.60E-02	6.60E-02	9.87E-02	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Cesium-134	EPA 901.1 Modified	8.82E-03	3.05E-02	3.05E-02	7.83E-02	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Cesium-137	EPA 901.1 Modified	-3.10E-03	6.00E-02	6.00E-02	8.20E-02	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Europium-152	EPA 901.1 Modified	-2.69E-02	1.71E-01	1.71E-01	1.53E-01	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Europium-154	EPA 901.1 Modified	2.06E-02	1.69E-01	1.69E-01	7.67E-02	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Europium-155	EPA 901.1 Modified	4.16E-02	8.15E-02	8.15E-02	1.22E-01	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Holmium-166m	EPA 901.1 Modified	5.72E-02	4.36E-02	4.37E-02	8.36E-02	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Iodine-129	EPA 901.1 Modified	-9.00E-02	1.31E-01	1.32E-01	1.83E-01	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.14E+01	1.81E+00	1.90E+00	8.99E-01		pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Manganese-54	EPA 901.1 Modified	5.07E-03	4.93E-02	4.93E-02	8.29E-02	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	8.90E-03	3.64E-02	3.64E-02	6.28E-02	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Niobium-94	EPA 901.1 Modified	4.50E-02	5.25E-02	5.26E-02	7.94E-02	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Lead-210	EPA 901.1 Modified	-6.34E-02	6.96E-01	6.96E-01	1.01E+00	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Lead-212	EPA 901.1 Modified	2.77E-01	1.39E-01	1.40E-01	1.91E-01		pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Lead-214	EPA 901.1 Modified	2.65E-01	1.15E-01	1.15E-01	1.67E-01		pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Promethium-145	EPA 901.1 Modified	-2.17E-02	1.02E-01	1.02E-01	1.49E-01	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Radium-226	EPA 901.1 Modified	1.77E-01	1.00E-01	1.01E-01	2.12E-01	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Antimony-125	EPA 901.1 Modified	-5.88E-02	1.46E-01	1.46E-01	1.90E-01	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Thorium-234	EPA 901.1 Modified	4.35E-01	7.06E-01	7.07E-01	1.06E+00	U	pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Thallium-208	EPA 901.1 Modified	3.35E-01	1.87E-01	1.87E-01	2.71E-01		pCi/g
19-10094-06	TRG	L1-12205-D-FSGS-117-SS-A	09/09/19 10:22	10/21/2019	10/23/2019	19-10094	Uranium-235	EPA 901.1 Modified	2.17E-01	2.27E-01	2.27E-01	3.55E-01	U	pCi/g

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

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Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Actinium-228	EPA 901.1 Modified	2.29E-01	1.61E-01	1.61E-01	2.82E-01	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Silver-108m	EPA 901.1 Modified	-1.93E-02	3.47E-02	3.47E-02	4.87E-02	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Americium-241	EPA 901.1 Modified	-8.35E-02	6.67E-02	6.69E-02	9.90E-02	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Barium-133	EPA 901.1 Modified	-3.91E-02	3.96E-02	3.96E-02	7.24E-02	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Bismuth-214	EPA 901.1 Modified	1.89E-01	8.21E-02	8.27E-02	2.40E-01	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Cobalt-60	EPA 901.1 Modified	-6.02E-03	4.90E-02	4.90E-02	4.89E-02	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Cesium-134	EPA 901.1 Modified	-6.68E-03	1.79E-02	1.79E-02	5.41E-02	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Cesium-137	EPA 901.1 Modified	-3.10E-02	3.96E-02	3.96E-02	5.35E-02	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Europium-152	EPA 901.1 Modified	-2.17E-02	8.48E-02	8.48E-02	1.51E-01	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Europium-154	EPA 901.1 Modified	3.78E-03	1.04E-01	1.04E-01	7.68E-02	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Europium-155	EPA 901.1 Modified	3.20E-02	8.11E-02	8.11E-02	1.21E-01	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Holmium-166m	EPA 901.1 Modified	3.79E-02	6.53E-02	6.53E-02	5.13E-02	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Iodine-129	EPA 901.1 Modified	1.31E-01	1.59E-01	1.59E-01	2.60E-01	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Potassium-40	EPA 901.1 Modified	9.42E+00	1.36E+00	1.44E+00	6.67E-01		pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Manganese-54	EPA 901.1 Modified	2.09E-02	3.43E-02	3.44E-02	5.91E-02	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	3.30E-02	2.73E-02	2.74E-02	3.72E-02	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Niobium-94	EPA 901.1 Modified	-7.46E-03	3.38E-02	3.38E-02	4.77E-02	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Lead-210	EPA 901.1 Modified	8.26E-01	8.81E-01	8.82E-01	1.47E+00	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Lead-212	EPA 901.1 Modified	2.63E-01	9.22E-02	9.32E-02	1.30E-01		pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Lead-214	EPA 901.1 Modified	2.07E-01	8.04E-02	8.11E-02	1.22E-01		pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Promethium-145	EPA 901.1 Modified	-6.26E-02	1.12E-01	1.12E-01	1.76E-01	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Radium-226	EPA 901.1 Modified	1.89E-01	8.21E-02	8.27E-02	2.40E-01	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Antimony-125	EPA 901.1 Modified	-1.01E-02	8.91E-02	8.91E-02	1.33E-01	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Thorium-234	EPA 901.1 Modified	7.13E-01	5.86E-01	5.87E-01	9.92E-01	U	pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Thallium-208	EPA 901.1 Modified	2.25E-01	9.59E-02	9.66E-02	1.73E-01		pCi/g
19-10094-07	TRG	L1-12205-E-FSGS-117-SS-A	09/09/19 13:32	10/21/2019	10/23/2019	19-10094	Uranium-235	EPA 901.1 Modified	-1.22E-01	2.01E-01	2.01E-01	2.81E-01	U	pCi/g

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

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Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Actinium-228	EPA 901.1 Modified	1.90E-01	1.23E-01	1.24E-01	2.15E-01	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Silver-108m	EPA 901.1 Modified	-2.49E-02	4.00E-02	4.00E-02	4.40E-02	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Americium-241	EPA 901.1 Modified	-1.07E-01	6.95E-02	6.97E-02	1.00E-01	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Barium-133	EPA 901.1 Modified	-3.82E-03	6.83E-02	6.83E-02	7.94E-02	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Bismuth-214	EPA 901.1 Modified	1.99E-01	9.77E-02	9.83E-02	1.77E-01		pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Cobalt-60	EPA 901.1 Modified	1.15E-02	4.16E-02	4.16E-02	4.57E-02	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Cesium-134	EPA 901.1 Modified	-4.37E-03	1.43E-02	1.43E-02	5.55E-02	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Cesium-137	EPA 901.1 Modified	-1.24E-02	3.62E-02	3.62E-02	5.24E-02	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Europium-152	EPA 901.1 Modified	-3.25E-02	1.38E-01	1.38E-01	1.55E-01	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Europium-154	EPA 901.1 Modified	5.52E-02	8.13E-02	8.14E-02	7.74E-02	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Europium-155	EPA 901.1 Modified	1.38E-01	7.12E-02	7.16E-02	1.58E-01	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Holmium-166m	EPA 901.1 Modified	-1.48E-02	7.02E-02	7.02E-02	5.09E-02	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Iodine-129	EPA 901.1 Modified	-4.36E-03	8.14E-02	8.14E-02	2.57E-01	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.24E+01	1.61E+00	1.73E+00	4.23E-01		pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Manganese-54	EPA 901.1 Modified	2.93E-02	3.46E-02	3.46E-02	5.72E-02	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	4.78E-03	2.92E-02	2.92E-02	4.27E-02	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Niobium-94	EPA 901.1 Modified	-4.82E-03	3.44E-02	3.44E-02	5.21E-02	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Lead-210	EPA 901.1 Modified	4.56E-02	7.22E-01	7.22E-01	1.15E+00	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Lead-212	EPA 901.1 Modified	3.07E-01	8.06E-02	8.21E-02	1.35E-01		pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Lead-214	EPA 901.1 Modified	2.43E-01	9.00E-02	9.09E-02	1.54E-01		pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Promethium-145	EPA 901.1 Modified	-1.00E-01	1.17E-01	1.17E-01	1.76E-01	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Radium-226	EPA 901.1 Modified	1.99E-01	9.77E-02	9.83E-02	1.77E-01		pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Antimony-125	EPA 901.1 Modified	-5.54E-02	9.99E-02	9.99E-02	1.37E-01	U	pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Thorium-234	EPA 901.1 Modified	1.57E+00	9.41E-01	9.44E-01	1.54E+00		pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Thallium-208	EPA 901.1 Modified	3.08E-01	1.05E-01	1.07E-01	4.24E-02		pCi/g
19-10094-08	TRG	L1-12205-A-FSGS-116-SS-A	09/25/19 13:15	10/21/2019	10/24/2019	19-10094	Uranium-235	EPA 901.1 Modified	8.21E-02	1.96E-01	1.96E-01	2.98E-01	U	pCi/g

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

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Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Actinium-228	EPA 901.1 Modified	4.19E-01	1.76E-01	1.77E-01	3.97E-01		pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Silver-108m	EPA 901.1 Modified	1.26E-02	5.22E-02	5.23E-02	5.68E-02	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Americium-241	EPA 901.1 Modified	-3.90E-04	7.24E-02	7.24E-02	1.04E-01	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Barium-133	EPA 901.1 Modified	-1.01E-02	3.61E-02	3.61E-02	1.04E-01	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Bismuth-214	EPA 901.1 Modified	3.19E-01	1.32E-01	1.33E-01	1.98E-01		pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Cobalt-60	EPA 901.1 Modified	1.66E-02	6.20E-02	6.20E-02	8.11E-02	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Cesium-134	EPA 901.1 Modified	1.72E-02	2.24E-02	2.24E-02	8.27E-02	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Cesium-137	EPA 901.1 Modified	8.24E-03	5.64E-02	5.64E-02	7.89E-02	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Europium-152	EPA 901.1 Modified	-2.60E-02	1.06E-01	1.06E-01	1.55E-01	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Europium-154	EPA 901.1 Modified	4.52E-03	1.56E-01	1.56E-01	7.88E-02	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Europium-155	EPA 901.1 Modified	7.10E-02	7.13E-02	7.14E-02	1.20E-01	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Holmium-166m	EPA 901.1 Modified	-5.29E-02	8.61E-02	8.62E-02	5.92E-02	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Iodine-129	EPA 901.1 Modified	-1.13E-01	1.37E-01	1.37E-01	1.86E-01	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.10E+01	1.72E+00	1.81E+00	6.35E-01		pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Manganese-54	EPA 901.1 Modified	2.16E-02	5.43E-02	5.43E-02	9.14E-02	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	3.06E-02	3.78E-02	3.78E-02	5.49E-02	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Niobium-94	EPA 901.1 Modified	-1.24E-02	4.12E-02	4.12E-02	6.38E-02	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Lead-210	EPA 901.1 Modified	1.06E+00	6.77E-01	6.79E-01	1.07E+00	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Lead-212	EPA 901.1 Modified	2.91E-01	1.27E-01	1.28E-01	1.60E-01		pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Lead-214	EPA 901.1 Modified	2.35E-01	1.03E-01	1.04E-01	2.08E-01		pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Promethium-145	EPA 901.1 Modified	6.86E-02	9.47E-02	9.48E-02	1.46E-01	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Radium-226	EPA 901.1 Modified	3.19E-01	1.32E-01	1.33E-01	1.98E-01		pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Antimony-125	EPA 901.1 Modified	-2.44E-02	1.23E-01	1.23E-01	1.79E-01	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Thorium-234	EPA 901.1 Modified	8.52E-01	6.45E-01	6.47E-01	1.01E+00	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Thallium-208	EPA 901.1 Modified	1.92E-01	1.66E-01	1.66E-01	2.66E-01	U	pCi/g
19-10094-09	TRG	L1-12111-A-QJGS-001-SS-A	09/23/19 13:30	10/21/2019	10/24/2019	19-10094	Uranium-235	EPA 901.1 Modified	2.19E-01	2.30E-01	2.30E-01	3.57E-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

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Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Actinium-228	EPA 901.1 Modified	3.80E-01	1.71E-01	1.72E-01	4.26E-01	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Silver-108m	EPA 901.1 Modified	-4.39E-02	4.34E-02	4.34E-02	5.21E-02	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Americium-241	EPA 901.1 Modified	-1.33E-01	7.69E-02	7.72E-02	1.11E-01	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Barium-133	EPA 901.1 Modified	4.43E-03	2.37E-02	2.37E-02	9.50E-02	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Bismuth-214	EPA 901.1 Modified	4.74E-01	9.00E-02	9.32E-02	6.33E-02		pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Cobalt-60	EPA 901.1 Modified	-3.81E-03	4.97E-02	4.97E-02	7.12E-02	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Cesium-134	EPA 901.1 Modified	-2.28E-01	8.18E-02	8.27E-02	6.17E-02	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Cesium-137	EPA 901.1 Modified	1.53E-03	4.17E-02	4.17E-02	6.05E-02	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Europium-152	EPA 901.1 Modified	7.47E-03	7.97E-02	7.97E-02	1.69E-01	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Europium-154	EPA 901.1 Modified	8.36E-03	1.19E-01	1.19E-01	8.55E-02	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Europium-155	EPA 901.1 Modified	8.38E-02	9.24E-02	9.25E-02	1.39E-01	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Holmium-166m	EPA 901.1 Modified	3.18E-02	6.11E-02	6.12E-02	5.83E-02	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Iodine-129	EPA 901.1 Modified	3.58E-02	1.68E-01	1.68E-01	2.74E-01	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.24E+01	1.65E+00	1.77E+00	7.28E-01		pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Manganese-54	EPA 901.1 Modified	2.67E-02	3.61E-02	3.61E-02	6.24E-02	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	-3.76E-03	3.30E-02	3.30E-02	4.72E-02	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Niobium-94	EPA 901.1 Modified	2.05E-02	3.10E-02	3.10E-02	5.41E-02	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Lead-210	EPA 901.1 Modified	6.87E-01	7.76E-01	7.77E-01	1.30E+00	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Lead-212	EPA 901.1 Modified	4.09E-01	1.16E-01	1.18E-01	1.52E-01		pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Lead-214	EPA 901.1 Modified	4.65E-01	1.09E-01	1.12E-01	1.61E-01		pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Promethium-145	EPA 901.1 Modified	-6.90E-03	1.23E-01	1.23E-01	1.99E-01	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Radium-226	EPA 901.1 Modified	4.74E-01	9.00E-02	9.32E-02	6.33E-02		pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Antimony-125	EPA 901.1 Modified	-1.75E-02	1.06E-01	1.06E-01	1.59E-01	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Thorium-234	EPA 901.1 Modified	1.06E+00	1.11E+00	1.11E+00	1.85E+00	U	pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Thallium-208	EPA 901.1 Modified	3.69E-01	1.20E-01	1.21E-01	2.13E-01		pCi/g
19-10094-10	TRG	L1-12111-A-FJGS-003-SS-A	09/23/19 13:34	10/21/2019	10/24/2019	19-10094	Uranium-235	EPA 901.1 Modified	1.15E-01	2.23E-01	2.23E-01	3.39E-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
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601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Jeffrey Graham	SDG:	19-10094
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Actinium-228	EPA 901.1 Modified	1.02E-01	2.21E-01	2.21E-01	3.77E-01	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Silver-108m	EPA 901.1 Modified	-1.31E-02	4.96E-02	4.96E-02	5.64E-02	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Americium-241	EPA 901.1 Modified	-1.26E-02	7.83E-02	7.83E-02	1.13E-01	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Barium-133	EPA 901.1 Modified	1.41E-02	2.92E-02	2.92E-02	1.16E-01	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Bismuth-214	EPA 901.1 Modified	2.59E-01	1.04E-01	1.05E-01	9.37E-02		pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Cobalt-60	EPA 901.1 Modified	8.91E-03	6.24E-02	6.24E-02	1.01E-01	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Cesium-134	EPA 901.1 Modified	8.51E-03	3.27E-02	3.27E-02	8.53E-02	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Cesium-137	EPA 901.1 Modified	4.33E-02	5.93E-02	5.94E-02	9.40E-02	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Europium-152	EPA 901.1 Modified	3.43E-02	1.41E-01	1.41E-01	1.65E-01	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Europium-154	EPA 901.1 Modified	4.67E-02	1.91E-01	1.91E-01	8.45E-02	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Europium-155	EPA 901.1 Modified	1.24E-01	8.33E-02	8.36E-02	1.31E-01	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Holmium-166m	EPA 901.1 Modified	-3.80E-02	8.63E-02	8.64E-02	6.25E-02	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Iodine-129	EPA 901.1 Modified	4.16E-03	1.41E-01	1.41E-01	2.09E-01	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.12E+01	1.75E+00	1.84E+00	1.20E-01		pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Manganese-54	EPA 901.1 Modified	2.22E-02	4.99E-02	4.99E-02	8.77E-02	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	-1.91E-02	4.27E-02	4.28E-02	6.57E-02	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Niobium-94	EPA 901.1 Modified	2.71E-02	5.12E-02	5.12E-02	7.66E-02	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Lead-210	EPA 901.1 Modified	9.11E-01	7.16E-01	7.18E-01	1.13E+00	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Lead-212	EPA 901.1 Modified	3.46E-01	1.54E-01	1.55E-01	1.98E-01		pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Lead-214	EPA 901.1 Modified	2.30E-01	1.50E-01	1.50E-01	2.14E-01		pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Promethium-145	EPA 901.1 Modified	2.37E-03	1.03E-01	1.03E-01	1.52E-01	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Radium-226	EPA 901.1 Modified	2.59E-01	1.04E-01	1.05E-01	9.37E-02		pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Antimony-125	EPA 901.1 Modified	3.67E-02	1.28E-01	1.28E-01	1.89E-01	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Thorium-234	EPA 901.1 Modified	7.04E-01	6.95E-01	6.96E-01	1.08E+00	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Thallium-208	EPA 901.1 Modified	2.29E-01	1.72E-01	1.72E-01	2.67E-01	U	pCi/g
19-10094-11	TRG	L1-12205-B-FSGS-105-SS-A	09/25/19 09:08	10/21/2019	10/24/2019	19-10094	Uranium-235	EPA 901.1 Modified	3.71E-02	2.52E-01	2.52E-01	3.76E-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

0030

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Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Actinium-228	EPA 901.1 Modified	2.01E-01	1.55E-01	1.56E-01	2.73E-01	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Silver-108m	EPA 901.1 Modified	6.42E-03	3.83E-02	3.83E-02	4.22E-02	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Americium-241	EPA 901.1 Modified	-4.53E-02	6.70E-02	6.70E-02	1.03E-01	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Barium-133	EPA 901.1 Modified	-5.03E-03	1.61E-02	1.61E-02	7.69E-02	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Bismuth-214	EPA 901.1 Modified	2.72E-01	8.96E-02	9.07E-02	1.92E-01		pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Cobalt-60	EPA 901.1 Modified	1.53E-02	5.20E-02	5.20E-02	7.05E-02	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Cesium-134	EPA 901.1 Modified	-1.69E-01	7.38E-02	7.43E-02	5.13E-02	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Cesium-137	EPA 901.1 Modified	1.35E-03	4.17E-02	4.17E-02	6.43E-02	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Europium-152	EPA 901.1 Modified	-6.56E-02	1.53E-01	1.53E-01	1.55E-01	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Europium-154	EPA 901.1 Modified	5.22E-02	1.12E-01	1.12E-01	7.72E-02	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Europium-155	EPA 901.1 Modified	1.94E-02	7.40E-02	7.40E-02	1.22E-01	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Holmium-166m	EPA 901.1 Modified	-4.69E-03	5.78E-02	5.78E-02	5.13E-02	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Iodine-129	EPA 901.1 Modified	-4.72E-02	1.70E-01	1.70E-01	2.70E-01	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.14E+01	1.52E+00	1.63E+00	4.61E-01		pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Manganese-54	EPA 901.1 Modified	-1.37E-02	4.03E-02	4.03E-02	5.73E-02	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	5.22E-03	3.04E-02	3.04E-02	4.31E-02	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Niobium-94	EPA 901.1 Modified	7.85E-03	3.34E-02	3.34E-02	5.37E-02	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Lead-210	EPA 901.1 Modified	3.79E-01	6.74E-01	6.74E-01	1.12E+00	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Lead-212	EPA 901.1 Modified	2.73E-01	9.71E-02	9.81E-02	1.38E-01		pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Lead-214	EPA 901.1 Modified	2.45E-01	8.77E-02	8.86E-02	1.40E-01		pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Promethium-145	EPA 901.1 Modified	9.36E-03	1.12E-01	1.12E-01	1.81E-01	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Radium-226	EPA 901.1 Modified	2.72E-01	8.96E-02	9.07E-02	1.92E-01		pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Antimony-125	EPA 901.1 Modified	3.89E-02	8.13E-02	8.14E-02	1.34E-01	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Thorium-234	EPA 901.1 Modified	2.95E-01	6.09E-01	6.09E-01	1.00E+00	U	pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Thallium-208	EPA 901.1 Modified	2.21E-01	9.88E-02	9.95E-02	4.28E-02		pCi/g
19-10094-12	TRG	L1-12106-A-FSGS-009-SS-A	09/26/19 12:46	10/21/2019	10/24/2019	19-10094	Uranium-235	EPA 901.1 Modified	2.09E-01	1.96E-01	1.97E-01	3.10E-01	U	pCi/g

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Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10094
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Actinium-228	EPA 901.1 Modified	2.86E-01	1.93E-01	1.94E-01	3.36E-01	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Silver-108m	EPA 901.1 Modified	2.43E-02	3.71E-02	3.71E-02	6.42E-02	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Americium-241	EPA 901.1 Modified	-4.50E-02	7.57E-02	7.57E-02	1.05E-01	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Barium-133	EPA 901.1 Modified	1.52E-02	2.61E-02	2.61E-02	1.11E-01	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Bismuth-214	EPA 901.1 Modified	3.40E-01	1.24E-01	1.25E-01	2.06E-01		pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Cobalt-60	EPA 901.1 Modified	-9.62E-03	7.73E-02	7.73E-02	8.71E-02	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Cesium-134	EPA 901.1 Modified	1.68E-02	2.81E-02	2.81E-02	7.65E-02	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Cesium-137	EPA 901.1 Modified	5.53E-03	4.83E-02	4.83E-02	7.04E-02	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Europium-152	EPA 901.1 Modified	-2.12E-01	2.30E-01	2.31E-01	1.61E-01	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Europium-154	EPA 901.1 Modified	1.13E-02	7.02E-02	7.02E-02	8.10E-02	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Europium-155	EPA 901.1 Modified	-1.43E-02	8.55E-02	8.55E-02	1.23E-01	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Holmium-166m	EPA 901.1 Modified	-2.05E-02	9.28E-02	9.28E-02	5.92E-02	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Iodine-129	EPA 901.1 Modified	-5.33E-02	1.37E-01	1.37E-01	1.97E-01	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.10E+01	1.80E+00	1.88E+00	1.15E+00		pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Manganese-54	EPA 901.1 Modified	1.22E-03	5.54E-02	5.54E-02	8.88E-02	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	6.68E-03	4.40E-02	4.40E-02	4.96E-02	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Niobium-94	EPA 901.1 Modified	4.51E-03	4.77E-02	4.77E-02	7.88E-02	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Lead-210	EPA 901.1 Modified	2.05E-01	7.07E-01	7.07E-01	1.05E+00	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Lead-212	EPA 901.1 Modified	2.62E-01	1.05E-01	1.06E-01	1.79E-01		pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Lead-214	EPA 901.1 Modified	2.99E-01	1.37E-01	1.38E-01	2.02E-01		pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Promethium-145	EPA 901.1 Modified	-1.19E-01	1.08E-01	1.09E-01	1.46E-01	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Radium-226	EPA 901.1 Modified	3.40E-01	1.24E-01	1.25E-01	2.06E-01		pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Antimony-125	EPA 901.1 Modified	-2.52E-02	1.39E-01	1.39E-01	1.90E-01	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Thorium-234	EPA 901.1 Modified	1.58E+00	1.03E+00	1.03E+00	1.69E+00	U	pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Thallium-208	EPA 901.1 Modified	2.67E-01	1.03E-01	1.04E-01	1.23E-01		pCi/g
19-10094-13	TRG	L1-12205-A-FSGS-104-SS-A	09/25/19 12:51	10/21/2019	10/24/2019	19-10094	Uranium-235	EPA 901.1 Modified	2.13E-01	2.22E-01	2.23E-01	3.48E-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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Final Report of Analysis

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Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Actinium-228	EPA 901.1 Modified	3.90E-01	1.48E-01	1.50E-01	2.30E-01		pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Silver-108m	EPA 901.1 Modified	-2.93E-02	4.41E-02	4.41E-02	4.56E-02	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Americium-241	EPA 901.1 Modified	-9.33E-02	7.06E-02	7.08E-02	1.03E-01	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Barium-133	EPA 901.1 Modified	-6.47E-03	1.66E-02	1.66E-02	8.28E-02	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Bismuth-214	EPA 901.1 Modified	2.55E-01	8.03E-02	8.13E-02	6.49E-02		pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Cobalt-60	EPA 901.1 Modified	1.98E-03	5.22E-02	5.22E-02	7.56E-02	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Cesium-134	EPA 901.1 Modified	4.83E-03	2.28E-02	2.28E-02	5.30E-02	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Cesium-137	EPA 901.1 Modified	1.82E-02	3.70E-02	3.71E-02	6.07E-02	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Europium-152	EPA 901.1 Modified	-3.33E-03	1.29E-01	1.29E-01	1.66E-01	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Europium-154	EPA 901.1 Modified	2.35E-02	1.20E-01	1.20E-01	8.33E-02	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Europium-155	EPA 901.1 Modified	2.50E-03	8.65E-02	8.65E-02	1.27E-01	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Holmium-166m	EPA 901.1 Modified	1.23E-02	5.53E-02	5.53E-02	5.48E-02	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Iodine-129	EPA 901.1 Modified	-7.43E-02	1.71E-01	1.71E-01	2.67E-01	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.23E+01	1.65E+00	1.77E+00	7.02E-01		pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Manganese-54	EPA 901.1 Modified	-1.41E-02	3.79E-02	3.79E-02	5.52E-02	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	-2.83E-02	3.40E-02	3.40E-02	4.27E-02	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Niobium-94	EPA 901.1 Modified	1.14E-02	3.01E-02	3.01E-02	4.97E-02	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Lead-210	EPA 901.1 Modified	8.79E-01	9.76E-01	9.77E-01	1.63E+00	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Lead-212	EPA 901.1 Modified	3.42E-01	1.10E-01	1.11E-01	1.51E-01		pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Lead-214	EPA 901.1 Modified	2.09E-01	8.90E-02	8.97E-02	1.50E-01		pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Promethium-145	EPA 901.1 Modified	-6.41E-02	1.23E-01	1.23E-01	1.93E-01	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Radium-226	EPA 901.1 Modified	2.55E-01	8.03E-02	8.13E-02	6.49E-02		pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Antimony-125	EPA 901.1 Modified	3.66E-02	9.79E-02	9.79E-02	1.55E-01	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Thorium-234	EPA 901.1 Modified	1.08E+00	6.31E-01	6.33E-01	1.08E+00	U	pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Thallium-208	EPA 901.1 Modified	2.39E-01	1.02E-01	1.03E-01	4.51E-02		pCi/g
19-10094-14	TRG	L1-12205-A-FSGS-109-SS-A	09/25/19 13:01	10/21/2019	10/24/2019	19-10094	Uranium-235	EPA 901.1 Modified	7.63E-02	2.14E-01	2.14E-01	3.21E-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

0033

Eberline Analytical
Final Report of Analysis

Report To:

Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG: **19-10094**
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Actinium-228	EPA 901.1 Modified	2.65E-01	2.09E-01	2.10E-01	3.86E-01	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Silver-108m	EPA 901.1 Modified	-3.57E-03	4.81E-02	4.81E-02	6.17E-02	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Americium-241	EPA 901.1 Modified	-1.55E-02	7.82E-02	7.82E-02	1.13E-01	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Barium-133	EPA 901.1 Modified	4.30E-03	2.89E-02	2.89E-02	1.17E-01	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Bismuth-214	EPA 901.1 Modified	3.52E-01	1.13E-01	1.14E-01	9.50E-02		pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Cobalt-60	EPA 901.1 Modified	9.28E-03	6.95E-02	6.95E-02	1.00E-01	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Cesium-134	EPA 901.1 Modified	2.10E-03	2.74E-02	2.74E-02	8.40E-02	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Cesium-137	EPA 901.1 Modified	-4.52E-02	6.32E-02	6.33E-02	7.61E-02	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Europium-152	EPA 901.1 Modified	-1.20E-02	8.39E-02	8.39E-02	1.62E-01	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Europium-154	EPA 901.1 Modified	-6.73E-02	2.13E-01	2.13E-01	8.37E-02	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Europium-155	EPA 901.1 Modified	3.51E-02	8.79E-02	8.79E-02	1.31E-01	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Holmium-166m	EPA 901.1 Modified	-2.84E-02	9.43E-02	9.43E-02	6.06E-02	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Iodine-129	EPA 901.1 Modified	-3.80E-02	1.35E-01	1.35E-01	1.96E-01	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Potassium-40	EPA 901.1 Modified	1.48E+01	2.17E+00	2.30E+00	8.58E-01		pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Manganese-54	EPA 901.1 Modified	-1.41E-02	6.25E-02	6.25E-02	9.56E-02	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Molybdenum-93	EPA 901.1 Modified	1.14E-02	4.32E-02	4.32E-02	7.11E-02	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Niobium-94	EPA 901.1 Modified	-1.83E-03	2.16E-02	2.16E-02	8.23E-02	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Lead-210	EPA 901.1 Modified	7.81E-01	7.78E-01	7.79E-01	1.29E+00	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Lead-212	EPA 901.1 Modified	2.41E-01	1.32E-01	1.33E-01	1.87E-01		pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Lead-214	EPA 901.1 Modified	2.39E-01	1.25E-01	1.25E-01	2.10E-01		pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Promethium-145	EPA 901.1 Modified	-9.68E-02	1.08E-01	1.08E-01	1.48E-01	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Radium-226	EPA 901.1 Modified	3.52E-01	1.13E-01	1.14E-01	9.50E-02		pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Antimony-125	EPA 901.1 Modified	-2.03E-02	1.45E-01	1.45E-01	1.99E-01	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Thorium-234	EPA 901.1 Modified	-1.14E-01	7.16E-01	7.16E-01	1.04E+00	U	pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Thallium-208	EPA 901.1 Modified	1.92E-01	8.90E-02	8.95E-02	1.31E-01		pCi/g
19-10094-15	TRG	L1-12106-A-FSGS-013-SS-A	09/26/19 12:54	10/21/2019	10/24/2019	19-10094	Uranium-235	EPA 901.1 Modified	7.70E-02	2.34E-01	2.34E-01	3.52E-01	U	pCi/g

0034

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

ZIONSOLUTIONS LLC
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REC'D OCT 21 2019
19-10094

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					
	L1-12107-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
4	L1-12205-E-FSGS-104-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1306	5 ROC HTD	NA	1087.82
5	L1-12205-E-QIGS-101-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/11/2019	0900	5 ROC HTD	NA	829.86
6	L1-12205-D-FSGS-117-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1022	5 ROC HTD	NA	1028.72
7	L1-12205-E-FSGS-117-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1332	5 ROC HTD	NA	1106.09
8	L1-12205-A-FSGS-116-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1315	5 ROC HTD	NA	1078.92

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Rec [initials] 10-21-19 @1100

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ZS-WM-131
Revision 0
Information Use

9	L1-12111-A-QJGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/23/2019	1330	5 ROC HTD	NA	1137.81
10	L1-12111-A-FJGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/23/2019	1334	5 ROC HTD	NA	1029.33
11	L1-12205-B-FSGS-105-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	0908	5 ROC HTD	NA	1044.71
12	L1-12106-A-FSGS-009-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/26/2019	1246	5 ROC HTD	NA	1127.18
13	L1-12205-A-FSGS-104-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1251	5 ROC HTD	NA	1135.95
14	L1-12205-A-FSGS-109-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1301	5 ROC HTD	NA	1130.91
15	L1-12106-A-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/26/2019	1254	5 ROC HTD	NA	1159.18

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

Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	
Jack Mucia	10/16/19	0710	Richard F. Rickert	10/16/2019	0710
Richard F. Rickert	10/17/2019	1600	FedEx Ground	10/17/2019	1600
FedEx G			Randolph Spencer	10/21/2019	1100

Comments
PO # 67718 HTD's 30 Day turnaround

9000

[259]