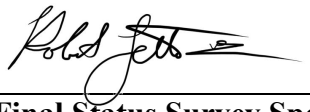
ZION SOLUTIONS LLC
An EnergySolutions Company

ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

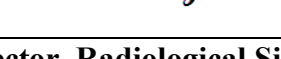
SOUTH YARD AREA NORTHEAST OF GATE HOUSE

SURVEY UNIT 12111

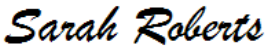
REVISION 1

PREPARED BY / DATE: Robert Yetter III  Robert F. Yetter III Apr 29 2020 9:59 AM cosign

Final Status Survey Specialist

REVIEWED BY / DATE: Robert Yetter  Robert F. Yetter Apr 29 2020 2:08 PM cosign

Director, Radiological Site Closure

APPROVED BY / DATE: Sarah Roberts  Sarah Roberts Apr 29 2020 6:50 PM cosign

Vice President, Radiological Programs

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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 DCGL
BcSOF	Base Case Sum of Fractions
C/LT	Characterization/License Termination
CCDD	Clean Concrete Demolition Debris
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
ORISE	Oak Ridge Institute for Science and Education
QC	Quality Control
RE	Radiological Engineer
ROC	Radionuclides of Concern

SOF	Sum of Fractions
TEDE	Total Effective Dose Equivalent
TSD	Technical Support Document
UBGR	Upper Bound of the Gray Region
VSP	Visual Sample Plan
ZNPS	Zion Nuclear Power Station
ZSRP	Zion Station Restoration Project

1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for Survey Unit 12111, the "South Yard Area Northeast of Gate House," 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 (L1-12111A-F) was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, *"Final Status Survey Package Development"* (Reference 3), the ZSRP LTP, and guidance from NUREG-1575, "*Multi-Agency Radiation Survey and Site Investigation Manual"* (MARSSIM) (Reference 4).

This open land survey unit has a MARSSIM classification of one. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I (α) and Type II (β) decision error rates were set at 0.05. Seventeen (17) systematic surface soil samples were acquired from the survey unit. In addition, surface scanning was performed on 100% of the accessible surface area in the survey unit. No areas of elevated activity were detected during the scans. An approximately 20-meter Section of rows 1 to 3 were covered by water and were not accessible for scan survey. Two (2) judgmental samples were taken in this area in lieu of the scan surveys. An additional judgmental sample was also taken in the northern 20-meter Section of rows 1 and 2 to investigate an elevated background count rate. The analytical results for all soil samples (systematic and judgmental) taken in survey unit 12111 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 0.061. The mean OpSOF for the systematic samples was 0.031. 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 0.197 mrem/year Total Effective Dose Equivalent (TEDE). Therefore, the null hypothesis is rejected and survey unit 12111 is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 12111, "South Yard Area Northeast of Gate House," is a Class 1 open land survey unit and is 1,964 m^2 in size. It is bounded on the west by survey unit 12202D, the south by survey unit 12202F, the east by survey units 12203A and 12205E, and the north by survey unit 12110.

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

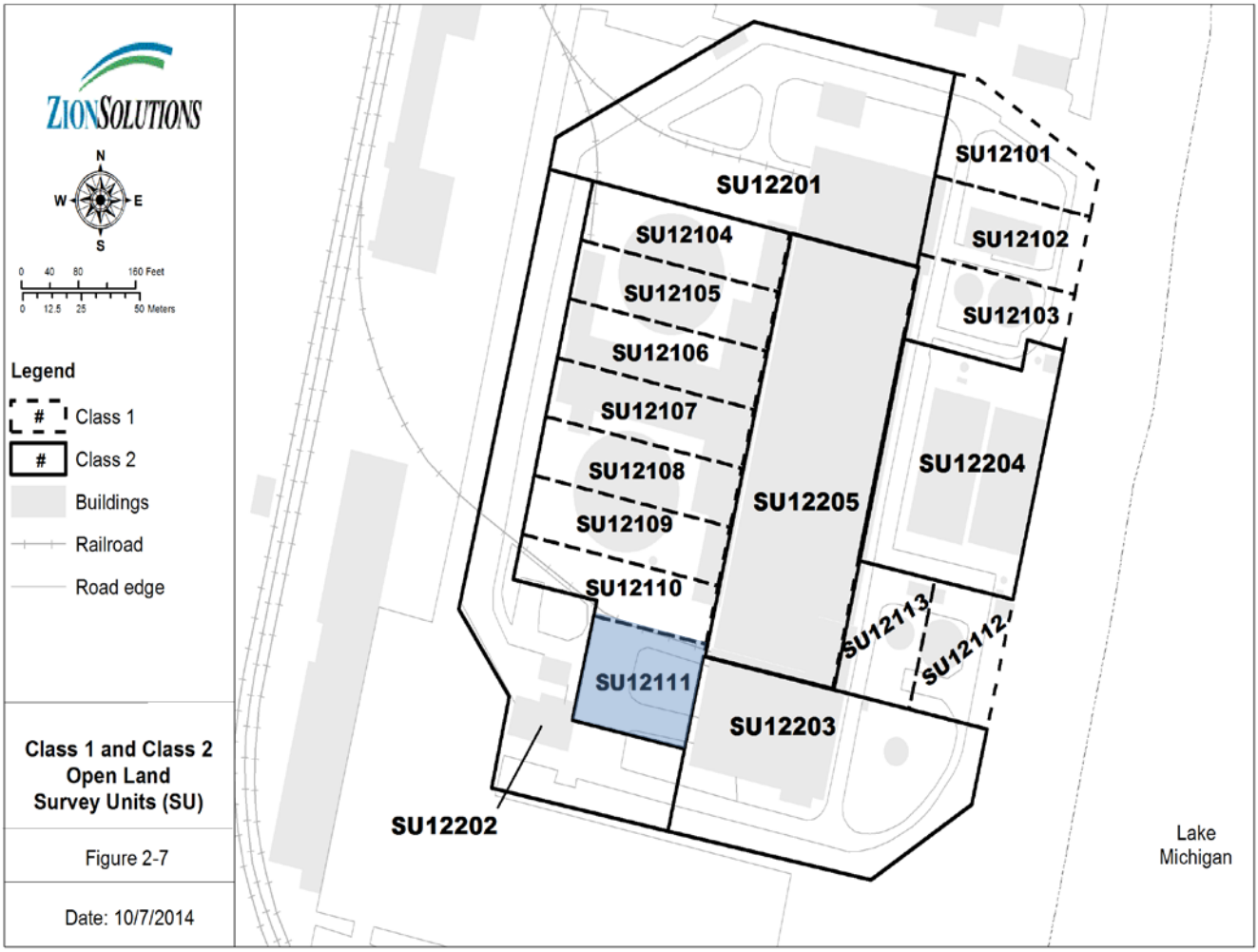
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 12111 was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 5).

The area encompassing this survey unit is made up of the south half of survey unit 10107 as identified in the *"Zion Station Historical Site Assessment"* (HSA) (Reference 6). The HSA classified this survey unit as Class 1. Subsequently, the LTP designated this area as survey unit 12111 and described it as the "South Yard Area NE of Gate House" in Table 2-31 of the LTP as represented in Figure 2-7 of the LTP, which is replicated below as Figure 1.

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



The HSA states that this area contained the Rad Waste Annex Area, the East and West Main Power Transformers, the Unit 1 Auxiliary Transformer and the Diesel Oil Tank – Tanker Connection Point. The HSA also notes that there were substantial spills of mixtures of spent resins and water in adjacent survey units 12109 and 12110.

Characterization surveys were performed in April of 2013 for survey unit 12111:

- Thirteen (13) judgmental surface samples.
- Forty-two (42) judgmental subsurface samples taken in thirteen (13) locations to a depth of 3-meters composited over 1-meter increments.
- Sodium Iodide (NaI) walkover scans were not performed due to ambient radiation levels in the area being prohibitive.

The results of the characterization survey were:

- Ten (10) of the thirteen (13) surface samples were > Minimum Detectable Concentration (MDC) for Cs-137 with a maximum concentration of 0.20 pCi/g.
- Only one (1) of the subsurface samples, taken in the first meter of depth at a location in the southeast corner of the survey unit, was >MDC for Cs-137 with a concentration of 0.04 pCi/g.

Surface soil samples were collected in this area under a Radiological Assessment survey in 2017 and 2018 with the highest result having an $OpSOF_{TOTAL}$ of 36.95 (Co-60: 32.40 pCi/g, Cs-137: 2.73 pCi/g).

In August of 2018, ZSRP completed the demolition and backfill of the Auxiliary Building basement and Spent Fuel Pool. The next buildings that were slated for demolition were the Unit 1 and Unit 2 Containment domes. It was the intention of ZSRP to use the exterior concrete of the Unit 1 and Unit 2 Containment domes as Clean Concrete Demolition Debris (CCDD). However, for the concrete to be considered for use as CCDD, it was important to maintain the unrestricted release pedigree of the concrete. The 588-foot grade surface soils surrounding the two containments were identified as contaminated. While it was necessary to remediate the soils surrounding the Containments, the timeframe required was prohibitive at the time. Therefore, in lieu of remediating the exposed soil, a sacrificial layer of clean soil from off-site was placed over the contaminated indigenous surface soil with up to 1-½ feet of clean fill. Once the sacrificial layer was in place, the Containment dome structures were demolished without having to wait for the remediation to be completed. From August, 2018 through December, 2018, both Unit 1 and Unit 2 Containments were demolished and the resultant CCDD was removed from the area.

After removal of the CCDD, the sacrificial soil was removed and the exposed 588-foot indigenous soils were scanned. The survey was performed under a Radiological Assessment, which required "100% scan of the soils exposed by the removal of the sacrificial layer" with an alarm set-point set at the Minimum Detectable Count Rate (MDCR) of the instrument plus background. Any indication of elevated activity greater than the MDCR would then prompt investigation and remediation, as necessary.

From February 26, 2019, through June 18, 2019, scanning and remediation commenced south of Unit 1 and progressed to the north and west of the Containment footprints. Large areas of elevated activity were identified by scan and verified by soil sample analysis. The areas were marked. All soil identified as exceeding the OpDCGLs for subsurface soil was excavated and removed from the site as radioactive waste. Following excavation, post-remediation surveys were performed by scan and media sampling. The analysis of all post-remediation soil samples showed an OpSOF less than one when sample results were directly compared against the OpDCGLs for subsurface soils. However, all excavations remained open to allow the Oak Ridge Institute for Science and Education (ORISE) to perform confirmatory surveys of the exposed remediated soil.

ORISE performed confirmatory surveys of the exposed subsurface soils surrounding the Containments in August of 2019. Shortly thereafter, clean fill was acquired from an off-site source and used to increase the grade of all survey units surrounding any end-state basement to the 591-foot elevation. In accordance with LTP, Section 6.4.1, the end-state basements will be covered by at least three feet of clean soil and physically altered to a condition which would not realistically allow the remaining structures, if excavated, to be occupied.

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 ZS-LT-300-001-002, as part of the survey design for FSS. The assessment confirmed that survey unit 12111 was correctly classified as Class 1.

4. DATA QUALITY OBJECTIVES

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

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

The primary objective of the FSS sample plan is to demonstrate that the level of residual radioactivity in survey unit 12111 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 Radionuclides of Concern (ROC) for the decommissioning of the Zion Nuclear Power Station (ZNPS).

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

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

Table 1 - Dose Significant Radionuclides and Mixture

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

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

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

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

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

The surface and subsurface soil BcDCGLs for the unrestricted release of open land survey units are listed in Tables 5-5 and 5-6 of the LTP and are provided in Table 2 and Table 3, respectively. The Insignificant Contributor (IC) dose percentage of 10% was used to adjust the DCGLs in soils to account for the dose from the eliminated IC radionuclides.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

5. SURVEY DESIGN

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

The DQO process determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 would be the ROC in survey unit 12111. 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 will be used in the surrogate calculations during FSS unless area specific ratios are determined by continuing characterization.

Table 6 - Surrogate Ratios

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

For the FSS of survey unit 12111, 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 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: $A = \frac{A_{SU}}{N} = \frac{1964}{17} = 115.5\ m^2$
- From the LTP, Table 5-16, the Area Factors for the next larger area (300 m^2) were used:
  - Cs-137 - 1.46
  - Cs-134 - 1.30
  - Co-60 - 1.16
- The $DCGL_{EMC}$ is the Surrogate Base Case DCGL times the Area Factor:
  - The $DCGL_{EMC}$ for Cs-137 = $1.46 * 14.15 = 20.66\ pCi/g$
  - The $DCGL_{EMC}$ for Cs-134 = $1.30 * 6.77 = 8.80\ pCi/g$
  - The $DCGL_{EMC}$ for Co-60 = $1.16 * 3.51 = 4.07\ pCi/g$

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

The implementation of quality control (QC) measures as referenced by LTP, Section 5.9 and Zion*Solutions* procedure ZS-LT-01, "*Quality Assurance Project Plan (for Characterization and FSS)*" (QAPP) (Reference 12) includes the collection of a soil sample for "split sample" analysis on 5% of the soil samples taken in a survey unit with the locations selected at random. One (1) surface soil sample (L1-12111A-FQGS-002-SS) was selected randomly for split sample analysis for the FSS of this survey unit.

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 L1-12111A-FSGS-003-SB and L1-12111A-FSGS-007-SB were selected for this survey unit.

The locations of the seventeen (17) systematic samples are listed in Table 8. Also included

are the locations of the two (2) subsurface samples. A map of the systematic sample locations is included in Attachment 1.

Table 8 - Systematic Sample Measurement Locations

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L1-12111A-FSGS-001-SS	641661.24	343608.88
L1-12111A-FSGS-002-SS	641661.24	343620.43
L1-12111A-FSGS-003-SS	641661.24	343631.98
L1-12111A-FSGS-004-SS	641661.24	343643.53
L1-12111A-FSGS-005-SS	641671.24	343603.10
L1-12111A-FSGS-006-SS	641671.24	343614.66
L1-12111A-FSGS-007-SS	641671.24	343626.21
L1-12111A-FSGS-008-SS	641671.24	343637.76
L1-12111A-FSGS-009-SS	641671.24	343649.31
L1-12111A-FSGS-010-SS	641681.25	343608.88
L1-12111A-FSGS-011-SS	641681.25	343620.43
L1-12111A-FSGS-012-SS	641681.25	343631.98
L1-12111A-FSGS-013-SS	641681.25	343643.53
L1-12111A-FSGS-014-SS	641691.25	343614.66
L1-12111A-FSGS-015-SS	641691.25	343626.21
L1-12111A-FSGS-016-SS	641691.25	343637.76
L1-12111A-FSGS-017-SS	641691.25	343649.31
L1-12111A-FSGS-003-SB	641661.24	343631.98
L1-12111A-FSGS-007-SB	641671.24	343626.21

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 12111.

Three (3) soil samples, L1-12111A-FSGS-003-SS, L1-12111A-QJGS-001-SS, and L1-12111A-FJGS-003-SS were selected to meet the requirement that 10% of the samples collected for the FSS of survey unit 12111 be analyzed for HTD ROC. These samples were selected based on having the highest OpSOF of the systematic and judgmental samples taken. 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 12111.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	1,964 m^2	GPS measurements of area
Number of Surface Soil Samples	17 (Systematic)	• σ = 0.30 • UBGR = SOF of 1 • LBGR = SOF of 0.5 • Type I error = 0.05 • Type II error = 0.05 • Δ/σ = 1.67 (MARSSIM Table 5.5)
Grid Spacing	11.6 m	(LTP, Section 5.6.4.5.2)
DCGLs	• Co-60 – 1.091 pCi/g • Cs-134 – 1.733 pCi/g • Cs-137 – 3.630 pCi/g • Ni-63 – 914.458 pCi/g • Sr-90 – 3.095 pCi/g	Operational DCGLs for Surface Soils, (LTP, Table 5-7)
HTD ROC Analysis	A minimum of two (2) soil samples selected for HTD ROC analysis	(LTP, Section 5.1)
Measurement Investigation Level	Operational DCGL	(LTP, Table 5-25)
Scan Survey Area Coverage	100%	(LTP, Table 5-24)
QC	One (1) surface soil sample selected randomly for split sample analysis	(LTP, Section 5.9)
Number of Subsurface Soil Samples	Two (2) - systematic surface soil sample locations 3 and 7	(LTP, Section 5.7.1.6.2)

6. SURVEY IMPLEMENTATION

Survey instructions for this FSS were incorporated into and performed in accordance with FSS sample plan L1-12111A-F, which was developed in accordance with ZS-LT-300-001-001. The FSS unit was inspected and controlled in accordance with Zion*Solutions* procedure ZS-LT-300-001-003, "*Isolation and Control for Final Status Survey*" (Reference 13).

For survey unit 12111, 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. Also, if during the performance of FSS, the analysis of a surface soil sample, or the results of a surface gamma scan indicated the potential presence of residual radioactivity at a concentration of 75% of the subsurface OpDCGL, then a biased subsurface soil sample(s) would have been taken to the appropriate depth within the area of concern as part of the investigation. This threshold was not encountered during the FSS of survey unit 12111.

FSS field activities were conducted under FSS sample plan L1-12111A-F. A "Field Log" (ZS-LT-300-001-001, Attachment 14) was used to document field activities and other information pertaining to the performance of the FSS. FSS field activities were projected to take four (4) working days to complete. Daily briefings were conducted to discuss the expectations for job performance and to review safety aspects of the job. The survey required field activities were performed during normal working hours starting on September 16, 2019, and concluding on September 23, 2019.

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

Gamma scans were performed on 100% of the surface area of the survey unit using a Ludlum 2350-1 paired with a Model 44-10 (2-inch x 2-inch) NaI detector operated in the rate-meter mode and using audio response. The probe was positioned within 2 inches of the ground and was moved at a scan speed of approximately 0.5 meters per second. No areas of elevated activity were detected on the scans. One area which showed elevated background readings was selected for judgmental sampling (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	304711/PR321902	1/18/1920
Ludlum 2350-1/Ludlum 44-10	216173/ES0118	12/6/2019
Ludlum 2350-1/Ludlum 44-10	304726/PR363452	8/28/2020
Ludlum 2350-1/Ludlum 44-10	304730/PR375273	1/16/2020

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 three (3) judgmental surface samples were collected (One at a location identified as having higher background activity on the surface scans and two in an area inaccessible to scanning due to standing water).

Three (3) samples; L1-12111A-FSGS-003-SS, L1-12111A-QJGS-001-SS, and L1-12111A-FJGS-003-SS, were selected for HTD radionuclide analysis. One (1) surface soil sample (L1-12111A-FQGS-002-SS) was selected randomly for split sample analysis for the FSS of this survey unit.

7. SURVEY RESULTS

One hundred percent (100%) of the surface of the survey unit was scanned for elevated radiation levels. Forty-nine (49) 1-meter wide scan rows, as shown on the map in Attachment 1, were marked in the field and scanned with the 2350-1/44-10 using latching mode. Readings were recorded at approximately 10-meter intervals during the scans. No elevated measurement locations 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	3782	4372	None	None
Row 2	3851	4372	None	None
Row 3	2595	2904	None	None
Row 4	2501	2904	None	None
Row 5	2578	2904	None	None
Row 6	2557	2904	None	None
Row 7	2571	2904	None	None
Row 8	2597	2904	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 9	2699	2904	None	None
Row 10	2603	2904	None	None
Row 11	2706	2904	None	None
Row 12	2865	2904	None	None
Row 13	2704	2974	None	None
Row 14	2627	2974	None	None
Row 15	2555	2974	None	None
Row 16	2535	2974	None	None
Row 17	2649	2974	None	None
Row 18	2577	2974	None	None
Row 19	2753	2974	None	None
Row 20	2580	2974	None	None
Row 21	2609	2974	None	None
Row 22	2541	2974	None	None
Row 23	2630	2974	None	None
Row 24	2531	2974	None	None
Row 25	2446	2892	None	None
Row 26	2677	2892	None	None
Row 27	2540	2892	None	None
Row 28	2588	2892	None	None
Row 29	2571	2892	None	None
Row 30	2531	2892	None	None
Row 31	2535	2892	None	None
Row 32	2592	2892	None	None
Row 33	2709	2892	None	None
Row 34	2612	2892	None	None
Row 35	2692	2892	None	None
Row 36	2396	2892	None	None
Row 37	2268	2838	None	None
Row 38	2298	2838	None	None
Row 39	2253	2838	None	None
Row 40	2287	2838	None	None
Row 41	2252	2838	None	None
Row 42	2224	2838	None	None
Row 43	2344	2838	None	None
Row 44	2311	2838	None	None
Row 45	2311	2838	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 46	2284	2838	None	None
Row 47	2284	2838	None	None
Row 48	2261	2838	None	None
Row 49	2299	2838	None	None

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

The seventeen (17) soil samples taken for non-parametric statistical testing, the three (3) judgmental surface soil samples, and the two (2) subsurface soil samples were analyzed using the on-site gamma spectroscopy system. Summaries of the sample analysis results are provided in Tables 12, 13, and 14, respectively. The basic statistics for the systematic sample population are summarized in Table 21. The gamma spectroscopy results revealed no samples with activity level above MDC for Cs-137, Co-60, or Cs-134. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6. The mean of the gamma spectroscopic analysis results for the sample population indicated that Cs-137 was present at levels lower than the concentrations of Cs-137 expected to be found in off-site soil in the vicinity of the ZNPS as presented in Zion*Solutions* TSD 13-004, "*Examination of Cs-137 Global Fallout In Soils At Zion Station*" (Reference 15). The complete gamma spectroscopy reports are presented in Attachment 7.

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

MEASUREMENT ID	Co-60(1) (pCi/g)	Cs-134(1) (pCi/g)	Cs-137(1) (pCi/g)	Ni-63(2) (pCi/g)	Sr-90(2) (pCi/g)
L1-12111A-FSGS-001-SS	1.86E-02	2.92E-03	2.29E-02	3.36E+00	4.58E-05
L1-12111A-FSGS-002-SS	0.00E+00	4.14E-02	0.00E+00	0.00E+00	0.00E+00
L1-12111A-FSGS-003-SS	4.82E-02	0.00E+00	2.82E-02	8.70E+00	5.64E-05
L1-12111A-FSGS-004-SS	0.00E+00	1.68E-02	0.00E+00	0.00E+00	0.00E+00
L1-12111A-FSGS-005-SS	3.04E-02	2.28E-02	1.04E-02	5.49E+00	2.08E-05
L1-12111A-FSGS-006-SS	3.25E-02	4.69E-03	0.00E+00	5.86E+00	0.00E+00
L1-12111A-FSGS-007-SS	2.72E-02	1.45E-02	0.00E+00	4.91E+00	0.00E+00
L1-12111A-FSGS-008-SS	1.89E-02	1.86E-02	2.07E-02	3.41E+00	4.14E-05
L1-12111A-FSGS-009-SS	4.34E-02	1.48E-02	0.00E+00	7.83E+00	0.00E+00
L1-12111A-FSGS-010-SS	0.00E+00	2.65E-02	0.00E+00	0.00E+00	0.00E+00

Table 12 (continued) - 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)
L1-12111A-FSGS-011-SS	2.71E-02	5.77E-03	0.00E+00	4.89E+00	0.00E+00
L1-12111A-FSGS-012-SS	1.93E-02	1.63E-02	0.00E+00	3.48E+00	0.00E+00
L1-12111A-FSGS-013-SS	1.46E-02	0.00E+00	0.00E+00	2.63E+00	0.00E+00
L1-12111A-FSGS-014-SS	1.50E-02	0.00E+00	1.43E-02	2.71E+00	2.86E-05
L1-12111A-FSGS-015-SS	0.00E+00	1.85E-02	2.26E-02	0.00E+00	4.52E-05
L1-12111A-FSGS-016-SS	3.54E-03	3.32E-02	0.00E+00	6.39E-01	0.00E+00
L1-12111A-FSGS-017-SS	0.00E+00	3.33E-02	8.67E-03	0.00E+00	1.73E-05

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

Table 13 - Summary of Gamma Spectroscopy Results for Judgmental 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)
L1-12111A-FJGS-001-SS	2.00E-02	2.84E-02	0.00E+00	3.61E+00	0.00E+00
L1-12111A-FJGS-002-SS	9.36E-03	3.88E-03	2.22E-02	1.69E+00	4.44E-05
L1-12111A-FJGS-003-SS	3.37E-02	2.53E-02	4.19E-02	6.08E+00	8.38E-05

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

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

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L1-12111A-FSGS-003-SB	1.29E-02	5.85E-03	3.35E-02	2.33E+00	6.70E-05
L1-12111A-FSGS-007-SB	1.47E-02	0.00E+00	0.00E+00	2.65E+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 off-site laboratory, Eberline Analytical, processed the three (3) samples selected for HTD ROC analysis. Samples L1-12111A-FSGS-003-SS-A, L1-12111A-QJGS-001-SS-A and L1-12111A-FJGS-003-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 # L1-12111A-FSGS-003-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	-1.97E-02	6.98E-02	8.37E-02	No
Cs-134	-8.46E-02	7.52E-02	7.68E-02	No
Cs-137	2.43E-02	5.57E-02	8.53E-02	No
Ni-63	1.85E-01	1.92E+00	3.30E+00	No
Sr-90	8.98E-02	2.56E-01	5.39E-01	No

Sample # L1-12111A-QJGS-001-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	1.66E-02	6.20E-02	8.11E-02	No
Cs-134	1.72E-02	2.24E-02	8.27E-02	No
Cs-137	8.24E-03	5.64E-02	7.89E-02	No
Ni-63	1.61E-01	1.80E+00	3.09E+00	No
Sr-90	-9.48E-02	2.75E-01	6.02E-01	No

Sample # L1-12111A-FJGS-003-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	-3.81E-03	4.97E-02	7.12E-02	No
Cs-134	-2.28E-01	8.18E-02	6.17E-02	No
Cs-137	1.53E-03	4.17E-02	6.05E-02	No
Ni-63	-1.31E+00	1.91E+00	3.35E+00	No
Sr-90	3.15E-01	3.01E-01	6.09E-01	No

The implementation of survey specific QC measures included the collection of one (1) systematic sample (L1-12111A-FQGS-002-SS) and one (1) judgmental sample (L1-12111A-QJGS-001-SS) for "split sample" analysis. The on-site laboratory analyzed the designated QC samples using the on-site gamma spectroscopy system. Gamma spectroscopy results (summarized in Table 16) revealed activity level for Cs-137, Co-60 and Cs-134 less than MDC in both 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)
L1-12111A-FQGS-002-SS	2.83E-02	0.00E+00	1.21E-02	5.11E+00	2.42E-05
L1-12111A-QJGS-001-SS	4.18E-02	4.53E-02	0.00E+00	7.54E+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

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

Where: C_n = concentration of radionuclide *n*

$DCGL_n$ = DCGL of radionuclide *n*.

The results of the unity rule calculations for the ROC in the systematic sample population when compared against the OpDCGLs for surface soils for survey unit 12111A are provided in Table 17. The results of the unity rule calculations for the ROC for the judgmental 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	
L1-12111A-FSGS-001-SS	1.70E-02	1.68E-03	6.31E-03	3.67E-03	1.48E-05	0.029
L1-12111A-FSGS-002-SS	0.00E+00	2.39E-02	0.00E+00	0.00E+00	0.00E+00	0.024
L1-12111A-FSGS-003-SS	4.42E-02	0.00E+00	7.77E-03	9.51E-03	1.82E-05	0.061
L1-12111A-FSGS-004-SS	0.00E+00	9.69E-03	0.00E+00	0.00E+00	0.00E+00	0.010
L1-12111A-FSGS-005-SS	2.79E-02	1.32E-02	2.87E-03	6.00E-03	6.72E-06	0.050
L1-12111A-FSGS-006-SS	2.98E-02	2.71E-03	0.00E+00	6.41E-03	0.00E+00	0.039
L1-12111A-FSGS-007-SS	2.49E-02	8.37E-03	0.00E+00	5.37E-03	0.00E+00	0.039
L1-12111A-FSGS-008-SS	1.73E-02	1.07E-02	5.70E-03	3.73E-03	1.34E-05	0.038
L1-12111A-FSGS-009-SS	3.98E-02	8.54E-03	0.00E+00	8.56E-03	0.00E+00	0.057
L1-12111A-FSGS-010-SS	0.00E+00	1.53E-02	0.00E+00	0.00E+00	0.00E+00	0.015
L1-12111A-FSGS-011-SS	2.48E-02	3.33E-03	0.00E+00	5.35E-03	0.00E+00	0.034
L1-12111A-FSGS-012-SS	1.77E-02	9.41E-03	0.00E+00	3.81E-03	0.00E+00	0.031
L1-12111A-FSGS-013-SS	1.34E-02	0.00E+00	0.00E+00	2.88E-03	0.00E+00	0.016
L1-12111A-FSGS-014-SS	1.37E-02	0.00E+00	3.94E-03	2.96E-03	9.24E-06	0.021

Table 17 (continued) - 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	
L1-12111A-FSGS-015-SS	0.00E+00	1.07E-02	6.23E-03	0.00E+00	1.46E-05	0.017
L1-12111A-FSGS-016-SS	3.24E-03	1.92E-02	0.00E+00	6.99E-04	0.00E+00	0.023
L1-12111A-FSGS-017-SS	0.00E+00	1.92E-02	2.39E-03	0.00E+00	5.60E-06	0.022

Systematic Measurements

Number of Systematic Measurements =	17
# of Systematic Measurements with OpSOF ≥ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	0
Max Individual Systematic Measurement OpSOF =	0.061
Mean Systematic Measurement OpSOF =	0.031

Table 18 - Sum of Fractions for Judgmental 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	
L1-12111A-FJGS-001-SS	1.83E-02	1.64E-02	0.00E+00	3.95E-03	0.00E+00	0.039
L1-12111A-FJGS-002-SS	8.58E-03	2.24E-03	6.12E-03	1.85E-03	1.43E-05	0.019
L1-12111A-FJGS-003-SS	3.09E-02	1.46E-02	1.15E-02	6.65E-03	2.71E-05	0.064

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	
L1-12111A-FSGS-003-SB	1.46E-02	5.15E-03	1.69E-02	1.19E-02	1.58E-04	0.049
L1-12111A-FSGS-007-SB	1.67E-02	0.00E+00	0.00E+00	1.36E-02	0.00E+00	0.030

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	
L1-12111A-FQGS-002-SS	2.59E-02	0.00E+00	3.33E-03	5.58E-03	7.82E-06	0.035
L1-12111A-QJGS-001-SS	3.83E-02	2.61E-02	0.00E+00	8.25E-03	0.00E+00	0.073

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	1.76E-02	1.86E-02	4.82E-02	0.00E+00	0.016	4.26	4.13E-03	1.03E-01
Cs-134	1.59E-02	1.63E-02	4.14E-02	0.00E+00	0.013	6.77	2.35E-03	5.87E-02
Cs-137	7.52E-03	0.00E+00	2.82E-02	0.00E+00	0.010	14.18	5.30E-04	1.33E-02
Ni-63	3.17E+00	3.36E+00	8.70E+00	0.00E+00	2.831	3572.1	8.88E-04	2.22E-02
Sr-90	1.50E-05	0.00E+00	5.64E-05	0.00E+00	0.000	12.09	1.24E-06	3.11E-05

The mean BcSOF for survey unit 12111 is 0.008, which equates to a dose of 0.197 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, L1-12111A-FQGS-002-SS and L1-12111A-QJGS-001-SS, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in ZS-LT-01. There was acceptable agreement between the field split results. Refer to Attachment 5 for data and QC analysis results.

9. INVESTIGATIONS AND RESULTS

Three (3) judgmental samples, along with one (1) QC split sample, were taken for this FSS.

- One (1) sample, L1-12111A-FJGS-001-SS along with split sample L1-12111A-QJGS-001-SS, was taken in the north 20-meter Section of rows 1 and 2 to investigate an area of higher background. This sample was taken at the location in this area which scanning exhibited the highest count rate.
- Two (2) samples, L1-12111A-FJGS-002-SS and L1-12111A-FJGS-003-SS, were taken in the south 20-meter Section of rows 1 to 3, which was inaccessible for scans due to standing water.

The sample results for all four (4) judgmental samples showed activity for the ROC was less than the MDC of the instrument.

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

Standing water prevented the gamma scans of approximately 60 m^2 in rows 1 to 3.

14. CONCLUSION

Survey unit 12111 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 12111 of 0.197 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 12111 is acceptable for unrestricted release.

15. REFERENCES

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

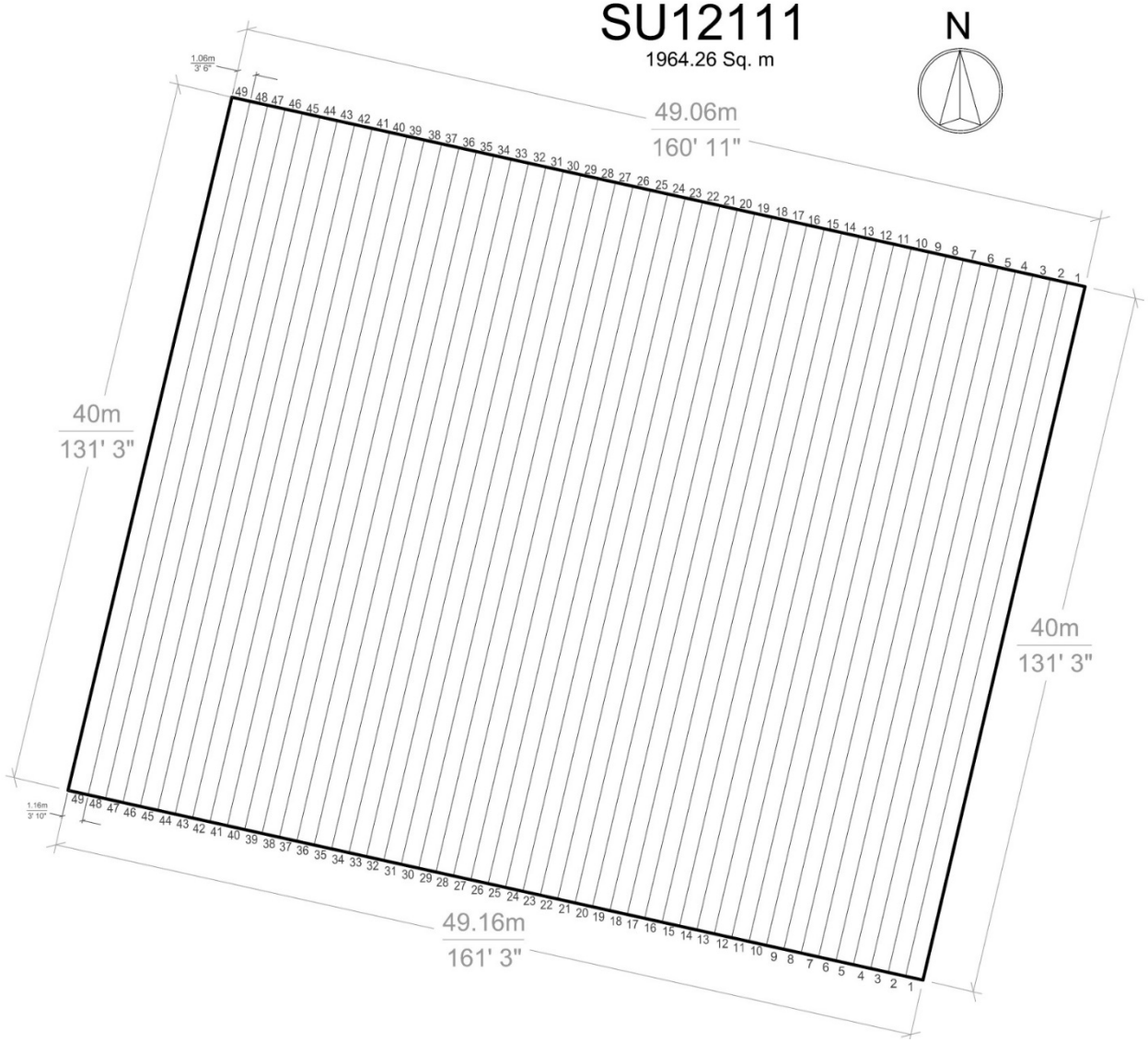
16. ATTACHMENTS

1. Attachment 1 - 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 12111 Final Status Survey Boundaries and Systematic Sample Points

Survey Unit 12111 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	PR321902	304711	12111	GS037	9/16/2019 8:09	2184	2139	2838	No
44-10	PR321902	304711	12111	GS037	9/16/2019 8:11	2237	2139	2838	No
44-10	PR321902	304711	12111	GS037	9/16/2019 8:14	2268	2139	2838	No
44-10	PR321902	304711	12111	GS037	9/16/2019 8:16	2214	2139	2838	No
44-10	PR321902	304711	12111	GS038	9/16/2019 8:20	2298	2139	2838	No
44-10	PR321902	304711	12111	GS038	9/16/2019 8:22	2239	2139	2838	No
44-10	PR321902	304711	12111	GS038	9/16/2019 8:24	2268	2139	2838	No
44-10	PR321902	304711	12111	GS038	9/16/2019 8:26	2228	2139	2838	No
44-10	PR321902	304711	12111	GS039	9/16/2019 8:29	2170	2139	2838	No
44-10	PR321902	304711	12111	GS039	9/16/2019 8:31	2243	2139	2838	No
44-10	PR321902	304711	12111	GS039	9/16/2019 8:34	2253	2139	2838	No
44-10	PR321902	304711	12111	GS039	9/16/2019 8:36	2209	2139	2838	No
44-10	PR321902	304711	12111	GS040	9/16/2019 8:40	2158	2139	2838	No
44-10	PR321902	304711	12111	GS040	9/16/2019 8:43	2222	2139	2838	No
44-10	PR321902	304711	12111	GS040	9/16/2019 8:45	2287	2139	2838	No
44-10	PR321902	304711	12111	GS040	9/16/2019 8:47	2188	2139	2838	No
44-10	PR321902	304711	12111	GS041	9/16/2019 8:50	2252	2139	2838	No
44-10	PR321902	304711	12111	GS041	9/16/2019 8:52	2233	2139	2838	No
44-10	PR321902	304711	12111	GS041	9/16/2019 8:55	2232	2139	2838	No
44-10	PR321902	304711	12111	GS041	9/16/2019 8:57	2149	2139	2838	No
44-10	PR321902	304711	12111	GS042	9/16/2019 9:00	2164	2139	2838	No
44-10	PR321902	304711	12111	GS042	9/16/2019 9:02	2153	2139	2838	No
44-10	PR321902	304711	12111	GS042	9/16/2019 9:05	2209	2139	2838	No
44-10	PR321902	304711	12111	GS042	9/16/2019 9:07	2224	2139	2838	No
44-10	PR321902	304711	12111	GS043	9/16/2019 9:10	2322	2139	2838	No
44-10	PR321902	304711	12111	GS043	9/16/2019 9:12	2344	2139	2838	No
44-10	PR321902	304711	12111	GS043	9/16/2019 9:14	2240	2139	2838	No
44-10	PR321902	304711	12111	GS043	9/16/2019 9:17	2293	2139	2838	No
44-10	PR321902	304711	12111	GS044	9/16/2019 9:20	2270	2139	2838	No
44-10	PR321902	304711	12111	GS044	9/16/2019 9:22	2311	2139	2838	No
44-10	PR321902	304711	12111	GS044	9/16/2019 9:24	2178	2139	2838	No
44-10	PR321902	304711	12111	GS044	9/16/2019 9:27	2279	2139	2838	No
44-10	PR321902	304711	12111	GS045	9/16/2019 9:32	2287	2139	2838	No
44-10	PR321902	304711	12111	GS045	9/16/2019 9:34	2233	2139	2838	No
44-10	PR321902	304711	12111	GS045	9/16/2019 9:37	2311	2139	2838	No
44-10	PR321902	304711	12111	GS045	9/16/2019 9:40	2306	2139	2838	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	12111	GS046	9/16/2019 9:43	2189	2139	2838	No
44-10	PR321902	304711	12111	GS046	9/16/2019 9:45	2248	2139	2838	No
44-10	PR321902	304711	12111	GS046	9/16/2019 9:47	2284	2139	2838	No
44-10	PR321902	304711	12111	GS046	9/16/2019 9:50	2191	2139	2838	No
44-10	PR321902	304711	12111	GS047	9/16/2019 9:53	2284	2139	2838	No
44-10	PR321902	304711	12111	GS047	9/16/2019 9:55	2271	2139	2838	No
44-10	PR321902	304711	12111	GS047	9/16/2019 9:57	2191	2139	2838	No
44-10	PR321902	304711	12111	GS047	9/16/2019 10:00	2231	2139	2838	No
44-10	PR321902	304711	12111	GS048	9/16/2019 10:03	2261	2139	2838	No
44-10	PR321902	304711	12111	GS048	9/16/2019 10:05	2233	2139	2838	No
44-10	PR321902	304711	12111	GS048	9/16/2019 10:07	2232	2139	2838	No
44-10	PR321902	304711	12111	GS048	9/16/2019 10:10	2207	2139	2838	No
44-10	PR321902	304711	12111	GS049	9/16/2019 10:13	2299	2139	2838	No
44-10	PR321902	304711	12111	GS049	9/16/2019 10:15	2242	2139	2838	No
44-10	PR321902	304711	12111	GS049	9/16/2019 10:17	2274	2139	2838	No
44-10	PR321902	304711	12111	GS049	9/16/2019 10:19	2275	2139	2838	No
44-10	ES0118	216173	12111	GS013	9/16/2019 7:42	2584	2256	2974	No
44-10	ES0118	216173	12111	GS013	9/16/2019 7:48	2704	2256	2974	No
44-10	ES0118	216173	12111	GS013	9/16/2019 7:50	2657	2256	2974	No
44-10	ES0118	216173	12111	GS013	9/16/2019 7:53	2478	2256	2974	No
44-10	ES0118	216173	12111	GS014	9/16/2019 7:55	2499	2256	2974	No
44-10	ES0118	216173	12111	GS014	9/16/2019 7:58	2456	2256	2974	No
44-10	ES0118	216173	12111	GS014	9/16/2019 8:00	2523	2256	2974	No
44-10	ES0118	216173	12111	GS014	9/16/2019 8:03	2627	2256	2974	No
44-10	ES0118	216173	12111	GS015	9/16/2019 8:06	2416	2256	2974	No
44-10	ES0118	216173	12111	GS015	9/16/2019 8:08	2476	2256	2974	No
44-10	ES0118	216173	12111	GS015	9/16/2019 8:11	2490	2256	2974	No
44-10	ES0118	216173	12111	GS015	9/16/2019 8:14	2555	2256	2974	No
44-10	ES0118	216173	12111	GS016	9/16/2019 8:16	2428	2256	2974	No
44-10	ES0118	216173	12111	GS016	9/16/2019 8:19	2535	2256	2974	No
44-10	ES0118	216173	12111	GS016	9/16/2019 8:21	2458	2256	2974	No
44-10	ES0118	216173	12111	GS016	9/16/2019 8:24	2474	2256	2974	No
44-10	ES0118	216173	12111	GS017	9/16/2019 8:27	2573	2256	2974	No
44-10	ES0118	216173	12111	GS017	9/16/2019 8:58	2649	2256	2974	No
44-10	ES0118	216173	12111	GS017	9/16/2019 9:00	2647	2256	2974	No
44-10	ES0118	216173	12111	GS017	9/16/2019 9:03	2636	2256	2974	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	ES0118	216173	12111	GS018	9/16/2019 9:05	2484	2256	2974	No
44-10	ES0118	216173	12111	GS018	9/16/2019 9:08	2577	2256	2974	No
44-10	ES0118	216173	12111	GS018	9/16/2019 9:10	2430	2256	2974	No
44-10	ES0118	216173	12111	GS018	9/16/2019 9:13	2483	2256	2974	No
44-10	ES0118	216173	12111	GS019	9/16/2019 9:16	2559	2256	2974	No
44-10	ES0118	216173	12111	GS019	9/16/2019 9:18	2632	2256	2974	No
44-10	ES0118	216173	12111	GS019	9/16/2019 9:21	2753	2256	2974	No
44-10	ES0118	216173	12111	GS019	9/16/2019 9:23	2569	2256	2974	No
44-10	ES0118	216173	12111	GS020	9/16/2019 9:26	2502	2256	2974	No
44-10	ES0118	216173	12111	GS020	9/16/2019 9:29	2580	2256	2974	No
44-10	ES0118	216173	12111	GS020	9/16/2019 9:31	2480	2256	2974	No
44-10	ES0118	216173	12111	GS020	9/16/2019 9:34	2472	2256	2974	No
44-10	ES0118	216173	12111	GS021	9/16/2019 9:36	2485	2256	2974	No
44-10	ES0118	216173	12111	GS021	9/16/2019 9:39	2416	2256	2974	No
44-10	ES0118	216173	12111	GS021	9/16/2019 9:42	2580	2256	2974	No
44-10	ES0118	216173	12111	GS021	9/16/2019 9:44	2609	2256	2974	No
44-10	ES0118	216173	12111	GS022	9/16/2019 9:47	2541	2256	2974	No
44-10	ES0118	216173	12111	GS022	9/16/2019 9:49	2504	2256	2974	No
44-10	ES0118	216173	12111	GS022	9/16/2019 9:52	2444	2256	2974	No
44-10	ES0118	216173	12111	GS022	9/16/2019 9:55	2389	2256	2974	No
44-10	ES0118	216173	12111	GS023	9/16/2019 9:57	2398	2256	2974	No
44-10	ES0118	216173	12111	GS023	9/16/2019 10:00	2610	2256	2974	No
44-10	ES0118	216173	12111	GS023	9/16/2019 10:02	2630	2256	2974	No
44-10	ES0118	216173	12111	GS023	9/16/2019 10:05	2555	2256	2974	No
44-10	ES0118	216173	12111	GS024	9/16/2019 10:07	2531	2256	2974	No
44-10	ES0118	216173	12111	GS024	9/16/2019 10:10	2497	2256	2974	No
44-10	ES0118	216173	12111	GS024	9/16/2019 10:12	2511	2256	2974	No
44-10	ES0118	216173	12111	GS024	9/16/2019 10:15	2421	2256	2974	No
44-10	PR363452	304726	12111	GS025	9/16/2019 8:05	2435	2185	2892	No
44-10	PR363452	304726	12111	GS025	9/16/2019 8:07	2446	2185	2892	No
44-10	PR363452	304726	12111	GS025	9/16/2019 8:10	2383	2185	2892	No
44-10	PR363452	304726	12111	GS025	9/16/2019 8:12	2318	2185	2892	No
44-10	PR363452	304726	12111	GS026	9/16/2019 8:15	2386	2185	2892	No
44-10	PR363452	304726	12111	GS026	9/16/2019 8:17	2677	2185	2892	No
44-10	PR363452	304726	12111	GS026	9/16/2019 8:19	2606	2185	2892	No
44-10	PR363452	304726	12111	GS026	9/16/2019 8:21	2321	2185	2892	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	12111	GS027	9/16/2019 8:24	2540	2185	2892	No
44-10	PR363452	304726	12111	GS027	9/16/2019 8:26	2419	2185	2892	No
44-10	PR363452	304726	12111	GS027	9/16/2019 8:28	2344	2185	2892	No
44-10	PR363452	304726	12111	GS027	9/16/2019 8:31	2650	2185	2892	No
44-10	PR363452	304726	12111	GS028	9/16/2019 8:33	2476	2185	2892	No
44-10	PR363452	304726	12111	GS028	9/16/2019 8:36	2352	2185	2892	No
44-10	PR363452	304726	12111	GS028	9/16/2019 8:38	2588	2185	2892	No
44-10	PR363452	304726	12111	GS028	9/16/2019 8:40	2343	2185	2892	No
44-10	PR363452	304726	12111	GS029	9/16/2019 8:43	2411	2185	2892	No
44-10	PR363452	304726	12111	GS029	9/16/2019 8:45	2404	2185	2892	No
44-10	PR363452	304726	12111	GS029	9/16/2019 8:47	2571	2185	2892	No
44-10	PR363452	304726	12111	GS029	9/16/2019 8:49	2469	2185	2892	No
44-10	PR363452	304726	12111	GS030	9/16/2019 8:52	2531	2185	2892	No
44-10	PR363452	304726	12111	GS030	9/16/2019 8:55	2358	2185	2892	No
44-10	PR363452	304726	12111	GS030	9/16/2019 8:57	2469	2185	2892	No
44-10	PR363452	304726	12111	GS030	9/16/2019 8:59	2436	2185	2892	No
44-10	PR363452	304726	12111	GS031	9/16/2019 9:02	2416	2185	2892	No
44-10	PR363452	304726	12111	GS031	9/16/2019 9:04	2462	2185	2892	No
44-10	PR363452	304726	12111	GS031	9/16/2019 9:06	2535	2185	2892	No
44-10	PR363452	304726	12111	GS031	9/16/2019 9:08	2428	2185	2892	No
44-10	PR363452	304726	12111	GS032	9/16/2019 9:12	2545	2185	2892	No
44-10	PR363452	304726	12111	GS032	9/16/2019 9:14	2409	2185	2892	No
44-10	PR363452	304726	12111	GS032	9/16/2019 9:16	2592	2185	2892	No
44-10	PR363452	304726	12111	GS032	9/16/2019 9:18	2479	2185	2892	No
44-10	PR363452	304726	12111	GS033	9/16/2019 9:21	2709	2185	2892	No
44-10	PR363452	304726	12111	GS033	9/16/2019 9:24	2448	2185	2892	No
44-10	PR363452	304726	12111	GS033	9/16/2019 9:26	2501	2185	2892	No
44-10	PR363452	304726	12111	GS033	9/16/2019 9:28	2415	2185	2892	No
44-10	PR363452	304726	12111	GS034	9/16/2019 9:31	2612	2185	2892	No
44-10	PR363452	304726	12111	GS034	9/16/2019 9:33	2408	2185	2892	No
44-10	PR363452	304726	12111	GS034	9/16/2019 9:35	2356	2185	2892	No
44-10	PR363452	304726	12111	GS034	9/16/2019 9:37	2396	2185	2892	No
44-10	PR363452	304726	12111	GS035	9/16/2019 9:40	2453	2185	2892	No
44-10	PR363452	304726	12111	GS035	9/16/2019 9:42	2692	2185	2892	No
44-10	PR363452	304726	12111	GS035	9/16/2019 9:44	2412	2185	2892	No
44-10	PR363452	304726	12111	GS035	9/16/2019 9:46	2468	2185	2892	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	12111	GS036	9/16/2019 9:49	2396	2185	2892	No
44-10	PR363452	304726	12111	GS036	9/16/2019 9:51	2393	2185	2892	No
44-10	PR363452	304726	12111	GS036	9/16/2019 9:53	2334	2185	2892	No
44-10	PR363452	304726	12111	GS036	9/16/2019 9:56	2374	2185	2892	No
44-10	PR363452	304726	12111	GS037	9/16/2019 9:58	2345	2185	2892	No
44-10	PR363452	304726	12111	GS037	9/16/2019 10:00	2390	2185	2892	No
44-10	PR363452	304726	12111	GS037	9/16/2019 10:03	2407	2185	2892	No
44-10	PR363452	304726	12111	GS037	9/16/2019 10:05	2516	2185	2892	No
44-10	PR375273	304730	12111	GS001	9/16/2019 8:30	3782	3480	4372	No
44-10	PR375273	304730	12111	GS001	9/16/2019 8:32	3663	3480	4372	No
44-10	PR375273	304730	12111	GS002	9/16/2019 8:34	3851	3480	4372	No
44-10	PR375273	304730	12111	GS002	9/16/2019 8:36	3729	3480	4372	No
44-10	PR375273	304730	12111	GS003	9/16/2019 8:39	2595	2196	2904	No
44-10	PR375273	304730	12111	GS003	9/16/2019 8:41	2487	2196	2904	No
44-10	PR375273	304730	12111	GS004	9/16/2019 8:43	2440	2196	2904	No
44-10	PR375273	304730	12111	GS004	9/16/2019 8:45	2501	2196	2904	No
44-10	PR375273	304730	12111	GS004	9/16/2019 8:47	2435	2196	2904	No
44-10	PR375273	304730	12111	GS004	9/16/2019 8:49	2410	2196	2904	No
44-10	PR375273	304730	12111	GS005	9/16/2019 8:51	2371	2196	2904	No
44-10	PR375273	304730	12111	GS005	9/16/2019 8:53	2372	2196	2904	No
44-10	PR375273	304730	12111	GS005	9/16/2019 8:55	2578	2196	2904	No
44-10	PR375273	304730	12111	GS005	9/16/2019 8:57	2506	2196	2904	No
44-10	PR375273	304730	12111	GS006	9/16/2019 8:59	2493	2196	2904	No
44-10	PR375273	304730	12111	GS006	9/16/2019 9:01	2431	2196	2904	No
44-10	PR375273	304730	12111	GS006	9/16/2019 9:03	2491	2196	2904	No
44-10	PR375273	304730	12111	GS006	9/16/2019 9:05	2557	2196	2904	No
44-10	PR375273	304730	12111	GS007	9/16/2019 9:07	2571	2196	2904	No
44-10	PR375273	304730	12111	GS007	9/16/2019 9:09	2445	2196	2904	No
44-10	PR375273	304730	12111	GS007	9/16/2019 9:11	2521	2196	2904	No
44-10	PR375273	304730	12111	GS007	9/16/2019 9:13	2495	2196	2904	No
44-10	PR375273	304730	12111	GS008	9/16/2019 9:15	2469	2196	2904	No
44-10	PR375273	304730	12111	GS008	9/16/2019 9:17	2450	2196	2904	No
44-10	PR375273	304730	12111	GS008	9/16/2019 9:19	2597	2196	2904	No
44-10	PR375273	304730	12111	GS008	9/16/2019 9:21	2461	2196	2904	No
44-10	PR375273	304730	12111	GS009	9/16/2019 9:23	2699	2196	2904	No
44-10	PR375273	304730	12111	GS009	9/16/2019 9:25	2678	2196	2904	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	PR375273	304730	12111	GS009	9/16/2019 9:27	2637	2196	2904	No
44-10	PR375273	304730	12111	GS009	9/16/2019 9:29	2405	2196	2904	No
44-10	PR375273	304730	12111	GS010	9/16/2019 10:07	2550	2196	2904	No
44-10	PR375273	304730	12111	GS010	9/16/2019 10:09	2603	2196	2904	No
44-10	PR375273	304730	12111	GS010	9/16/2019 10:11	2435	2196	2904	No
44-10	PR375273	304730	12111	GS010	9/16/2019 10:13	2501	2196	2904	No
44-10	PR375273	304730	12111	GS011	9/16/2019 10:15	2413	2196	2904	No
44-10	PR375273	304730	12111	GS011	9/16/2019 10:17	2395	2196	2904	No
44-10	PR375273	304730	12111	GS011	9/16/2019 10:19	2706	2196	2904	No
44-10	PR375273	304730	12111	GS011	9/16/2019 10:21	2520	2196	2904	No
44-10	PR375273	304730	12111	GS012	9/16/2019 10:23	2865	2196	2904	No
44-10	PR375273	304730	12111	GS012	9/16/2019 10:25	2412	2196	2904	No
44-10	PR375273	304730	12111	GS012	9/16/2019 10:27	2376	2196	2904	No
44-10	PR375273	304730	12111	GS012	9/16/2019 10:29	2511	2196	2904	No

ATTACHMENT 3

CONSULTATION TRIGGERS FOR RESIDENTIAL AND COMMERCIAL/INDUSTRIAL SOIL CONTAMINATION

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

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

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

ATTACHMENT 4
SIGN TEST

Attachment 12
Sign Statistical Test

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

Survey Area: No. 12000 **Description:** Security Restricted Area Grounds
Survey Unit: No. 12111 **Description:** South Yard Area Northeast of Gate House
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	1.70E-02	1.68E-03	6.31E-03	3.67E-03	1.48E-05	SOF	0.029	0.971	+
2	0.00E+00	2.39E-02	0.00E+00	0.00E+00	0.00E+00	SOF	0.024	0.976	+
3	4.42E-02	0.00E+00	7.77E-03	9.51E-03	1.82E-05	SOF	0.061	0.939	+
4	0.00E+00	9.69E-03	0.00E+00	0.00E+00	0.00E+00	SOF	0.010	0.990	+
5	2.79E-02	1.32E-02	2.87E-03	6.00E-03	6.72E-06	SOF	0.050	0.950	+
6	2.98E-02	2.71E-03	0.00E+00	6.41E-03	0.00E+00	SOF	0.039	0.961	+
7	2.49E-02	8.37E-03	0.00E+00	5.37E-03	0.00E+00	SOF	0.039	0.961	+
8	1.73E-02	1.07E-02	5.70E-03	3.73E-03	1.34E-05	SOF	0.038	0.962	+
9	3.98E-02	8.54E-03	0.00E+00	8.56E-03	0.00E+00	SOF	0.057	0.943	+
10	0.00E+00	1.53E-02	0.00E+00	0.00E+00	0.00E+00	SOF	0.015	0.985	+
11	2.48E-02	3.33E-03	0.00E+00	5.35E-03	0.00E+00	SOF	0.034	0.966	+
12	1.77E-02	9.41E-03	0.00E+00	3.81E-03	0.00E+00	SOF	0.031	0.969	+
13	1.34E-02	0.00E+00	0.00E+00	2.88E-03	0.00E+00	SOF	0.016	0.984	+
14	1.37E-02	0.00E+00	3.94E-03	2.96E-03	9.24E-06	SOF	0.021	0.979	+
15	0.00E+00	1.07E-02	6.23E-03	0.00E+00	1.46E-05	SOF	0.017	0.983	+
16	3.24E-03	1.92E-02	0.00E+00	6.99E-04	0.00E+00	SOF	0.023	0.977	+
17	0.00E+00	1.92E-02	2.39E-03	0.00E+00	5.60E-06	SOF	0.022	0.978	+

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] 12/18/19
(Print Name) (Signature) (Date)

Peer Reviewed By (RE): R.J. Mandia / [signature] 12-18-19
(Print Name) (Signature) (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #:	12000	Survey Unit #:	12111	Survey Unit Name:	South Yard Area Northeast of Gate House
Sample Plan#:	L1-12111A-F				

Sample Description: Comparison of split samples collected from systematic surface soil sample #2 and judgmental surface soil sample #1. The samples were analyzed using gamma spectroscopy by on-site HPGe system. The standard/comparison samples were L1-12111A-FSGS-002SS/L1-12111A-FQGS-002SS and L1-12111A-FJGS-001SS/L1-12111A-QJGS-001SS.

	STANDARD				COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
Systematic Sample #2								
K-40	9.34E+00	6.26E-01	14.92	0.6-1.66	8.62E+00	6.10E-01	1.08	Y
Judgmental Sample #1								
K-40	8.52E+00	5.91E-01	14.42	0.6-1.66	8.61E+00	5.80E-01	0.99	Y

Comments/Corrective Actions:
For systematic sample #2, the standard sample and QC sample did not both have positive results for a gamma emitting ROC, therefore K-40 was used in the QC comparison.There was acceptable agreement when using K-40. No further action is necessary. For judgmental sample #1, the standard sample and QC sample did not both have positive results for a gamma emitting ROC, therefore K-40 was used in the QC comparison.There was acceptable agreement when using K-40. No further action is necessary.

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

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

Performed by:	Date:	Reveiwed by:	Date:
J Graham	12/18/19	R.J. Mandic	12-18-19

ATTACHMENT 6
GRAPHICAL PRESENTATIONS

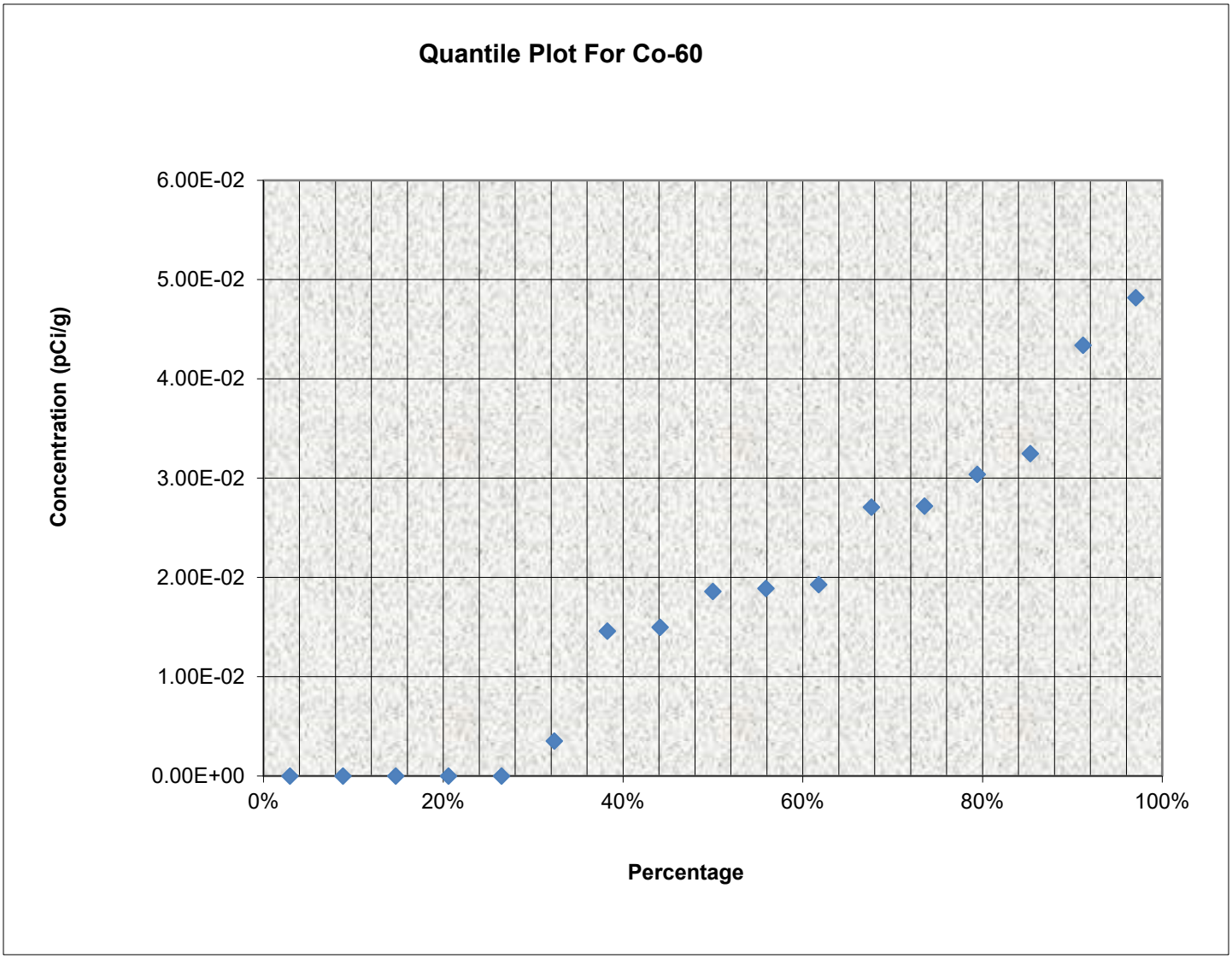
Posting Plot

QUANTILE PLOT FOR Co-60

Survey Unit: 12111

Survey Unit Name: South Yard Area Northeast of Gate House

Mean: 1.76E-02 pCi/g

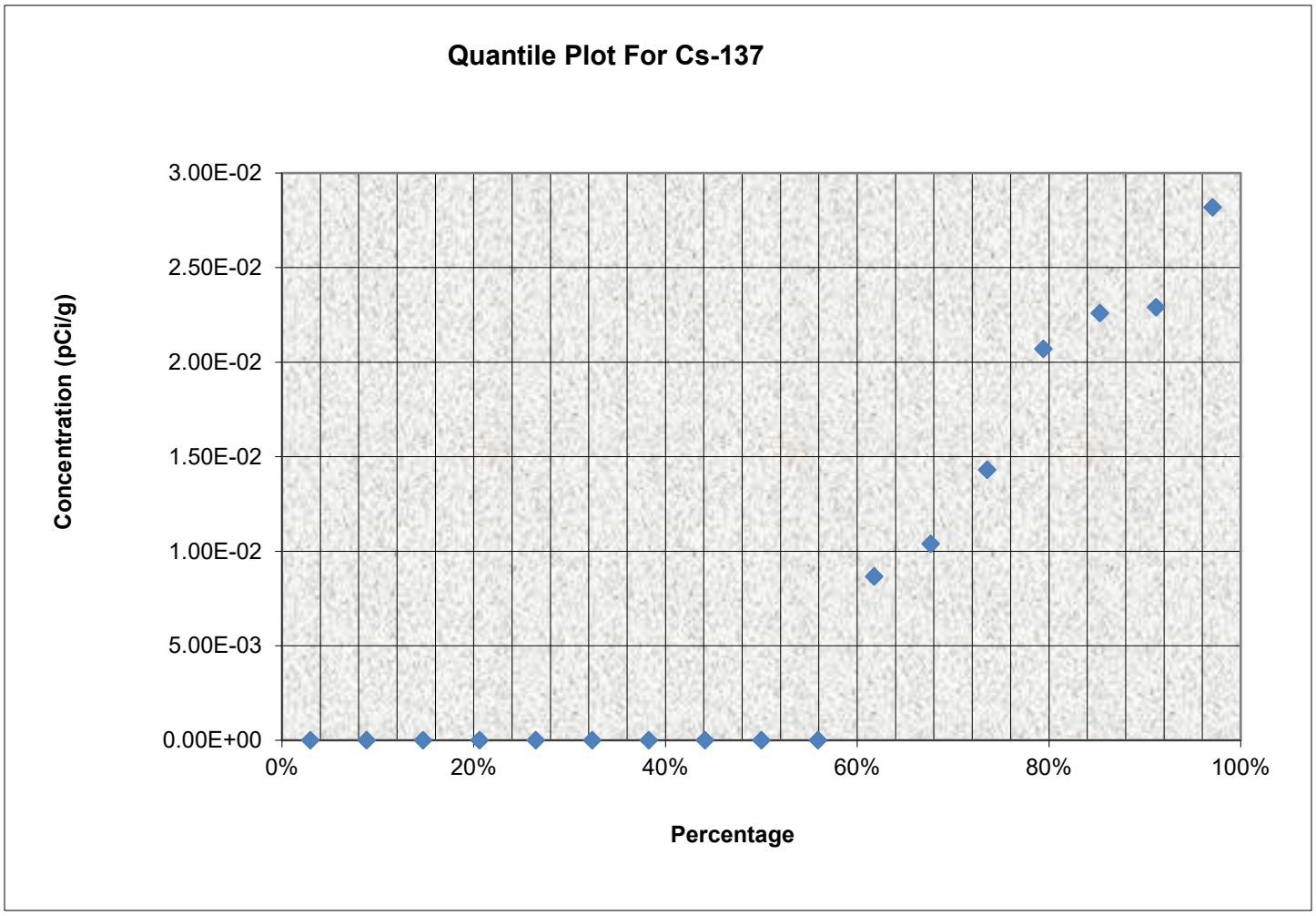


QUANTILE PLOT FOR Cs-137

Survey Unit: 12111

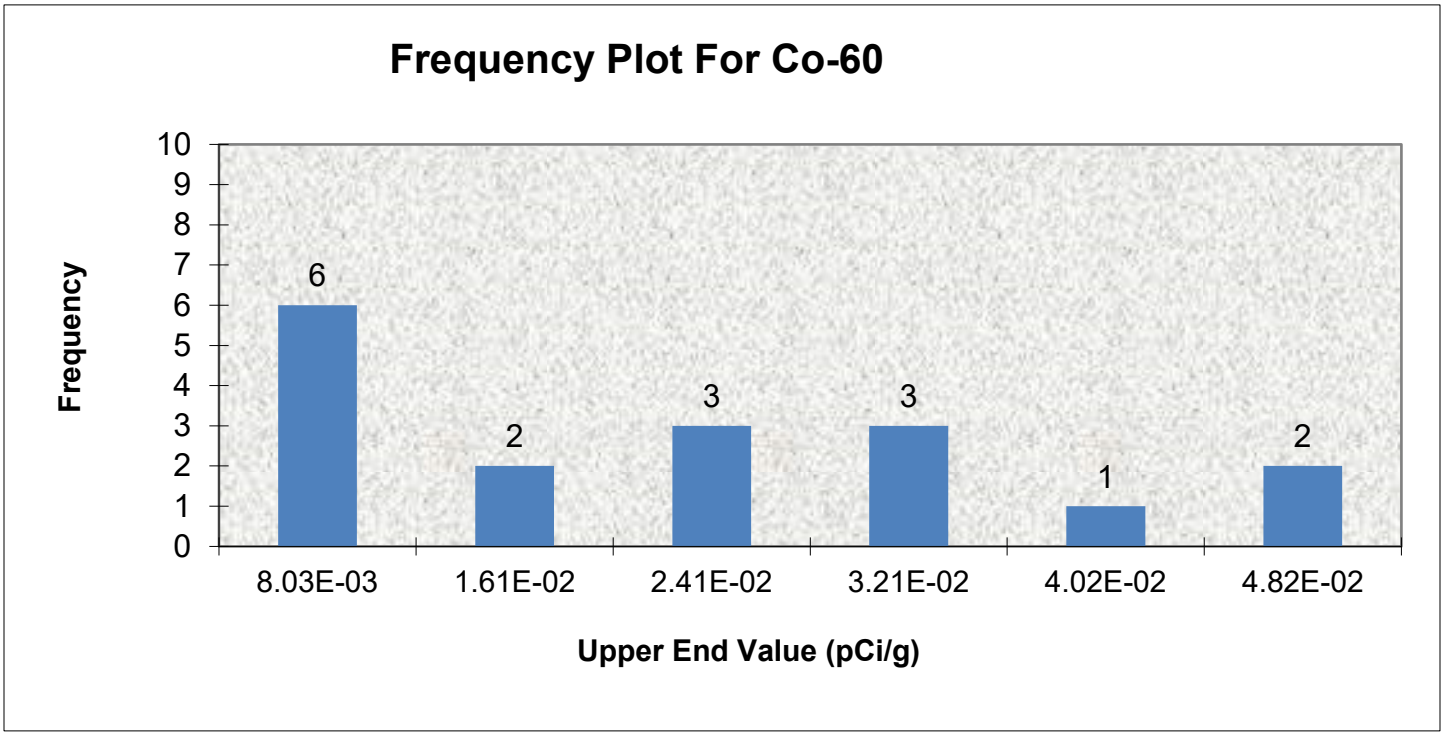
Survey Unit Name: South Yard Area Northeast of Gate House

Mean: 7.52E-03 pCi/g



HISTOGRAM FOR Co-60

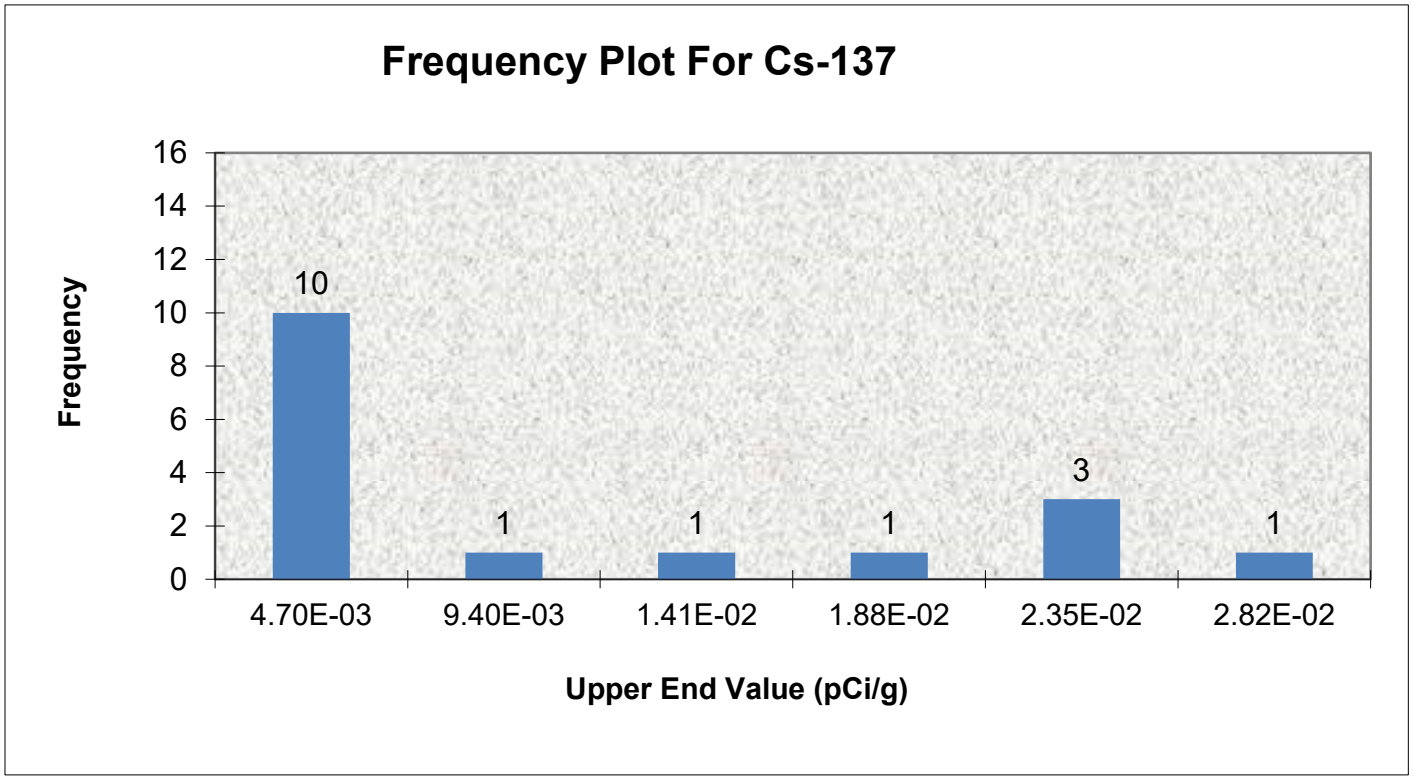
Survey Unit:	12111	
Survey Unit Name:	South Yard Area Northeast of Gate House	
Mean:	1.76E-02	pCi/g
Median:	1.86E-02	pCi/g
ST DEV:	0.016	
Skew:	0.426	



Upper Value	Observation Frequency	Observation %
8.03E-03	6	35%
1.61E-02	2	12%
2.41E-02	3	18%
3.21E-02	3	18%
4.02E-02	1	6%
4.82E-02	2	12%
TOTAL	17	100%

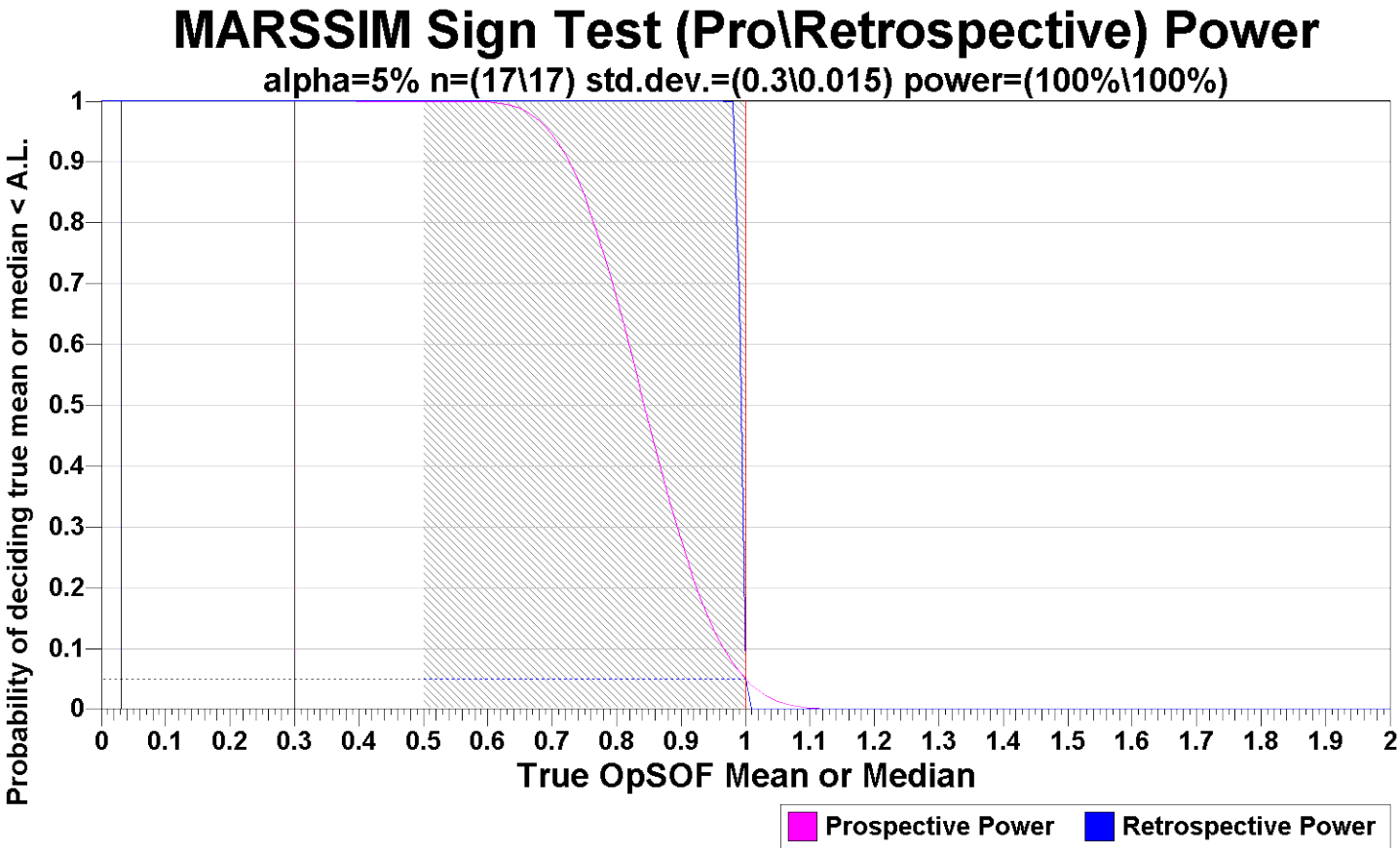
HISTOGRAM FOR Cs-137

Survey Unit:	12111	
Survey Unit Name:	South Yard Area Northeast of Gate House	
Mean:	7.52E-03	pCi/g
Median:	0.00E+00	pCi/g
ST DEV:	0.010	
Skew:	0.936	



Upper Value	Observation Frequency	Observation %
4.70E-03	10	59%
9.40E-03	1	6%
1.41E-02	1	6%
1.88E-02	1	6%
2.35E-02	3	18%
2.82E-02	1	6%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Unit 12111



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 17-Sep-19-10005
L1-12111A-FSGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10005
Sample Description	: L1-12111A-FSGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.847E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:00:00AM
Acquisition Started	: 9/17/2019 8:34:40AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79547
Fill Height	: 1846.65 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 8:49:43AM

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

Data Validated
0800 9-18-19

Analysis Report for 17-Sep-19-10005

L1-12111A-FSGS-001SS

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	477.43	9.57E+01	17.92	1.09E+02	1.24
2	295.34	586 -	595	590.73	5.95E+01	12.99	4.85E+01	1.40
3	352.02	700 -	708	703.99	9.31E+01	13.29	3.89E+01	1.16
4	609.26	1214 -	1223	1218.09	6.22E+01	10.39	1.98E+01	1.06
5	911.12	1817 -	1826	1821.68	3.97E+01	8.08	1.13E+01	1.06
6	1460.78	2915 -	2928	2921.61	4.39E+02	21.15	3.27E+00	2.21

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	7.88E+00	5.11E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.31E-01	2.66E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.49E-01	2.64E-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-19-10005

L1-12111A-FSGS-001SS

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	2.17E-01	5.03E-02
		351.93	*	35.60	1.98E-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	2.17E-01	4.52E-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-19-10005

L1-12111A-FSGS-001SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	7.88E+00	5.11E-01	
X	Bi-211	0.865			
	Pb-212	1.000	1.31E-01	2.66E-02	
	Bi-214	1.000	1.49E-01	2.64E-02	
	Pb-214	0.999	2.03E-01	2.72E-02	
	Ac-228	1.000	2.17E-01	4.52E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 17-Sep-19-10005

L1-12111A-FSGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 8:49:43AM
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	4.68E-02	4.93E-02	4.93E-02
	BE-7	477.60		10.44	8.29E-02	3.12E-01	3.12E-01
+	K-40	1460.82	*	10.66	7.88E+00	2.31E-01	2.31E-01
	Mn-54	834.85		99.98	-8.68E-03	3.39E-02	3.39E-02
	Co-60	1173.23		99.85	1.86E-02	3.84E-02	5.50E-02
		1332.49		99.98	9.86E-03		3.84E-02
	Nb-94	702.65		99.81	2.65E-02	3.87E-02	4.32E-02
		871.09		99.89	-7.61E-03		3.87E-02
	Ag-108m	79.13		6.60	5.74E-01	3.20E-02	1.10E+00
		433.94		90.50	-2.14E-03		3.20E-02
		614.28		89.80	-1.10E-02		4.72E-02
		722.94		90.80	-1.37E-02		4.24E-02
	Sb-125	176.31		6.84	1.87E-01	9.35E-02	5.03E-01
		380.45		1.52	6.19E-01		1.99E+00
		427.87		29.60	-8.26E-02		9.35E-02
		463.36		10.49	5.03E-03		3.10E-01
		600.60		17.65	-2.57E-02		2.12E-01
		606.71		4.98	-2.91E-01		1.18E+00
		635.95		11.22	2.29E-02		2.82E-01

Analysis Report for 17-Sep-19-10005

L1-12111A-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.04E-01	9.35E-02	1.86E+00
Ba-133	79.61	2.65	1.06E-01	6.76E-02	2.51E+00
	81.00	32.90	-1.35E-01		1.80E-01
	276.40	7.16	1.68E-02		4.13E-01
	302.85	18.34	-5.45E-03		1.47E-01
	356.01	62.05	-4.46E-02		6.76E-02
	383.85	8.94	-8.60E-02		3.15E-01
Cs-134	475.36	1.48	4.21E-01	4.28E-02	2.22E+00
	563.25	8.34	-5.39E-02		3.93E-01
	569.33	15.37	-1.05E-01		2.06E-01
	604.72	97.62	-2.67E-02		5.51E-02
	795.86	85.46	2.92E-03		4.28E-02
	801.95	8.69	-1.13E-01		3.64E-01
	1038.61	0.99	-5.85E-01		4.58E+00
	1167.97	1.79	-2.96E-01		2.84E+00
	1365.19	3.02	-6.20E-01		1.09E+00
Cs-137	661.66	85.10	2.29E-02	4.27E-02	4.27E-02
Eu-152	121.78	28.67	8.70E-03	1.09E-01	1.09E-01
	244.70	7.61	1.51E-01		4.72E-01
	295.94	0.45	6.82E+00		8.47E+00
	344.28	26.60	-9.20E-02		1.13E-01
	367.79	0.86	1.43E+00		3.68E+00
	411.12	2.24	1.97E-01		1.61E+00
	443.96	2.83	-4.88E-01		9.25E-01
	488.68	0.42	2.71E+00		7.94E+00
	563.99	0.49	5.81E-01		6.76E+00
	586.26	0.46	1.04E+01		1.07E+01
	678.62	0.47	-1.24E+00		8.21E+00
	688.67	0.86	-8.04E-01		4.00E+00
	719.35	0.28	1.78E+00		1.21E+01
	778.90	12.96	-5.90E-02		2.95E-01
	810.45	0.32	4.46E+00		1.01E+01
	867.37	4.26	1.04E-01		8.91E-01
	919.33	0.43	-4.20E+00		8.58E+00
	964.08	14.65	-4.61E-02		3.43E-01
	1085.87	10.24	4.61E-02		4.20E-01
	1089.74	1.73	-5.93E-01		2.58E+00
	1112.07	13.69	-1.86E-01		3.08E-01
	1212.95	1.43	2.60E+00		4.02E+00
	1249.94	0.19	6.48E+00		2.65E+01
	1299.14	1.63	-6.72E-01		2.75E+00
	1408.01	21.07	-8.94E-02		1.20E-01
	1457.64	0.50	-8.74E+00		3.96E+01
	1528.10	0.28	-4.56E+00		1.03E+01
Eu-154	123.07	40.40	1.91E-02	7.67E-02	7.67E-02
	247.93	6.89	1.28E-01		4.47E-01
	591.76	4.95	-1.60E-01		6.57E-01
	692.42	1.78	-5.52E-01		1.72E+00
	723.30	20.06	-5.91E-04		2.04E-01
	756.80	4.52	-4.01E-01		7.30E-01
	873.18	12.08	-4.82E-02		3.26E-01

Analysis Report for 17-Sep-19-10005

L1-12111A-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.55E-02	7.67E-02	3.62E-01
	1004.76	18.01	1.06E-01		2.24E-01
	1274.43	34.80	9.54E-03		1.32E-01
	1596.48	1.80	5.41E-01		2.14E+00
Eu-155	45.30	1.31	-1.24E+00	1.69E-01	1.09E+01
	60.01	1.22	-1.07E+00		1.20E+01
	86.55	30.70	2.68E-02		1.69E-01
	105.31	21.10	7.51E-02		1.90E-01
Ra-226	186.21	3.64	8.58E-01	1.04E+00	1.04E+00
Pa-231	27.36	10.30	9.46E-01	1.17E+00	1.22E+00
	283.69	1.70	-6.31E-01		1.59E+00
	300.07	2.47	6.42E-02		1.17E+00
	302.65	2.20	-4.54E-02		1.22E+00
	330.06	1.40	4.17E-01		2.22E+00
U-235	143.76	10.96	-1.22E-01	6.57E-02	2.53E-01
	163.33	5.08	-7.01E-02		6.68E-01
	185.71	57.20	5.01E-02		6.57E-02
	202.11	1.08	1.52E+00		3.09E+00
	205.31	5.01	-5.16E-01		6.21E-01
Am-241	59.54	35.90	4.88E-02	4.31E-01	4.31E-01

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

Apex-Gamma

Analysis Report for 17-Sep-19-10006
L1-12111A-FSGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10006
Sample Description	: L1-12111A-FSGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.657E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:02:00AM
Acquisition Started	: 9/17/2019 8:34:47AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79548
Fill Height	: 1657.00 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 8:49:51AM

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

Data Validated
0800 9-18-19

Analysis Report for 17-Sep-19-10006

L1-12111A-FSGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.62	949 -	961	954.56	1.07E+02	16.48	6.18E+01	1.00
2	295.18	1176 -	1187	1180.64	5.18E+01	11.43	3.12E+01	0.34
3	338.39	1347 -	1358	1353.34	3.34E+01	9.11	1.96E+01	0.76
4	351.92	1401 -	1413	1407.43	5.89E+01	11.32	2.61E+01	0.43
5	582.74	2325 -	2337	2330.16	4.91E+01	8.35	7.91E+00	0.52
6	609.09	2428 -	2442	2435.51	5.76E+01	9.21	9.43E+00	0.39
7	910.93	3636 -	3648	3642.68	3.18E+01	7.85	1.12E+01	0.65
8	1460.43	5830 -	5853	5841.56	3.83E+02	19.57	0.00E+00	1.83

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.82	*	10.66	9.34E+00	6.26E-01
Tl-208	0.96	583.19	*	85.00	8.04E-02	1.45E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.89E-01	3.28E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.82E-01	3.10E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 17-Sep-19-10006

L1-12111A-FSGS-002SS

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	1.00	241.99		7.25		
		295.22	*	18.42	2.43E-01	5.71E-02
		351.93	*	35.60	1.62E-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	2.83E-01	8.05E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.32E-01	5.82E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 17-Sep-19-10006

L1-12111A-FSGS-002SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.976	9.34E+00	6.26E-01	
	Tl-208	0.968	8.04E-02	1.45E-02	
X	Bi-211	0.890			
	Pb-212	1.000	1.89E-01	3.28E-02	
	Bi-214	0.996	1.82E-01	3.10E-02	
	Pb-214	1.000	1.83E-01	2.91E-02	
	Ac-228	0.996	2.50E-01	4.71E-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-19-10006

L1-12111A-FSGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 8:49:51AM
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	6.94E-02	5.28E-02	5.28E-02
	BE-7	477.60		10.44	-2.32E-01	4.00E-01	4.00E-01
+	K-40	1460.82	*	10.66	9.34E+00	7.01E-02	7.01E-02
	Mn-54	834.85		99.98	-1.12E-02	4.78E-02	4.78E-02
	Co-60	1173.23		99.85	-4.55E-02	4.38E-02	6.79E-02
		1332.49		99.98	-3.34E-02		4.38E-02
	Nb-94	702.65		99.81	-2.94E-02	4.89E-02	4.89E-02
		871.09		99.89	-1.17E-02		5.32E-02
	Ag-108m	79.13		6.60	7.70E-01	4.13E-02	1.91E+00
		433.94		90.50	-2.95E-02		4.13E-02
		614.28		89.80	-2.26E-02		5.75E-02
		722.94		90.80	7.99E-03		4.77E-02
	Sb-125	176.31		6.84	-3.29E-01	1.39E-01	5.50E-01
		380.45		1.52	9.58E-01		2.45E+00
		427.87		29.60	-1.05E-02		1.39E-01
		463.36		10.49	-3.77E-02		4.21E-01
		600.60		17.65	-6.57E-02		2.38E-01
		606.71		4.98	2.10E+00		1.39E+00
		635.95		11.22	1.41E-01		3.90E-01

Analysis Report for 17-Sep-19-10006

L1-12111A-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.38E-01	1.39E-01	2.54E+00
Ba-133	79.61	2.65	-1.41E+00	7.80E-02	4.50E+00
	81.00	32.90	-1.92E-01		3.20E-01
	276.40	7.16	3.79E-01		5.43E-01
	302.85	18.34	5.25E-03		2.11E-01
	356.01	62.05	-6.23E-03		7.80E-02
	383.85	8.94	-1.63E-01		4.05E-01
Cs-134	475.36	1.48	3.13E+00	6.12E-02	3.07E+00
	563.25	8.34	-7.22E-02		5.30E-01
	569.33	15.37	1.00E-01		2.93E-01
	604.72	97.62	-1.13E-02		6.74E-02
	795.86	85.46	4.14E-02		6.12E-02
	801.95	8.69	-1.21E-01		5.15E-01
	1038.61	0.99	-4.68E-01		6.33E+00
	1167.97	1.79	3.07E+00		3.98E+00
	1365.19	3.02	4.56E-01		1.54E+00
Cs-137	661.66	85.10	-4.84E-03	5.36E-02	5.36E-02
Eu-152	121.78	28.67	-6.11E-03	1.52E-01	1.72E-01
	244.70	7.61	3.35E-01		6.15E-01
	295.94	0.45	9.79E+00		1.12E+01
	344.28	26.60	-2.89E-02		1.52E-01
	367.79	0.86	2.72E+00		4.48E+00
	411.12	2.24	1.64E-01		1.65E+00
	443.96	2.83	-9.88E-01		1.50E+00
	488.68	0.42	-1.91E-01		1.06E+01
	563.99	0.49	1.92E+00		9.21E+00
	586.26	0.46	-5.25E+00		1.32E+01
	678.62	0.47	-5.15E+00		9.96E+00
	688.67	0.86	1.37E+00		5.82E+00
	719.35	0.28	2.41E+00		1.55E+01
	778.90	12.96	-3.92E-03		4.08E-01
	810.45	0.32	7.02E+00		1.53E+01
	867.37	4.26	-4.28E-01		1.25E+00
	919.33	0.43	-7.68E+00		1.12E+01
	964.08	14.65	-1.81E-01		4.87E-01
	1085.87	10.24	-4.37E-01		5.14E-01
	1089.74	1.73	7.38E-01		3.18E+00
	1112.07	13.69	4.58E-03		4.58E-01
	1212.95	1.43	2.04E+00		5.82E+00
	1249.94	0.19	-2.89E+01		3.74E+01
	1299.14	1.63	2.13E+00		4.21E+00
	1408.01	21.07	2.70E-02		2.57E-01
	1457.64	0.50	1.96E+02		5.02E+01
	1528.10	0.28	-7.48E+00		1.07E+01
Eu-154	123.07	40.40	-1.78E-02	1.22E-01	1.22E-01
	247.93	6.89	8.59E-02		6.04E-01
	591.76	4.95	2.58E-01		8.04E-01
	692.42	1.78	-1.31E+00		2.96E+00
	723.30	20.06	-9.92E-02		2.12E-01
	756.80	4.52	8.98E-01		1.22E+00
	873.18	12.08	-7.19E-01		4.06E-01

Analysis Report for 17-Sep-19-10006

L1-12111A-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.44E-01	1.22E-01	4.75E-01
	1004.76	18.01	-1.29E-01		2.89E-01
	1274.43	34.80	1.17E-03		1.85E-01
	1596.48	1.80	1.39E+00		2.68E+00
Eu-155	45.30	1.31	-7.30E-01	2.80E-01	3.05E+01
	60.01	1.22	-6.56E+00		3.33E+01
	86.55	30.70	-5.28E-02		2.80E-01
	105.31	21.10	2.42E-02		2.85E-01
Ra-226	186.21	3.64	3.61E-01	1.11E+00	1.11E+00
Pa-231	27.36	10.30	2.71E+00	1.58E+00	3.61E+00
	283.69	1.70	-2.56E-01		2.16E+00
	300.07	2.47	6.45E-01		1.58E+00
	302.65	2.20	-9.46E-01		1.72E+00
	330.06	1.40	1.75E-01		3.22E+00
U-235	143.76	10.96	-1.39E-01	6.99E-02	4.09E-01
	163.33	5.08	2.01E-01		8.32E-01
	185.71	57.20	6.08E-03		6.99E-02
	202.11	1.08	1.32E+00		3.66E+00
	205.31	5.01	-7.03E-01		7.79E-01
Am-241	59.54	35.90	-1.16E-01	1.19E+00	1.19E+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 17-Sep-19-10007

L1-12111A-FQGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10007
Sample Description	: L1-12111A-FQGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.616E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:02:00AM
Acquisition Started	: 9/17/2019 8:53:34AM
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	: 0.15 %
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79551
Fill Height	: 1615.91 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:08:37AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated
0800 9-18-19

Analysis Report for 17-Sep-19-10007

L1-12111A-FQGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.59	948 -	962	954.44	1.02E+02	18.87	8.60E+01	0.89
2	351.86	1401 -	1412	1407.18	7.75E+01	11.60	2.25E+01	0.65
3	582.89	2324 -	2338	2330.79	5.25E+01	8.61	7.50E+00	1.07
4	609.02	2430 -	2442	2435.26	6.16E+01	9.27	9.35E+00	0.79
5	1460.25	5830 -	5853	5840.83	3.51E+02	19.64	8.73E+00	1.56
6	1763.66	7049 -	7062	7055.66	1.12E+01	4.08	1.83E+00	1.25

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.94	1460.82	*	10.66	8.62E+00	6.10E-01
Tl-208	0.98	583.19	*	85.00	8.65E-02	1.51E-02
Bi-211	0.90	351.07	*	13.02	5.86E-01	9.97E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.81E-01	3.64E-02
		300.09		3.30		
Bi-214	0.97	609.32	*	45.49	1.96E-01	3.17E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 17-Sep-19-10007

L1-12111A-FQGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.97	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	2.21E-01	8.12E-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	2.14E-01	3.64E-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	0.949	8.62E+00	6.10E-01	
	Tl-208	0.986	8.65E-02	1.51E-02	
?	Bi-211	0.905	5.86E-01	9.97E-02	
	Pb-212	1.000	1.81E-01	3.64E-02	
	Bi-214	0.979	1.99E-01	2.95E-02	
?	Pb-214	1.000	2.14E-01	3.64E-02	

Analysis Report for 17-Sep-19-10007

L1-12111A-FQGS-002SS

? = 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-19-10007

L1-12111A-FQGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:08:37AM
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	4.46E-02	5.72E-02	5.72E-02
	BE-7	477.60		10.44	-1.05E-01	3.89E-01	3.89E-01
+	K-40	1460.82	*	10.66	8.62E+00	5.58E-01	5.58E-01
	Mn-54	834.85		99.98	5.15E-03	4.25E-02	4.25E-02
	Co-60	1173.23		99.85	2.83E-02	5.94E-02	7.63E-02
		1332.49		99.98	8.85E-04		5.94E-02
	Nb-94	702.65		99.81	-5.55E-03	4.78E-02	4.78E-02
		871.09		99.89	2.25E-02		5.67E-02
	Ag-108m	79.13		6.60	1.37E+00	4.51E-02	2.02E+00
		433.94		90.50	-5.50E-03		4.51E-02
		614.28		89.80	-1.53E-02		6.57E-02
		722.94		90.80	4.55E-02		5.79E-02
	Sb-125	176.31		6.84	2.47E-01	1.28E-01	6.22E-01
		380.45		1.52	3.88E-01		2.46E+00
		427.87		29.60	-2.76E-02		1.28E-01
		463.36		10.49	-1.32E-02		4.42E-01
		600.60		17.65	5.45E-02		2.50E-01
		606.71		4.98	1.64E+00		1.40E+00
		635.95		11.22	-1.86E-01		3.36E-01

Analysis Report for 17-Sep-19-10007

L1-12111A-FQGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.46E-01	1.28E-01	2.73E+00
Ba-133	79.61	2.65	-2.03E-01	6.98E-02	4.67E+00
	81.00	32.90	-1.43E-01		3.17E-01
	276.40	7.16	-3.30E-02		5.57E-01
	302.85	18.34	1.58E-01		2.23E-01
	356.01	62.05	-7.51E-02		6.98E-02
	383.85	8.94	-2.65E-02		4.07E-01
Cs-134	475.36	1.48	-1.29E+00	6.16E-02	2.51E+00
	563.25	8.34	9.61E-02		4.79E-01
	569.33	15.37	4.37E-02		2.62E-01
	604.72	97.62	-2.97E-02		6.70E-02
	795.86	85.46	-6.71E-02		6.16E-02
	801.95	8.69	3.83E-01		6.57E-01
	1038.61	0.99	2.27E-02		6.10E+00
	1167.97	1.79	-1.14E+00		3.59E+00
	1365.19	3.02	9.56E-01		1.92E+00
Cs-137	661.66	85.10	1.21E-02	4.91E-02	4.91E-02
Eu-152	121.78	28.67	-8.88E-03	1.39E-01	1.55E-01
	244.70	7.61	-4.53E-01		5.55E-01
	295.94	0.45	6.17E+00		1.08E+01
	344.28	26.60	-6.79E-02		1.39E-01
	367.79	0.86	-1.88E+00		4.18E+00
	411.12	2.24	-1.21E+00		1.94E+00
	443.96	2.83	8.78E-01		1.64E+00
	488.68	0.42	1.88E+00		8.21E+00
	563.99	0.49	-2.23E+00		8.01E+00
	586.26	0.46	-3.57E+00		1.34E+01
	678.62	0.47	2.01E+00		1.11E+01
	688.67	0.86	2.97E+00		4.99E+00
	719.35	0.28	4.00E+00		1.47E+01
	778.90	12.96	6.86E-02		3.89E-01
	810.45	0.32	9.61E+00		1.79E+01
	867.37	4.26	-9.39E-01		1.25E+00
	919.33	0.43	6.90E-02		1.11E+01
	964.08	14.65	3.32E-01		4.47E-01
	1085.87	10.24	2.80E-02		5.69E-01
	1089.74	1.73	5.69E-01		3.86E+00
	1112.07	13.69	1.54E-01		4.40E-01
	1212.95	1.43	-6.94E-01		5.22E+00
	1249.94	0.19	-9.35E+00		3.66E+01
	1299.14	1.63	-3.59E-01		3.97E+00
	1408.01	21.07	4.14E-02		2.52E-01
	1457.64	0.50	1.91E+02		4.95E+01
	1528.10	0.28	8.65E+00		1.66E+01
Eu-154	123.07	40.40	-6.18E-02	1.08E-01	1.08E-01
	247.93	6.89	1.29E-01		5.89E-01
	591.76	4.95	2.38E-01		9.05E-01
	692.42	1.78	-3.32E-02		2.66E+00
	723.30	20.06	2.15E-01		2.65E-01
	756.80	4.52	-8.38E-02		1.08E+00
	873.18	12.08	-3.55E-02		4.44E-01

Analysis Report for 17-Sep-19-10007

L1-12111A-FQGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.04E-02	1.08E-01	5.07E-01
	1004.76	18.01	-7.21E-02		2.85E-01
	1274.43	34.80	1.84E-02		1.89E-01
	1596.48	1.80	-4.42E-01		1.75E+00
Eu-155	45.30	1.31	4.09E+00	2.82E-01	3.24E+01
	60.01	1.22	-1.91E+01		3.22E+01
	86.55	30.70	-6.89E-02		2.83E-01
	105.31	21.10	1.12E-01		2.82E-01
Ra-226	186.21	3.64	4.57E-01	1.18E+00	1.18E+00
Pa-231	27.36	10.30	3.25E+00	1.68E+00	3.56E+00
	283.69	1.70	-9.51E-01		2.26E+00
	300.07	2.47	-1.22E+00		1.68E+00
	302.65	2.20	9.46E-01		1.84E+00
	330.06	1.40	-1.57E+00		2.67E+00
U-235	143.76	10.96	6.40E-02	7.57E-02	3.98E-01
	163.33	5.08	3.47E-01		8.32E-01
	185.71	57.20	4.47E-02		7.57E-02
	202.11	1.08	-1.16E+00		3.47E+00
	205.31	5.01	-4.10E-01		7.07E-01
Am-241	59.54	35.90	-5.50E-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 17-Sep-19-10008

L1-12111A-FSGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10008
Sample Description	: L1-12111A-FSGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.628E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:06:00AM
Acquisition Started	: 9/17/2019 8:34:57AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79549
Fill Height	: 1628.47 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 8:50:08AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0800 9-18-19

Analysis Report for 17-Sep-19-10008

L1-12111A-FSGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.87	947 -	961	955.04	1.03E+02	16.98	6.40E+01	1.19
2	352.02	1397 -	1413	1407.10	7.97E+01	12.96	2.83E+01	0.82
3	609.02	2428 -	2443	2434.12	5.88E+01	10.12	1.42E+01	1.33
4	910.91	3635 -	3647	3641.08	3.21E+01	6.72	4.92E+00	1.04
5	1460.21	5828 -	5850	5838.78	2.88E+02	18.65	1.60E+01	1.18

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	0.94	1460.82	*	10.66	6.35E+00	4.95E-01
Bi-211	0.86	351.07	*	13.02	5.42E-01	9.84E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.62E-01	2.97E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.68E-01	3.06E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		

Analysis Report for 17-Sep-19-10008

L1-12111A-FSGS-003SS

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	1.98E-01	3.59E-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	2.12E-01	4.54E-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-19-10008

L1-12111A-FSGS-003SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.942	6.35E+00	4.95E-01	
?	Bi-211	0.865	5.42E-01	9.84E-02	
	Pb-212	0.992	1.62E-01	2.97E-02	
	Bi-214	0.994	1.68E-01	3.06E-02	
?	Pb-214	0.999	1.98E-01	3.59E-02	
	Ac-228	0.996	2.12E-01	4.54E-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-19-10008

L1-12111A-FSGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 8:50:08AM
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	7.44E-02	5.64E-02	5.64E-02
	BE-7	477.60		10.44	3.07E-01	4.10E-01	4.10E-01
+	K-40	1460.82	*	10.66	6.35E+00	6.43E-01	6.43E-01
	Mn-54	834.85		99.98	7.37E-03	3.92E-02	3.92E-02
	Co-60	1173.23		99.85	2.64E-02	5.57E-02	5.97E-02
		1332.49		99.98	4.82E-02		5.57E-02
	Nb-94	702.65		99.81	-4.63E-02	3.57E-02	3.57E-02
		871.09		99.89	1.41E-02		4.60E-02
	Ag-108m	79.13		6.60	4.97E-01	3.73E-02	1.20E+00
		433.94		90.50	4.03E-03		3.73E-02
		614.28		89.80	-3.57E-02		5.25E-02
		722.94		90.80	8.01E-03		3.99E-02
	Sb-125	176.31		6.84	3.30E-02	1.13E-01	4.26E-01
		380.45		1.52	-2.19E-01		2.25E+00
		427.87		29.60	-6.40E-02		1.13E-01
		463.36		10.49	-3.46E-02		3.52E-01
		600.60		17.65	-1.21E-02		2.25E-01
		606.71		4.98	-6.28E-01		1.25E+00
		635.95		11.22	-1.47E-01		3.37E-01

Analysis Report for 17-Sep-19-10008

L1-12111A-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.18E-01	1.13E-01	1.89E+00
Ba-133	79.61	2.65	1.13E+00	6.55E-02	2.87E+00
	81.00	32.90	-1.91E-01		1.94E-01
	276.40	7.16	2.07E-01		4.77E-01
	302.85	18.34	-2.64E-02		1.87E-01
	356.01	62.05	-4.62E-03		6.55E-02
	383.85	8.94	-2.93E-04		3.70E-01
Cs-134	475.36	1.48	2.21E+00	4.33E-02	2.88E+00
	563.25	8.34	-4.82E-01		3.97E-01
	569.33	15.37	5.22E-02		2.21E-01
	604.72	97.62	-6.43E-02		5.55E-02
	795.86	85.46	-4.68E-03		4.33E-02
	801.95	8.69	2.58E-01		4.84E-01
	1038.61	0.99	2.23E+00		4.78E+00
	1167.97	1.79	-1.57E+00		3.37E+00
	1365.19	3.02	-1.67E-01		1.08E+00
Cs-137	661.66	85.10	2.82E-02	4.42E-02	4.42E-02
Eu-152	121.78	28.67	4.28E-02	1.13E-01	1.13E-01
	244.70	7.61	5.49E-02		4.49E-01
	295.94	0.45	1.32E+00		8.79E+00
	344.28	26.60	7.37E-02		1.29E-01
	367.79	0.86	-7.01E-01		3.18E+00
	411.12	2.24	7.30E-01		1.35E+00
	443.96	2.83	-6.33E-01		1.09E+00
	488.68	0.42	2.92E+00		8.83E+00
	563.99	0.49	-3.54E+00		6.37E+00
	586.26	0.46	6.62E+00		1.14E+01
	678.62	0.47	2.41E+00		7.82E+00
	688.67	0.86	1.26E+00		4.09E+00
	719.35	0.28	-1.40E+00		1.21E+01
	778.90	12.96	-2.47E-01		2.82E-01
	810.45	0.32	-7.88E+00		1.08E+01
	867.37	4.26	-1.37E-01		1.00E+00
	919.33	0.43	1.18E-01		1.04E+01
	964.08	14.65	-1.57E-01		3.63E-01
	1085.87	10.24	3.60E-01		5.54E-01
	1089.74	1.73	8.33E-01		3.29E+00
	1112.07	13.69	-2.35E-01		3.75E-01
	1212.95	1.43	-2.48E+00		4.74E+00
	1249.94	0.19	-5.56E-01		2.93E+01
	1299.14	1.63	4.31E-01		2.93E+00
	1408.01	21.07	-1.45E-02		2.12E-01
	1457.64	0.50	1.43E+02		4.11E+01
	1528.10	0.28	8.63E+00		1.56E+01
Eu-154	123.07	40.40	2.99E-02	7.94E-02	7.94E-02
	247.93	6.89	-1.53E-01		4.35E-01
	591.76	4.95	-4.70E-01		7.28E-01
	692.42	1.78	3.13E-01		2.39E+00
	723.30	20.06	-4.58E-02		1.77E-01
	756.80	4.52	-1.47E-01		9.10E-01
	873.18	12.08	4.62E-02		4.28E-01

Analysis Report for 17-Sep-19-10008

L1-12111A-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.99E-01	7.94E-02	4.97E-01
	1004.76	18.01	1.70E-01		2.86E-01
	1274.43	34.80	-5.46E-02		1.61E-01
	1596.48	1.80	1.26E+00		2.42E+00
Eu-155	45.30	1.31	2.69E+00	1.79E-01	9.79E+00
	60.01	1.22	-3.28E+00		1.07E+01
	86.55	30.70	-1.60E-02		1.79E-01
	105.31	21.10	2.52E-02		1.84E-01
Ra-226	186.21	3.64	4.05E-01	8.76E-01	8.76E-01
Pa-231	27.36	10.30	2.82E-01	1.10E+00	1.10E+00
	283.69	1.70	-1.29E+00		1.63E+00
	300.07	2.47	-7.72E-01		1.41E+00
	302.65	2.20	-5.74E-01		1.55E+00
	330.06	1.40	1.17E-01		2.43E+00
U-235	143.76	10.96	-9.38E-02	5.52E-02	2.86E-01
	163.33	5.08	-1.06E-01		5.80E-01
	185.71	57.20	2.04E-02		5.52E-02
	202.11	1.08	-6.66E-01		2.65E+00
	205.31	5.01	3.58E-01		6.36E-01
Am-241	59.54	35.90	-1.76E-01	3.78E-01	3.78E-01

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

Apex-Gamma

Analysis Report for 17-Sep-19-10009

L1-12111A-FSGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10009
Sample Description	: L1-12111A-FSGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.743E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:08:00AM
Acquisition Started	: 9/17/2019 8:35:08AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79550
Fill Height	: 1742.52 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 8:50:12AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0800 9-18-19

Analysis Report for 17-Sep-19-10009

L1-12111A-FSGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.67	945 -	962	955.15	1.37E+02	18.98	6.86E+01	1.21
2	295.28	1177 -	1185	1181.35	3.50E+01	8.56	1.80E+01	0.48
3	351.90	1402 -	1414	1407.60	6.24E+01	11.88	2.96E+01	1.12
4	583.22	2327 -	2337	2332.20	2.63E+01	7.68	1.37E+01	0.51
5	609.40	2430 -	2445	2436.86	4.58E+01	10.08	1.82E+01	0.49
6	911.24	3637 -	3650	3643.99	3.12E+01	7.45	8.79E+00	0.30
7	1460.76	5832 -	5855	5843.41	3.68E+02	20.58	1.44E+01	2.06

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	7.45E+00	5.28E-01
Tl-208	1.00	583.19	*	85.00	3.67E-02	1.09E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.11E-01	3.38E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.23E-01	2.80E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 17-Sep-19-10009

L1-12111A-FSGS-004SS

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	1.43E-01	3.67E-02
		351.93	*	35.60	1.49E-01	3.07E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.92E-01	4.65E-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 17-Sep-19-10009

L1-12111A-FSGS-004SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	7.45E+00	5.28E-01	
	Tl-208	1.000	3.67E-02	1.09E-02	
X	Bi-211	0.895			
	Pb-212	1.000	2.11E-01	3.38E-02	
	Bi-214	1.000	1.23E-01	2.80E-02	
	Pb-214	1.000	1.46E-01	2.35E-02	
	Ac-228	1.000	1.92E-01	4.65E-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-19-10009

L1-12111A-FSGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 8:50:12AM
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	2.69E-02	4.41E-02	4.41E-02
	BE-7	477.60		10.44	-2.44E-01	3.03E-01	3.03E-01
+	K-40	1460.82	*	10.66	7.45E+00	5.73E-01	5.73E-01
	Mn-54	834.85		99.98	-8.32E-03	4.30E-02	4.30E-02
	Co-60	1173.23		99.85	-2.78E-02	4.33E-02	5.67E-02
		1332.49		99.98	-1.67E-02		4.33E-02
	Nb-94	702.65		99.81	1.65E-02	4.20E-02	4.79E-02
		871.09		99.89	1.07E-02		4.20E-02
	Ag-108m	79.13		6.60	1.31E-01	4.28E-02	1.50E+00
		433.94		90.50	1.92E-03		4.28E-02
		614.28		89.80	-1.61E-02		6.32E-02
		722.94		90.80	2.15E-02		5.52E-02
	Sb-125	176.31		6.84	2.64E-01	1.13E-01	5.01E-01
		380.45		1.52	-6.17E-02		2.15E+00
		427.87		29.60	-4.81E-02		1.13E-01
		463.36		10.49	1.52E-01		3.74E-01
		600.60		17.65	-1.45E-01		2.11E-01
		606.71		4.98	1.45E+00		1.18E+00
		635.95		11.22	-3.36E-01		3.36E-01

Analysis Report for 17-Sep-19-10009

L1-12111A-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.40E+00	1.13E-01	2.02E+00
Ba-133	79.61	2.65	7.81E-01	7.20E-02	3.63E+00
	81.00	32.90	-2.48E-01		2.57E-01
	276.40	7.16	9.16E-02		5.05E-01
	302.85	18.34	-1.84E-02		1.68E-01
	356.01	62.05	-2.08E-02		7.20E-02
	383.85	8.94	-4.53E-02		3.74E-01
Cs-134	475.36	1.48	4.74E-01	5.32E-02	2.22E+00
	563.25	8.34	-4.63E-02		4.29E-01
	569.33	15.37	7.23E-02		2.66E-01
	604.72	97.62	-2.29E-02		5.32E-02
	795.86	85.46	1.68E-02		5.64E-02
	801.95	8.69	-1.73E-02		5.04E-01
	1038.61	0.99	-2.61E-01		4.60E+00
	1167.97	1.79	1.55E+00		3.24E+00
	1365.19	3.02	-6.14E-01		1.33E+00
Cs-137	661.66	85.10	-4.51E-02	4.20E-02	4.20E-02
Eu-152	121.78	28.67	7.34E-02	1.19E-01	1.31E-01
	244.70	7.61	3.30E-01		4.94E-01
	295.94	0.45	3.74E+00		8.89E+00
	344.28	26.60	-1.28E-02		1.19E-01
	367.79	0.86	-1.88E+00		3.73E+00
	411.12	2.24	5.77E-01		1.66E+00
	443.96	2.83	-1.24E+00		1.12E+00
	488.68	0.42	9.74E-01		8.35E+00
	563.99	0.49	1.00E+00		7.38E+00
	586.26	0.46	9.26E+00		1.11E+01
	678.62	0.47	-3.78E+00		7.17E+00
	688.67	0.86	-1.04E+00		4.61E+00
	719.35	0.28	-2.10E+00		1.64E+01
	778.90	12.96	-2.94E-01		3.07E-01
	810.45	0.32	4.09E+00		1.23E+01
	867.37	4.26	-8.27E-01		9.66E-01
	919.33	0.43	-7.34E+00		1.04E+01
	964.08	14.65	2.29E-01		4.28E-01
	1085.87	10.24	-2.04E-01		5.48E-01
	1089.74	1.73	2.95E+00		3.49E+00
	1112.07	13.69	8.60E-02		4.37E-01
	1212.95	1.43	1.72E+00		5.08E+00
	1249.94	0.19	7.69E-02		2.99E+01
	1299.14	1.63	3.73E-01		3.16E+00
	1408.01	21.07	4.86E-02		1.95E-01
	1457.64	0.50	1.61E+02		4.22E+01
	1528.10	0.28	6.34E+00		1.30E+01
Eu-154	123.07	40.40	1.05E-01	9.56E-02	9.56E-02
	247.93	6.89	-3.46E-03		4.90E-01
	591.76	4.95	-3.35E-01		8.21E-01
	692.42	1.78	-1.39E+00		2.39E+00
	723.30	20.06	-1.13E-01		2.43E-01
	756.80	4.52	3.71E-01		9.05E-01
	873.18	12.08	-1.62E-01		3.36E-01

Analysis Report for 17-Sep-19-10009

L1-12111A-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.47E-01	9.56E-02	4.23E-01
	1004.76	18.01	-2.37E-02		2.81E-01
	1274.43	34.80	6.44E-02		1.51E-01
	1596.48	1.80	-2.31E-01		1.75E+00
Eu-155	45.30	1.31	-1.03E+01	2.07E-01	1.83E+01
	60.01	1.22	-6.30E+00		2.13E+01
	86.55	30.70	6.21E-02		2.31E-01
	105.31	21.10	-1.42E-01		2.07E-01
Ra-226	186.21	3.64	6.56E-01	9.74E-01	9.74E-01
Pa-231	27.36	10.30	2.19E+00	1.30E+00	2.27E+00
	283.69	1.70	2.10E-01		1.74E+00
	300.07	2.47	-1.95E+00		1.30E+00
	302.65	2.20	-6.05E-01		1.39E+00
	330.06	1.40	2.16E-01		2.51E+00
U-235	143.76	10.96	3.98E-02	6.17E-02	3.24E-01
	163.33	5.08	-1.47E-01		6.78E-01
	185.71	57.20	3.68E-02		6.17E-02
	202.11	1.08	2.08E+00		3.16E+00
	205.31	5.01	-7.79E-01		6.91E-01
Am-241	59.54	35.90	-3.05E-01	7.43E-01	7.43E-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-19-10010
L1-12111A-FSGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10010
Sample Description	: L1-12111A-FSGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.784E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:10:00AM
Acquisition Started	: 9/17/2019 8:53:39AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79552
Fill Height	: 1783.78 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:08:42AM

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

Data Validated
0800 9-18-19

Analysis Report for 17-Sep-19-10010

L1-12111A-FSGS-005SS

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	8.26E+01	16.89	9.94E+01	1.15
2	295.12	585 -	594	590.29	6.52E+01	13.39	4.98E+01	1.39
3	351.91	698 -	708	703.77	7.97E+01	14.94	6.03E+01	1.34
4	609.33	1213 -	1223	1218.24	6.93E+01	10.22	1.47E+01	1.44
5	911.29	1818 -	1828	1822.04	2.98E+01	7.07	8.25E+00	1.33
6	1460.80	2914 -	2928	2921.65	4.51E+02	21.37	1.89E+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	1.00	1460.82	*	10.66	8.16E+00	5.24E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.13E-01	2.49E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.67E-01	2.65E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		

Analysis Report for 17-Sep-19-10010

L1-12111A-FSGS-005SS

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	2.38E-01	5.25E-02
		351.93	*	35.60	1.70E-01	3.47E-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	1.64E-01	3.95E-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-19-10010

L1-12111A-FSGS-005SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	8.16E+00	5.24E-01	
X	Bi-211	0.892			
	Pb-212	1.000	1.13E-01	2.49E-02	
	Bi-214	1.000	1.67E-01	2.65E-02	
	Pb-214	0.999	1.91E-01	2.89E-02	
	Ac-228	1.000	1.64E-01	3.95E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 17-Sep-19-10010

L1-12111A-FSGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:08:42AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

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	5.91E-02	5.02E-02	5.02E-02
	BE-7	477.60		10.44	2.05E-01	3.73E-01	3.73E-01
+	K-40	1460.82	*	10.66	8.16E+00	1.96E-01	1.96E-01
	Mn-54	834.85		99.98	1.96E-03	3.61E-02	3.61E-02
	Co-60	1173.23		99.85	3.04E-02	3.98E-02	6.07E-02
		1332.49		99.98	-1.11E-02		3.98E-02
	Nb-94	702.65		99.81	9.33E-03	3.70E-02	4.17E-02
		871.09		99.89	5.86E-03		3.70E-02
	Ag-108m	79.13		6.60	5.87E-02	3.25E-02	1.08E+00
		433.94		90.50	-2.25E-03		3.25E-02
		614.28		89.80	-2.06E-02		4.79E-02
		722.94		90.80	4.97E-03		4.62E-02
	Sb-125	176.31		6.84	1.15E-01	8.80E-02	5.05E-01
		380.45		1.52	7.09E-02		2.03E+00
		427.87		29.60	-2.68E-02		8.80E-02
		463.36		10.49	4.74E-02		2.79E-01
		600.60		17.65	-2.55E-03		1.92E-01
		606.71		4.98	-5.02E-02		1.11E+00
		635.95		11.22	-2.70E-02		2.49E-01

Analysis Report for 17-Sep-19-10010

L1-12111A-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.04E+00	8.80E-02	1.90E+00
Ba-133	79.61	2.65	-4.36E-01	7.03E-02	2.56E+00
	81.00	32.90	-2.41E-01		1.76E-01
	276.40	7.16	1.46E-01		4.20E-01
	302.85	18.34	3.85E-02		1.74E-01
	356.01	62.05	-1.29E-02		7.03E-02
	383.85	8.94	-1.01E-01		3.38E-01
Cs-134	475.36	1.48	7.71E-01	4.80E-02	2.48E+00
	563.25	8.34	-4.10E-02		3.58E-01
	569.33	15.37	3.96E-02		2.07E-01
	604.72	97.62	-1.23E-02		4.80E-02
	795.86	85.46	2.28E-02		5.28E-02
	801.95	8.69	-1.23E-01		4.82E-01
	1038.61	0.99	-5.81E-01		3.96E+00
	1167.97	1.79	7.45E-01		3.38E+00
	1365.19	3.02	4.06E-01		1.55E+00
Cs-137	661.66	85.10	1.04E-02	4.90E-02	4.90E-02
Eu-152	121.78	28.67	-2.49E-02	1.13E-01	1.13E-01
	244.70	7.61	-1.38E-01		4.07E-01
	295.94	0.45	-1.62E+00		8.76E+00
	344.28	26.60	-9.41E-02		1.20E-01
	367.79	0.86	1.00E+00		3.55E+00
	411.12	2.24	6.51E-01		1.40E+00
	443.96	2.83	-4.95E-01		9.56E-01
	488.68	0.42	-8.88E-01		7.22E+00
	563.99	0.49	1.04E-01		6.27E+00
	586.26	0.46	9.31E+00		9.91E+00
	678.62	0.47	1.36E+00		6.91E+00
	688.67	0.86	7.21E-02		3.50E+00
	719.35	0.28	-3.49E+00		1.29E+01
	778.90	12.96	4.20E-02		2.79E-01
	810.45	0.32	3.74E+00		1.19E+01
	867.37	4.26	-2.71E-01		8.18E-01
	919.33	0.43	0.00E+00		8.12E+00
	964.08	14.65	-1.00E-01		3.41E-01
	1085.87	10.24	-3.25E-01		4.37E-01
	1089.74	1.73	1.79E+00		2.83E+00
	1112.07	13.69	-9.76E-02		3.62E-01
	1212.95	1.43	-1.21E+00		3.62E+00
	1249.94	0.19	-7.80E-01		2.94E+01
	1299.14	1.63	-2.16E+00		2.77E+00
	1408.01	21.07	-3.26E-02		2.02E-01
	1457.64	0.50	-2.54E+00		4.04E+01
	1528.10	0.28	2.50E+00		1.10E+01
Eu-154	123.07	40.40	-3.99E-02	7.75E-02	7.75E-02
	247.93	6.89	1.32E-01		4.15E-01
	591.76	4.95	1.74E-01		6.95E-01
	692.42	1.78	-8.51E-01		1.63E+00
	723.30	20.06	1.49E-01		2.26E-01
	756.80	4.52	4.37E-01		8.35E-01
	873.18	12.08	8.66E-02		3.28E-01

Analysis Report for 17-Sep-19-10010

L1-12111A-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.02E-01	7.75E-02	3.57E-01
	1004.76	18.01	1.22E-01		2.25E-01
	1274.43	34.80	-5.67E-02		1.23E-01
	1596.48	1.80	-2.46E-01		1.79E+00
Eu-155	45.30	1.31	5.86E-01	1.71E-01	1.12E+01
	60.01	1.22	-4.18E+00		1.16E+01
	86.55	30.70	-3.50E-02		1.71E-01
	105.31	21.10	3.21E-02		1.84E-01
Ra-226	186.21	3.64	1.21E-01	9.63E-01	9.63E-01
Pa-231	27.36	10.30	5.86E-01	1.15E+00	1.15E+00
	283.69	1.70	5.64E-01		1.87E+00
	300.07	2.47	-7.61E-01		1.30E+00
	302.65	2.20	3.21E-01		1.45E+00
	330.06	1.40	7.11E-01		2.23E+00
U-235	143.76	10.96	9.51E-02	6.12E-02	2.81E-01
	163.33	5.08	1.17E-01		6.73E-01
	185.71	57.20	-1.65E-04		6.12E-02
	202.11	1.08	-1.21E+00		2.83E+00
	205.31	5.01	-4.52E-01		6.23E-01
Am-241	59.54	35.90	-1.01E-01	4.17E-01	4.17E-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-19-10011
L1-12111A-FSGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10011
Sample Description	: L1-12111A-FSGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.455E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:12:00AM
Acquisition Started	: 9/17/2019 8:53:45AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79553
Fill Height	: 1454.52 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:09:07AM

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

Date Validated
0800 9/18/19

Analysis Report for 17-Sep-19-10011

L1-12111A-FSGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.72	949 -	960	954.47	1.12E+02	16.93	6.76E+01	0.73
2	295.28	1176 -	1184	1180.40	4.08E+01	9.16	2.03E+01	0.82
3	352.04	1401 -	1414	1407.17	7.32E+01	11.94	2.48E+01	0.97
4	582.96	2323 -	2336	2329.95	4.44E+01	8.25	8.64E+00	1.21
5	609.29	2427 -	2442	2435.19	8.30E+01	10.05	6.01E+00	1.05
6	1460.17	5826 -	5850	5838.60	3.51E+02	19.40	6.25E+00	1.92

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.93	1460.82	*	10.66	7.99E+00	5.62E-01
Tl-208	0.99	583.19	*	85.00	6.76E-02	1.32E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.80E-01	3.08E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.44E-01	3.29E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 17-Sep-19-10011

L1-12111A-FSGS-006SS

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	1.76E-01	4.20E-02
		351.93	*	35.60	1.86E-01	3.39E-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	0.933	7.99E+00	5.62E-01	
	Tl-208	0.992	6.76E-02	1.32E-02	
X	Bi-211	0.860			
	Pb-212	0.999	1.80E-01	3.08E-02	
	Bi-214	1.000	2.44E-01	3.29E-02	
	Pb-214	0.999	1.82E-01	2.64E-02	

Analysis Report for 17-Sep-19-10011

L1-12111A-FSGS-006SS

? = 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-19-10011

L1-12111A-FSGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:09:07AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.39E-02	5.61E-02	5.61E-02
	BE-7	477.60		10.44	-1.01E-01	3.99E-01	3.99E-01
+	K-40	1460.82	*	10.66	7.99E+00	4.58E-01	4.58E-01
	Mn-54	834.85		99.98	-1.80E-02	5.05E-02	5.05E-02
	Co-60	1173.23		99.85	3.25E-02	4.72E-02	7.45E-02
		1332.49		99.98	8.90E-04		4.72E-02
	Nb-94	702.65		99.81	1.31E-02	3.89E-02	3.89E-02
		871.09		99.89	-9.68E-03		4.24E-02
	Ag-108m	79.13		6.60	9.41E-01	3.69E-02	1.26E+00
		433.94		90.50	3.88E-04		3.69E-02
		614.28		89.80	-3.61E-03		6.17E-02
		722.94		90.80	1.64E-02		6.03E-02
	Sb-125	176.31		6.84	8.32E-02	1.10E-01	4.35E-01
		380.45		1.52	-5.81E-01		2.10E+00
		427.87		29.60	-4.49E-02		1.10E-01
		463.36		10.49	4.74E-02		4.11E-01
		600.60		17.65	-1.76E-01		2.19E-01
		606.71		4.98	2.14E+00		1.37E+00
		635.95		11.22	-4.64E-02		3.05E-01

Analysis Report for 17-Sep-19-10011

L1-12111A-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.36E+00	1.10E-01	2.29E+00
Ba-133	79.61	2.65	1.38E+00	7.13E-02	2.97E+00
	81.00	32.90	-1.66E-01		1.98E-01
	276.40	7.16	7.69E-02		4.95E-01
	302.85	18.34	6.51E-02		1.78E-01
	356.01	62.05	-1.76E-02		7.13E-02
	383.85	8.94	4.98E-02		3.98E-01
Cs-134	475.36	1.48	2.92E+00	4.85E-02	2.83E+00
	563.25	8.34	-2.58E-01		5.38E-01
	569.33	15.37	1.38E-03		2.42E-01
	604.72	97.62	-1.58E-02		5.82E-02
	795.86	85.46	4.69E-03		4.85E-02
	801.95	8.69	7.39E-02		5.32E-01
	1038.61	0.99	1.03E+00		5.99E+00
	1167.97	1.79	6.52E-01		4.11E+00
	1365.19	3.02	-5.74E-02		1.49E+00
Cs-137	661.66	85.10	-4.27E-02	4.46E-02	4.46E-02
Eu-152	121.78	28.67	4.97E-02	1.24E-01	1.24E-01
	244.70	7.61	-3.51E-01		5.13E-01
	295.94	0.45	5.78E+00		9.22E+00
	344.28	26.60	-2.32E-02		1.41E-01
	367.79	0.86	4.65E-01		4.14E+00
	411.12	2.24	-4.18E-03		1.47E+00
	443.96	2.83	1.20E-01		1.31E+00
	488.68	0.42	2.35E+00		9.75E+00
	563.99	0.49	3.77E-02		8.66E+00
	586.26	0.46	1.84E+00		1.22E+01
	678.62	0.47	6.66E+00		8.47E+00
	688.67	0.86	-3.27E+00		4.54E+00
	719.35	0.28	5.04E+00		1.61E+01
	778.90	12.96	-5.24E-02		3.55E-01
	810.45	0.32	-1.05E+01		1.38E+01
	867.37	4.26	-7.08E-01		1.01E+00
	919.33	0.43	-2.99E-01		1.17E+01
	964.08	14.65	3.86E-01		4.76E-01
	1085.87	10.24	-2.68E-01		6.27E-01
	1089.74	1.73	3.24E+00		3.81E+00
	1112.07	13.69	-1.14E-01		3.72E-01
	1212.95	1.43	4.90E+00		5.54E+00
	1249.94	0.19	2.02E+01		3.35E+01
	1299.14	1.63	4.17E-01		3.93E+00
	1408.01	21.07	-9.02E-02		2.11E-01
	1457.64	0.50	1.65E+02		4.52E+01
	1528.10	0.28	5.35E+00		1.30E+01
Eu-154	123.07	40.40	8.25E-03	8.49E-02	8.49E-02
	247.93	6.89	1.05E-01		5.03E-01
	591.76	4.95	-5.44E-01		6.98E-01
	692.42	1.78	6.08E-01		2.46E+00
	723.30	20.06	1.05E-01		2.73E-01
	756.80	4.52	1.26E-01		9.04E-01
	873.18	12.08	2.49E-01		3.72E-01

Analysis Report for 17-Sep-19-10011

L1-12111A-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.34E-01	8.49E-02	4.79E-01
	1004.76	18.01	4.04E-02		2.65E-01
	1274.43	34.80	7.73E-02		2.00E-01
	1596.48	1.80	2.32E+00		3.20E+00
Eu-155	45.30	1.31	-4.94E+00	1.88E-01	1.01E+01
	60.01	1.22	-4.20E+00		1.18E+01
	86.55	30.70	1.85E-01		1.88E-01
	105.31	21.10	2.09E-03		1.94E-01
Ra-226	186.21	3.64	1.32E+00	1.00E+00	1.00E+00
Pa-231	27.36	10.30	1.09E+00	1.34E+00	1.35E+00
	283.69	1.70	-6.64E-01		2.00E+00
	300.07	2.47	-1.95E+00		1.34E+00
	302.65	2.20	-2.44E-01		1.45E+00
	330.06	1.40	1.88E-01		2.94E+00
U-235	143.76	10.96	2.62E-01	6.43E-02	3.07E-01
	163.33	5.08	-3.20E-02		5.85E-01
	185.71	57.20	7.85E-02		6.43E-02
	202.11	1.08	1.26E+00		2.91E+00
	205.31	5.01	-6.28E-01		6.20E-01
Am-241	59.54	35.90	1.46E-01	4.39E-01	4.39E-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 17-Sep-19-10012

L1-12111A-FSGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10012
Sample Description	: L1-12111A-FSGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.687E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:14:00AM
Acquisition Started	: 9/17/2019 8:53:53AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79554
Fill Height	: 1687.49 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:09:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0800 9-18-19

Analysis Report for 17-Sep-19-10012

L1-12111A-FSGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.57	949 -	960	954.76	1.18E+02	15.08	4.36E+01	0.93
2	351.90	1402 -	1414	1407.59	6.82E+01	12.01	2.88E+01	1.08
3	477.87	1907 -	1916	1911.05	2.75E+01	7.17	1.05E+01	0.84
4	911.33	3639 -	3651	3644.38	3.37E+01	6.06	1.29E+00	0.53
5	1460.91	5831 -	5856	5844.03	4.16E+02	21.95	1.57E+01	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
BE-7	0.98	477.60	*	10.44	2.80E-01	7.56E-02
K-40	0.99	1460.82	*	10.66	8.50E+00	5.80E-01
Bi-211	0.89	351.07	*	13.02	4.46E-01	8.64E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.83E-01	2.75E-02
		300.09		3.30		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.63E-01	3.16E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		

Analysis Report for 17-Sep-19-10012

L1-12111A-FSGS-007SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Ac-228	0.99	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	2.08E-01	3.85E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.989	2.80E-01	7.56E-02	
	K-40	0.999	8.50E+00	5.80E-01	
?	Bi-211	0.896	4.46E-01	8.64E-02	
	Pb-212	0.999	1.83E-01	2.75E-02	
?	Pb-214	1.000	1.63E-01	3.16E-02	
	Ac-228	0.999	2.08E-01	3.85E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 17-Sep-19-10012

L1-12111A-FSGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:09:00AM
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	3.07E-02	5.20E-02	5.20E-02
+	BE-7	477.60	*	10.44	2.80E-01	1.98E-01	1.98E-01
+	K-40	1460.82	*	10.66	8.50E+00	6.20E-01	6.20E-01
	Mn-54	834.85		99.98	-2.26E-03	3.83E-02	3.83E-02
	Co-60	1173.23		99.85	2.72E-02	5.66E-02	6.37E-02
		1332.49		99.98	4.43E-03		5.66E-02
	Nb-94	702.65		99.81	-7.94E-03	4.16E-02	4.16E-02
		871.09		99.89	-1.29E-02		4.84E-02
	Ag-108m	79.13		6.60	4.63E-01	3.77E-02	1.45E+00
		433.94		90.50	6.50E-03		3.77E-02
		614.28		89.80	4.14E-02		6.25E-02
		722.94		90.80	6.49E-03		5.01E-02
	Sb-125	176.31		6.84	2.32E-01	1.20E-01	4.60E-01
		380.45		1.52	2.12E+00		2.43E+00
		427.87		29.60	-6.33E-02		1.20E-01
		463.36		10.49	-1.54E-01		3.54E-01
		600.60		17.65	-1.63E-01		2.18E-01
		606.71		4.98	1.22E+00		1.23E+00
		635.95		11.22	-6.47E-02		3.18E-01

Analysis Report for 17-Sep-19-10012

L1-12111A-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.39E-01	1.20E-01	2.31E+00
Ba-133	79.61	2.65	1.18E+00	7.20E-02	3.48E+00
	81.00	32.90	-3.60E-01		2.45E-01
	276.40	7.16	2.37E-01		4.94E-01
	302.85	18.34	2.58E-02		1.74E-01
	356.01	62.05	1.08E-02		7.20E-02
	383.85	8.94	-2.02E-01		4.29E-01
Cs-134	475.36	1.48	3.71E+00	5.13E-02	2.96E+00
	563.25	8.34	1.35E-01		4.54E-01
	569.33	15.37	-7.68E-02		2.71E-01
	604.72	97.62	-1.28E-02		5.49E-02
	795.86	85.46	1.45E-02		5.13E-02
	801.95	8.69	-6.51E-03		5.28E-01
	1038.61	0.99	-1.85E+00		5.83E+00
	1167.97	1.79	1.99E+00		3.39E+00
	1365.19	3.02	8.18E-01		1.60E+00
Cs-137	661.66	85.10	-9.83E-03	4.63E-02	4.63E-02
Eu-152	121.78	28.67	-1.87E-02	1.30E-01	1.30E-01
	244.70	7.61	1.82E-01		4.77E-01
	295.94	0.45	4.83E+00		8.98E+00
	344.28	26.60	-1.86E-01		1.33E-01
	367.79	0.86	-2.65E-01		3.82E+00
	411.12	2.24	1.08E+00		1.56E+00
	443.96	2.83	-3.47E-02		1.24E+00
	488.68	0.42	8.84E+00		9.40E+00
	563.99	0.49	1.77E+00		7.62E+00
	586.26	0.46	1.21E+01		1.15E+01
	678.62	0.47	7.32E-01		8.13E+00
	688.67	0.86	6.75E-01		4.58E+00
	719.35	0.28	-7.58E+00		1.29E+01
	778.90	12.96	3.39E-02		3.03E-01
	810.45	0.32	6.26E+00		1.38E+01
	867.37	4.26	-4.29E-01		1.15E+00
	919.33	0.43	-6.00E+00		9.70E+00
	964.08	14.65	3.24E-01		4.23E-01
	1085.87	10.24	-9.00E-02		4.76E-01
	1089.74	1.73	-5.06E-01		2.87E+00
	1112.07	13.69	-4.93E-01		3.74E-01
	1212.95	1.43	-1.56E+00		4.56E+00
	1249.94	0.19	1.97E+01		3.39E+01
	1299.14	1.63	3.69E+00		3.59E+00
	1408.01	21.07	-5.11E-02		1.96E-01
	1457.64	0.50	1.86E+02		4.48E+01
	1528.10	0.28	-2.24E-01		1.31E+01
Eu-154	123.07	40.40	-3.01E-02	9.18E-02	9.18E-02
	247.93	6.89	1.89E-01		4.60E-01
	591.76	4.95	4.27E-01		8.70E-01
	692.42	1.78	4.80E-01		2.34E+00
	723.30	20.06	1.27E-01		2.32E-01
	756.80	4.52	-4.75E-01		9.37E-01
	873.18	12.08	-2.46E-01		4.16E-01

Analysis Report for 17-Sep-19-10012

L1-12111A-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.03E-02	9.18E-02	4.17E-01
	1004.76	18.01	2.73E-03		2.24E-01
	1274.43	34.80	9.23E-02		1.66E-01
	1596.48	1.80	1.16E+00		2.23E+00
Eu-155	45.30	1.31	1.73E+00	2.10E-01	1.94E+01
	60.01	1.22	-4.73E+00		1.91E+01
	86.55	30.70	1.24E-01		2.39E-01
	105.31	21.10	-1.54E-01		2.10E-01
Ra-226	186.21	3.64	5.15E-01	1.02E+00	1.02E+00
Pa-231	27.36	10.30	2.13E+00	1.38E+00	2.43E+00
	283.69	1.70	-1.24E+00		1.84E+00
	300.07	2.47	-1.98E+00		1.38E+00
	302.65	2.20	-4.42E-01		1.44E+00
	330.06	1.40	1.41E+00		2.61E+00
U-235	143.76	10.96	-1.26E-01	6.53E-02	3.26E-01
	163.33	5.08	-7.27E-01		7.10E-01
	185.71	57.20	6.11E-02		6.53E-02
	202.11	1.08	4.73E-01		3.26E+00
	205.31	5.01	-3.75E-01		6.99E-01
Am-241	59.54	35.90	-3.06E-01	6.66E-01	6.66E-01

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

Apex-Gamma

Analysis Report for 17-Sep-19-10013

L1-12111A-FSGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10013
Sample Description	: L1-12111A-FSGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.728E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:16:00AM
Acquisition Started	: 9/17/2019 9:14:21AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79555
Fill Height	: 1728.31 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:29:24AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated

0800 9-18-19

Analysis Report for 17-Sep-19-10013

L1-12111A-FSGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.67	473 -	481	477.52	1.12E+02	18.90	1.14E+02	1.04
2	295.17	585 -	595	590.39	3.77E+01	14.29	6.93E+01	0.99
3	351.92	700 -	708	703.78	7.44E+01	12.23	3.46E+01	1.23
4	583.19	1160 -	1171	1165.99	4.06E+01	9.44	1.94E+01	1.36
5	609.35	1212 -	1223	1218.28	7.60E+01	11.34	2.10E+01	1.59
6	910.94	1817 -	1827	1821.34	4.62E+01	8.61	1.18E+01	1.17
7	969.27	1934 -	1941	1937.99	2.18E+01	7.68	1.82E+01	0.98
8	1460.73	2914 -	2928	2921.52	3.98E+02	20.61	9.39E+00	2.02

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.25E+00	4.90E-01
Tl-208	1.00	583.19	*	85.00	5.11E-02	1.23E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.54E-01	2.88E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.84E-01	2.96E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 17-Sep-19-10013

L1-12111A-FSGS-008SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.38E-01	5.36E-02
		351.93	*	35.60	1.60E-01	2.92E-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	2.56E-01	4.89E-02
		964.77		4.99		
		968.97	*	15.80	2.05E-01	7.28E-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 17-Sep-19-10013

L1-12111A-FSGS-008SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	7.25E+00	4.90E-01	
	Tl-208	1.000	5.11E-02	1.23E-02	
X	Bi-211	0.891			
	Pb-212	1.000	1.54E-01	2.88E-02	
	Bi-214	1.000	1.84E-01	2.96E-02	
	Pb-214	1.000	1.55E-01	2.56E-02	
	Ac-228	0.994	2.40E-01	4.06E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 17-Sep-19-10013
L1-12111A-FSGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:29:24AM
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	5.99E-02	5.12E-02	5.12E-02
	BE-7	477.60		10.44	2.37E-01	3.64E-01	3.64E-01
+	K-40	1460.82	*	10.66	7.25E+00	3.74E-01	3.74E-01
	Mn-54	834.85		99.98	8.72E-03	4.11E-02	4.11E-02
	Co-60	1173.23		99.85	-1.28E-02	4.88E-02	5.24E-02
		1332.49		99.98	1.89E-02		4.88E-02
	Nb-94	702.65		99.81	-8.42E-03	3.59E-02	3.63E-02
		871.09		99.89	1.36E-02		3.59E-02
	Ag-108m	79.13		6.60	7.52E-02	3.27E-02	1.03E+00
		433.94		90.50	1.29E-02		3.27E-02
		614.28		89.80	-2.30E-02		4.97E-02
		722.94		90.80	1.79E-03		4.50E-02
	Sb-125	176.31		6.84	3.72E-02	8.33E-02	4.83E-01
		380.45		1.52	-1.59E+00		1.66E+00
		427.87		29.60	-4.79E-03		8.33E-02
		463.36		10.49	1.24E-02		3.07E-01
		600.60		17.65	1.48E-02		2.00E-01
		606.71		4.98	-9.06E-02		1.18E+00
		635.95		11.22	-3.18E-02		3.03E-01

Analysis Report for 17-Sep-19-10013

L1-12111A-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	9.33E-01	8.33E-02	2.12E+00
Ba-133	79.61	2.65	-7.41E-01	6.22E-02	2.34E+00
	81.00	32.90	-1.07E-01		1.68E-01
	276.40	7.16	1.59E-01		4.54E-01
	302.85	18.34	1.22E-01		1.80E-01
	356.01	62.05	-1.74E-02		6.22E-02
	383.85	8.94	1.44E-01		3.40E-01
Cs-134	475.36	1.48	5.02E-01	4.66E-02	2.46E+00
	563.25	8.34	8.78E-02		4.21E-01
	569.33	15.37	8.18E-02		2.38E-01
	604.72	97.62	-6.98E-03		5.17E-02
	795.86	85.46	1.86E-02		4.66E-02
	801.95	8.69	5.32E-03		4.54E-01
	1038.61	0.99	-1.43E+00		4.84E+00
	1167.97	1.79	7.00E-01		3.17E+00
	1365.19	3.02	-6.01E-01		1.11E+00
Cs-137	661.66	85.10	2.07E-02	4.93E-02	4.93E-02
Eu-152	121.78	28.67	-7.88E-02	1.05E-01	1.05E-01
	244.70	7.61	3.30E-02		4.54E-01
	295.94	0.45	-1.31E+00		8.18E+00
	344.28	26.60	-1.21E-01		1.10E-01
	367.79	0.86	-2.35E+00		3.36E+00
	411.12	2.24	-4.37E-01		1.28E+00
	443.96	2.83	1.96E-01		1.01E+00
	488.68	0.42	-5.05E+00		6.60E+00
	563.99	0.49	8.22E-01		7.08E+00
	586.26	0.46	-1.46E+00		9.97E+00
	678.62	0.47	1.25E-01		7.18E+00
	688.67	0.86	2.93E-01		3.92E+00
	719.35	0.28	4.90E+00		1.41E+01
	778.90	12.96	-6.65E-02		2.77E-01
	810.45	0.32	-5.37E+00		1.15E+01
	867.37	4.26	-6.31E-01		7.53E-01
	919.33	0.43	-5.81E+00		9.02E+00
	964.08	14.65	-1.72E-01		3.43E-01
	1085.87	10.24	8.65E-02		4.26E-01
	1089.74	1.73	4.02E-01		2.44E+00
	1112.07	13.69	6.84E-02		3.84E-01
	1212.95	1.43	3.00E-02		3.44E+00
	1249.94	0.19	1.89E-01		2.81E+01
	1299.14	1.63	-1.85E+00		2.62E+00
	1408.01	21.07	8.41E-02		1.93E-01
	1457.64	0.50	-1.52E+00		3.86E+01
	1528.10	0.28	2.85E+00		8.88E+00
Eu-154	123.07	40.40	-1.13E-02	7.80E-02	7.80E-02
	247.93	6.89	-2.41E-01		4.14E-01
	591.76	4.95	2.56E-01		6.64E-01
	692.42	1.78	5.63E-01		2.13E+00
	723.30	20.06	-4.36E-03		1.99E-01
	756.80	4.52	-9.70E-02		7.91E-01
	873.18	12.08	9.29E-02		2.79E-01

Analysis Report for 17-Sep-19-10013

L1-12111A-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.82E-01	7.80E-02	4.45E-01
	1004.76	18.01	-7.87E-02		2.19E-01
	1274.43	34.80	-3.34E-02		1.52E-01
	1596.48	1.80	3.46E-01		1.29E+00
Eu-155	45.30	1.31	9.23E-01	1.71E-01	1.09E+01
	60.01	1.22	2.81E+00		1.27E+01
	86.55	30.70	5.57E-02		1.71E-01
	105.31	21.10	3.47E-02		1.75E-01
Ra-226	186.21	3.64	4.26E-01	9.61E-01	9.61E-01
Pa-231	27.36	10.30	7.30E-01	1.09E+00	1.09E+00
	283.69	1.70	-1.12E+00		1.57E+00
	300.07	2.47	1.73E-01		1.31E+00
	302.65	2.20	1.02E+00		1.50E+00
	330.06	1.40	6.65E-01		2.23E+00
U-235	143.76	10.96	1.62E-01	6.16E-02	2.98E-01
	163.33	5.08	7.80E-02		6.28E-01
	185.71	57.20	3.08E-02		6.16E-02
	202.11	1.08	1.29E+00		3.07E+00
	205.31	5.01	2.91E-02		6.65E-01
Am-241	59.54	35.90	-2.40E-02	4.36E-01	4.36E-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-19-10014
L1-12111A-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10014
Sample Description	: L1-12111A-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.811E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:18:00AM
Acquisition Started	: 9/17/2019 9:14:36AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79556
Fill Height	: 1811.07 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:29:42AM

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

Data Validated
0800 9/18/19

Analysis Report for 17-Sep-19-10014

L1-12111A-FSGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	948 -	960	954.69	8.61E+01	16.42	6.99E+01	0.80
2	295.27	1175 -	1187	1180.98	4.75E+01	10.95	2.75E+01	1.18
3	351.95	1400 -	1413	1407.55	7.34E+01	13.41	3.86E+01	0.74
4	582.89	2325 -	2338	2330.75	4.14E+01	8.55	1.16E+01	1.38
5	609.10	2429 -	2442	2435.55	5.55E+01	9.19	1.05E+01	0.90
6	727.81	2906 -	2915	2910.27	1.49E+01	4.16	1.08E+00	0.90
7	910.85	3638 -	3648	3642.34	2.35E+01	6.07	5.50E+00	0.61
8	1237.63	4944 -	4955	4949.81	7.53E+00	5.13	7.47E+00	0.40
9	1460.49	5831 -	5853	5841.81	3.61E+02	19.33	3.08E+00	1.49

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	8.61E+00	5.94E-01
Tl-208	0.98	583.19	*	85.00	6.68E-02	1.44E-02
Bi-212	0.97	39.86		1.06		
		727.33	*	6.67	3.56E-01	1.01E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.50E-01	3.11E-02

Analysis Report for 17-Sep-19-10014

L1-12111A-FSGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	1.00	300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.72E-01	3.03E-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	2.92E-01	1.99E-01
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.20E-01	5.37E-02
		351.93	*	35.60	2.00E-01	3.98E-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	1.68E-01	4.41E-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 17-Sep-19-10014

L1-12111A-FSGS-009SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.983	8.61E+00	5.94E-01	
	Tl-208	0.986	6.68E-02	1.44E-02	
X	Bi-211	0.882			
	Bi-212	0.976	3.56E-01	1.01E-01	
	Pb-212	1.000	1.50E-01	3.11E-02	
	Bi-214	0.995	1.75E-01	3.00E-02	
	Pb-214	1.000	2.07E-01	3.20E-02	
	Ac-228	0.994	1.68E-01	4.41E-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-19-10014

L1-12111A-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:29:42AM
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	5.42E-02	5.84E-02	5.84E-02
	BE-7	477.60		10.44	1.74E-02	4.43E-01	4.43E-01
+	K-40	1460.82	*	10.66	8.61E+00	3.56E-01	3.56E-01
	Mn-54	834.85		99.98	-1.71E-02	4.85E-02	4.85E-02
	Co-60	1173.23		99.85	4.34E-02	4.95E-02	7.67E-02
		1332.49		99.98	2.97E-03		4.95E-02
	Nb-94	702.65		99.81	-3.80E-02	4.67E-02	4.67E-02
		871.09		99.89	-4.80E-04		5.07E-02
	Ag-108m	79.13		6.60	3.29E-01	4.20E-02	1.83E+00
		433.94		90.50	-2.80E-03		4.20E-02
		614.28		89.80	-1.96E-02		5.65E-02
		722.94		90.80	-1.07E-02		5.45E-02
	Sb-125	176.31		6.84	5.57E-02	1.17E-01	5.85E-01
		380.45		1.52	8.29E-01		2.78E+00
		427.87		29.60	-3.25E-02		1.17E-01
		463.36		10.49	-2.86E-01		4.26E-01
		600.60		17.65	-8.25E-02		2.31E-01
		606.71		4.98	1.59E+00		1.35E+00
		635.95		11.22	-2.28E-01		3.22E-01

Analysis Report for 17-Sep-19-10014

L1-12111A-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	8.60E-01	1.17E-01	2.26E+00
Ba-133	79.61	2.65	6.11E-01	7.49E-02	4.36E+00
	81.00	32.90	-4.14E-01		2.87E-01
	276.40	7.16	3.80E-01		5.62E-01
	302.85	18.34	4.82E-02		2.14E-01
	356.01	62.05	-5.91E-02		7.49E-02
	383.85	8.94	-3.16E-02		4.46E-01
Cs-134	475.36	1.48	2.87E+00	5.58E-02	3.16E+00
	563.25	8.34	-5.07E-01		4.54E-01
	569.33	15.37	2.59E-01		3.17E-01
	604.72	97.62	-2.69E-02		6.43E-02
	795.86	85.46	1.48E-02		5.58E-02
	801.95	8.69	3.91E-04		5.25E-01
	1038.61	0.99	-9.37E-01		5.58E+00
	1167.97	1.79	7.95E-01		3.85E+00
	1365.19	3.02	-1.15E+00		1.82E+00
Cs-137	661.66	85.10	-8.15E-03	5.34E-02	5.34E-02
Eu-152	121.78	28.67	-1.27E-01	1.41E-01	1.55E-01
	244.70	7.61	7.78E-02		5.78E-01
	295.94	0.45	8.16E+00		1.02E+01
	344.28	26.60	9.68E-02		1.41E-01
	367.79	0.86	-2.08E+00		4.02E+00
	411.12	2.24	-6.55E-01		1.69E+00
	443.96	2.83	2.65E-01		1.33E+00
	488.68	0.42	-2.04E+00		9.27E+00
	563.99	0.49	-4.77E-01		8.64E+00
	586.26	0.46	-2.20E+00		1.29E+01
	678.62	0.47	5.55E+00		8.94E+00
	688.67	0.86	4.81E-01		4.96E+00
	719.35	0.28	-2.13E+00		1.70E+01
	778.90	12.96	-1.81E-02		3.39E-01
	810.45	0.32	2.18E+00		1.27E+01
	867.37	4.26	-1.78E-01		1.11E+00
	919.33	0.43	-6.09E+00		1.13E+01
	964.08	14.65	4.83E-02		4.15E-01
	1085.87	10.24	1.02E-01		6.50E-01
	1089.74	1.73	4.03E+00		3.95E+00
	1112.07	13.69	-4.11E-01		3.75E-01
	1212.95	1.43	-6.92E+00		4.89E+00
	1249.94	0.19	1.13E+01		3.67E+01
	1299.14	1.63	6.07E-01		3.72E+00
	1408.01	21.07	9.00E-02		2.45E-01
	1457.64	0.50	1.75E+02		4.80E+01
	1528.10	0.28	4.67E+00		1.27E+01
Eu-154	123.07	40.40	5.09E-02	1.15E-01	1.15E-01
	247.93	6.89	-2.07E-01		5.83E-01
	591.76	4.95	6.22E-01		8.39E-01
	692.42	1.78	1.71E-01		2.74E+00
	723.30	20.06	-1.37E-02		2.62E-01
	756.80	4.52	3.47E-01		1.02E+00
	873.18	12.08	4.00E-01		4.46E-01

Analysis Report for 17-Sep-19-10014

L1-12111A-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-9.92E-02	1.15E-01	5.46E-01
	1004.76	18.01	9.64E-02		3.43E-01
	1274.43	34.80	4.28E-02		1.99E-01
	1596.48	1.80	9.10E-01		2.22E+00
Eu-155	45.30	1.31	-1.97E+00	2.77E-01	3.01E+01
	60.01	1.22	7.51E+00		3.34E+01
	86.55	30.70	7.99E-02		2.77E-01
	105.31	21.10	1.63E-01		2.77E-01
Ra-226	186.21	3.64	2.03E-01	1.07E+00	1.07E+00
Pa-231	27.36	10.30	2.99E+00	1.53E+00	3.55E+00
	283.69	1.70	2.87E-01		2.06E+00
	300.07	2.47	-1.70E-01		1.53E+00
	302.65	2.20	1.12E+00		1.80E+00
	330.06	1.40	-8.60E-01		2.99E+00
U-235	143.76	10.96	-4.98E-03	6.78E-02	4.06E-01
	163.33	5.08	4.63E-01		7.76E-01
	185.71	57.20	7.40E-03		6.78E-02
	202.11	1.08	-4.07E-01		3.50E+00
	205.31	5.01	6.02E-02		7.95E-01
Am-241	59.54	35.90	3.21E-01	1.20E+00	1.20E+00

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

Apex-Gamma

Analysis Report for 17-Sep-19-10015

L1-12111A-FSGS-010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10015
Sample Description	: L1-12111A-FSGS-010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.624E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:20:00AM
Acquisition Started	: 9/17/2019 9:14:44AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79557
Fill Height	: 1623.97 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:29:55AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0800 9/18/19

Analysis Report for 17-Sep-19-10015

L1-12111A-FSGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.68	946 -	961	954.30	1.35E+02	18.24	6.58E+01	1.00
2	295.29	1175 -	1189	1180.45	6.78E+01	10.96	1.82E+01	1.17
3	351.97	1402 -	1413	1406.91	8.87E+01	11.71	1.93E+01	0.91
4	583.20	2325 -	2338	2330.94	4.69E+01	8.64	1.01E+01	1.15
5	609.09	2426 -	2441	2434.38	4.69E+01	9.46	1.41E+01	0.52
6	726.90	2901 -	2910	2905.33	1.55E+01	4.84	3.54E+00	0.58
7	1460.15	5826 -	5850	5838.53	4.07E+02	20.49	3.12E+00	1.80

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.93	1460.82	*	10.66	8.98E+00	5.97E-01
Tl-208	1.00	583.19	*	85.00	6.96E-02	1.35E-02
Bi-212	0.98	39.86		1.06		
		727.33	*	6.67	3.40E-01	1.08E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.12E-01	3.34E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.34E-01	2.82E-02

Analysis Report for 17-Sep-19-10015

L1-12111A-FSGS-010SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.87E-01	5.17E-02
		351.93	*	35.60	2.21E-01	3.41E-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	0.930	8.98E+00	5.97E-01	
	Tl-208	1.000	6.96E-02	1.35E-02	
X	Bi-211	0.877			
	Bi-212	0.981	3.40E-01	1.08E-01	
	Pb-212	1.000	2.12E-01	3.34E-02	
	Bi-214	0.996	1.34E-01	2.82E-02	

Analysis Report for 17-Sep-19-10015

L1-12111A-FSGS-010SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
Pb-214	1.000	2.41E-01	2.85E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 17-Sep-19-10015

L1-12111A-FSGS-010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:29:55AM
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	6.31E-02	5.59E-02	5.59E-02
	BE-7	477.60		10.44	2.64E-01	3.96E-01	3.96E-01
+	K-40	1460.82	*	10.66	8.98E+00	3.32E-01	3.32E-01
	Mn-54	834.85		99.98	-1.29E-02	4.91E-02	4.91E-02
	Co-60	1173.23		99.85	-1.95E-02	5.10E-02	6.71E-02
		1332.49		99.98	-1.63E-02		5.10E-02
	Nb-94	702.65		99.81	2.20E-02	3.55E-02	4.77E-02
		871.09		99.89	-9.11E-03		3.55E-02
	Ag-108m	79.13		6.60	3.56E-01	4.14E-02	1.14E+00
		433.94		90.50	-8.87E-03		4.14E-02
		614.28		89.80	2.40E-02		5.31E-02
		722.94		90.80	-1.41E-02		5.75E-02
	Sb-125	176.31		6.84	-1.44E-01	1.27E-01	4.42E-01
		380.45		1.52	-3.25E-02		2.48E+00
		427.87		29.60	-6.88E-02		1.27E-01
		463.36		10.49	8.26E-02		3.85E-01
		600.60		17.65	9.85E-02		2.19E-01
		606.71		4.98	1.42E+00		1.18E+00
		635.95		11.22	1.93E-01		3.78E-01

Analysis Report for 17-Sep-19-10015

L1-12111A-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.14E-01	1.27E-01	2.33E+00
Ba-133	79.61	2.65	1.59E+00	6.78E-02	2.78E+00
	81.00	32.90	-3.22E-01		1.81E-01
	276.40	7.16	2.04E-01		4.81E-01
	302.85	18.34	3.66E-02		1.77E-01
	356.01	62.05	-2.25E-02		6.78E-02
	383.85	8.94	1.34E-02		4.06E-01
Cs-134	475.36	1.48	1.07E+00	5.43E-02	2.81E+00
	563.25	8.34	-4.87E-01		4.97E-01
	569.33	15.37	1.53E-01		2.46E-01
	604.72	97.62	-1.85E-02		5.43E-02
	795.86	85.46	2.65E-02		5.70E-02
	801.95	8.69	-3.54E-01		4.84E-01
	1038.61	0.99	-2.22E+00		4.97E+00
	1167.97	1.79	-3.09E-02		3.74E+00
	1365.19	3.02	6.79E-01		1.64E+00
Cs-137	661.66	85.10	-2.02E-03	4.57E-02	4.57E-02
Eu-152	121.78	28.67	1.18E-02	1.17E-01	1.17E-01
	244.70	7.61	1.49E-01		4.92E-01
	295.94	0.45	6.64E+00		9.18E+00
	344.28	26.60	-1.18E-02		1.29E-01
	367.79	0.86	-9.02E-01		4.18E+00
	411.12	2.24	9.51E-01		1.64E+00
	443.96	2.83	-3.00E-03		1.27E+00
	488.68	0.42	2.59E+00		8.31E+00
	563.99	0.49	-1.18E+01		7.95E+00
	586.26	0.46	-5.62E+00		1.22E+01
	678.62	0.47	1.25E+00		8.65E+00
	688.67	0.86	1.94E+00		4.73E+00
	719.35	0.28	1.54E+01		1.61E+01
	778.90	12.96	-2.10E-01		2.39E-01
	810.45	0.32	1.23E+00		1.27E+01
	867.37	4.26	-4.88E-01		8.77E-01
	919.33	0.43	-7.30E+00		1.02E+01
	964.08	14.65	9.29E-02		4.07E-01
	1085.87	10.24	3.04E-01		5.29E-01
	1089.74	1.73	1.23E+00		2.99E+00
	1112.07	13.69	-9.70E-02		4.39E-01
	1212.95	1.43	-1.13E+00		4.46E+00
	1249.94	0.19	5.81E+00		3.48E+01
	1299.14	1.63	-2.13E+00		4.04E+00
	1408.01	21.07	-7.15E-02		2.12E-01
	1457.64	0.50	1.90E+02		4.70E+01
	1528.10	0.28	2.59E+00		9.66E+00
Eu-154	123.07	40.40	-1.60E-02	8.12E-02	8.12E-02
	247.93	6.89	1.20E-01		4.74E-01
	591.76	4.95	-1.96E-01		7.51E-01
	692.42	1.78	5.40E-01		2.53E+00
	723.30	20.06	-3.28E-02		2.61E-01
	756.80	4.52	4.17E-01		1.01E+00
	873.18	12.08	1.69E-01		3.19E-01

Analysis Report for 17-Sep-19-10015

L1-12111A-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.12E-01	8.12E-02	5.05E-01
	1004.76	18.01	1.15E-01		2.86E-01
	1274.43	34.80	-1.60E-01		1.81E-01
	1596.48	1.80	1.61E-01		1.91E+00
Eu-155	45.30	1.31	-7.97E+00	1.76E-01	9.63E+00
	60.01	1.22	-3.00E-01		1.22E+01
	86.55	30.70	-2.67E-02		1.87E-01
	105.31	21.10	-4.52E-02		1.76E-01
Ra-226	186.21	3.64	7.34E-01	9.31E-01	9.31E-01
Pa-231	27.36	10.30	6.88E-01	1.27E+00	1.27E+00
	283.69	1.70	4.14E-01		1.79E+00
	300.07	2.47	-9.22E-03		1.33E+00
	302.65	2.20	6.45E-01		1.49E+00
	330.06	1.40	1.64E-01		2.42E+00
U-235	143.76	10.96	2.72E-01	5.92E-02	3.33E-01
	163.33	5.08	3.53E-01		6.47E-01
	185.71	57.20	4.26E-02		5.92E-02
	202.11	1.08	1.00E+00		3.00E+00
	205.31	5.01	-1.60E-01		6.43E-01
Am-241	59.54	35.90	-1.12E-01	4.25E-01	4.25E-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 17-Sep-19-10016
L1-12111A-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10016
Sample Description	: L1-12111A-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.536E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:22:00AM
Acquisition Started	: 9/17/2019 9:14:52AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79558
Fill Height	: 1535.81 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:29:55AM

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

Date Validated
0800 9-18-19

Analysis Report for 17-Sep-19-10016

L1-12111A-FSGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.04	305 -	314	309.49	2.27E+01	12.63	6.03E+01	0.33
2	238.69	946 -	961	955.23	1.21E+02	17.68	6.42E+01	1.08
3	295.25	1175 -	1187	1181.22	4.50E+01	10.65	2.60E+01	0.82
4	338.39	1348 -	1359	1353.60	3.67E+01	9.64	2.23E+01	1.15
5	352.02	1402 -	1414	1408.07	6.59E+01	12.27	3.21E+01	0.51
6	609.44	2428 -	2443	2437.02	6.18E+01	11.09	2.02E+01	0.64
7	1460.89	5833 -	5854	5843.93	3.49E+02	19.94	1.33E+01	1.50

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.29E+00	5.24E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.89E-01	3.16E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	2.12E-01	1.20E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.70E-01	3.21E-02
		768.36		4.89		

Analysis Report for 17-Sep-19-10016

L1-12111A-FSGS-011SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.87E-01	4.67E-02
		351.93	*	35.60	1.60E-01	3.25E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	3.74E-01	2.12E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.57	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.74E-01	7.54E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

Analysis Report for 17-Sep-19-10016

L1-12111A-FSGS-011SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	7.29E+00	5.24E-01	
X	Bi-211	0.866			
	Pb-212	0.999	1.89E-01	3.16E-02	
?	Pb212-XR	1.000	2.12E-01	1.20E-01	
	Bi-214	0.999	1.70E-01	3.21E-02	
	Pb-214	0.999	1.69E-01	2.67E-02	
?	Pb214-XR	1.000	3.74E-01	2.12E-01	
	Ac-228	0.571	2.74E-01	7.54E-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-19-10016

L1-12111A-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:29:55AM
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	2.49E-02	4.79E-02	4.79E-02
	BE-7	477.60		10.44	3.99E-01	4.26E-01	4.26E-01
+	K-40	1460.82	*	10.66	7.29E+00	5.57E-01	5.57E-01
	Mn-54	834.85		99.98	1.15E-02	4.55E-02	4.55E-02
	Co-60	1173.23		99.85	1.59E-02	4.20E-02	6.59E-02
		1332.49		99.98	2.71E-02		4.20E-02
	Nb-94	702.65		99.81	4.09E-03	4.30E-02	4.30E-02
		871.09		99.89	-1.91E-03		5.25E-02
	Ag-108m	79.13		6.60	-5.90E-01	4.02E-02	1.36E+00
		433.94		90.50	6.71E-03		4.02E-02
		614.28		89.80	-2.58E-02		6.88E-02
		722.94		90.80	2.47E-02		5.72E-02
	Sb-125	176.31		6.84	3.85E-01	1.10E-01	5.21E-01
		380.45		1.52	5.84E-02		2.18E+00
		427.87		29.60	-1.13E-01		1.10E-01
		463.36		10.49	8.14E-02		3.89E-01
		600.60		17.65	-1.59E-01		2.17E-01
		606.71		4.98	2.29E+00		1.34E+00
		635.95		11.22	-2.79E-01		3.34E-01

Analysis Report for 17-Sep-19-10016

L1-12111A-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-4.49E-02	1.10E-01	2.30E+00
Ba-133	79.61	2.65	-2.24E+00	7.64E-02	3.28E+00
	81.00	32.90	-2.20E-01		2.26E-01
	276.40	7.16	-1.77E-01		4.70E-01
	302.85	18.34	-1.82E-03		1.83E-01
	356.01	62.05	-9.53E-03		7.64E-02
	383.85	8.94	8.23E-02		3.61E-01
Cs-134	475.36	1.48	6.62E-01	5.66E-02	2.79E+00
	563.25	8.34	2.66E-01		4.95E-01
	569.33	15.37	7.31E-02		2.47E-01
	604.72	97.62	5.77E-03		6.11E-02
	795.86	85.46	-3.14E-03		5.66E-02
	801.95	8.69	-2.15E-02		5.32E-01
	1038.61	0.99	-3.95E+00		5.07E+00
	1167.97	1.79	4.41E-01		3.82E+00
	1365.19	3.02	1.13E+00		1.55E+00
Cs-137	661.66	85.10	-4.56E-03	5.15E-02	5.15E-02
Eu-152	121.78	28.67	8.11E-02	1.28E-01	1.45E-01
	244.70	7.61	-1.26E-01		4.58E-01
	295.94	0.45	7.36E+00		9.23E+00
	344.28	26.60	-4.78E-02		1.28E-01
	367.79	0.86	1.88E-01		3.74E+00
	411.12	2.24	1.22E+00		1.75E+00
	443.96	2.83	2.77E-01		1.22E+00
	488.68	0.42	-6.78E-01		7.83E+00
	563.99	0.49	3.98E-01		8.22E+00
	586.26	0.46	7.09E+00		1.18E+01
	678.62	0.47	1.03E+00		8.54E+00
	688.67	0.86	1.67E+00		5.18E+00
	719.35	0.28	7.93E+00		1.50E+01
	778.90	12.96	1.86E-02		3.40E-01
	810.45	0.32	-5.95E+00		1.45E+01
	867.37	4.26	-1.39E+00		1.17E+00
	919.33	0.43	-1.55E+01		1.15E+01
	964.08	14.65	4.13E-01		4.62E-01
	1085.87	10.24	-5.16E-01		5.12E-01
	1089.74	1.73	-3.21E-01		3.43E+00
	1112.07	13.69	5.56E-02		4.98E-01
	1212.95	1.43	-6.35E-01		4.56E+00
	1249.94	0.19	6.87E+00		3.26E+01
	1299.14	1.63	-1.32E+00		3.33E+00
	1408.01	21.07	-1.34E-01		2.33E-01
	1457.64	0.50	1.63E+02		4.25E+01
	1528.10	0.28	4.09E+00		1.11E+01
Eu-154	123.07	40.40	8.01E-02	1.01E-01	1.01E-01
	247.93	6.89	-3.01E-01		4.58E-01
	591.76	4.95	5.32E-01		7.85E-01
	692.42	1.78	5.29E-02		2.36E+00
	723.30	20.06	2.67E-01		2.66E-01
	756.80	4.52	1.44E-01		1.03E+00
	873.18	12.08	2.11E-01		4.40E-01

Analysis Report for 17-Sep-19-10016

L1-12111A-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	4.12E-02	1.01E-01	4.66E-01
	1004.76	18.01	2.15E-01		3.01E-01
	1274.43	34.80	7.67E-02		1.79E-01
	1596.48	1.80	-9.62E-01		2.18E+00
Eu-155	45.30	1.31	-3.37E+00	2.04E-01	1.85E+01
	60.01	1.22	1.37E-01		2.14E+01
	86.55	30.70	-3.65E-02		2.24E-01
	105.31	21.10	-7.71E-02		2.04E-01
Ra-226	186.21	3.64	1.13E+00	1.08E+00	1.08E+00
Pa-231	27.36	10.30	2.09E+00	1.43E+00	2.29E+00
	283.69	1.70	-3.35E-01		1.96E+00
	300.07	2.47	-3.95E-01		1.43E+00
	302.65	2.20	6.55E-01		1.53E+00
	330.06	1.40	-1.44E+00		2.66E+00
U-235	143.76	10.96	1.38E-01	6.78E-02	3.23E-01
	163.33	5.08	3.27E-01		7.06E-01
	185.71	57.20	5.07E-02		6.78E-02
	202.11	1.08	-4.35E-01		3.31E+00
	205.31	5.01	-4.55E-01		6.83E-01
Am-241	59.54	35.90	-2.29E-02	7.65E-01	7.65E-01

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

Apex-Gamma

Analysis Report for 17-Sep-19-10017
L1-12111A-FSGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10017
Sample Description	: L1-12111A-FSGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.824E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:24:00AM
Acquisition Started	: 9/17/2019 9:34:52AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79559
Fill Height	: 1823.51 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:49:55AM

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

Data Validated
0800 9-18-19

Analysis Report for 17-Sep-19-10017

L1-12111A-FSGS-012SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.70	474 -	482	477.57	1.39E+02	18.33	8.93E+01	1.27
2	295.17	585 -	595	590.40	7.22E+01	14.16	4.98E+01	1.24
3	351.82	698 -	708	703.59	8.00E+01	13.94	4.80E+01	1.48
4	477.75	949 -	960	955.23	4.94E+01	10.81	2.66E+01	1.07
5	608.97	1214 -	1223	1217.53	4.95E+01	10.54	2.65E+01	1.02
6	911.40	1819 -	1828	1822.25	3.32E+01	8.42	1.58E+01	2.01
7	1460.87	2914 -	2929	2921.80	4.32E+02	21.34	7.89E+00	2.12
8	1764.91	3526 -	3534	3530.67	1.60E+01	4.00	0.00E+00	0.91

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	4.47E-01	1.03E-01
K-40	1.00	1460.82	*	10.66	7.78E+00	5.12E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.90E-01	2.94E-02
		300.09		3.30		
Bi-214	0.98	609.32	*	45.49	1.18E-01	2.62E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 17-Sep-19-10017

L1-12111A-FSGS-012SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.98	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	2.31E-01	5.85E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.63E-01	5.57E-02
		351.93	*	35.60	1.70E-01	3.26E-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	1.82E-01	4.68E-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 17-Sep-19-10017

L1-12111A-FSGS-012SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.997	4.47E-01	1.03E-01	
	K-40	1.000	7.78E+00	5.12E-01	
X	Bi-211	0.913			
	Pb-212	0.999	1.90E-01	2.94E-02	
	Bi-214	0.988	1.37E-01	2.39E-02	
	Pb-214	0.999	1.94E-01	2.82E-02	
	Ac-228	0.998	1.82E-01	4.68E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 17-Sep-19-10017

L1-12111A-FSGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:49:55AM
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	4.97E-02	4.92E-02	4.92E-02
+	BE-7	477.60	*	10.44	4.47E-01	2.78E-01	2.78E-01
+	K-40	1460.82	*	10.66	7.78E+00	3.48E-01	3.48E-01
	Mn-54	834.85		99.98	4.77E-03	4.29E-02	4.29E-02
	Co-60	1173.23		99.85	1.39E-02	4.07E-02	5.51E-02
		1332.49		99.98	1.93E-02		4.07E-02
	Nb-94	702.65		99.81	-8.40E-03	3.48E-02	3.98E-02
		871.09		99.89	1.36E-02		3.48E-02
	Ag-108m	79.13		6.60	2.07E-01	3.24E-02	1.12E+00
		433.94		90.50	-1.46E-02		3.24E-02
		614.28		89.80	-1.20E-02		4.32E-02
		722.94		90.80	-1.68E-03		4.45E-02
	Sb-125	176.31		6.84	-5.80E-02	1.08E-01	4.67E-01
		380.45		1.52	-5.55E-01		1.83E+00
		427.87		29.60	-2.69E-03		1.08E-01
		463.36		10.49	1.65E-01		3.24E-01
		600.60		17.65	-1.90E-03		2.15E-01
		606.71		4.98	-6.99E-01		1.11E+00
		635.95		11.22	-3.93E-02		2.48E-01

Analysis Report for 17-Sep-19-10017

L1-12111A-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.76E-01	1.08E-01	2.32E+00
Ba-133	79.61	2.65	-8.12E-01	6.29E-02	2.61E+00
	81.00	32.90	-1.25E-01		1.87E-01
	276.40	7.16	4.33E-02		4.09E-01
	302.85	18.34	1.80E-02		1.55E-01
	356.01	62.05	-2.14E-02		6.29E-02
	383.85	8.94	5.87E-02		3.37E-01
Cs-134	475.36	1.48	-3.66E-01	5.26E-02	2.93E+00
	563.25	8.34	-3.45E-02		3.89E-01
	569.33	15.37	-1.28E-02		2.10E-01
	604.72	97.62	-4.65E-02		5.41E-02
	795.86	85.46	1.63E-02		5.26E-02
	801.95	8.69	-3.38E-01		4.02E-01
	1038.61	0.99	-2.08E-01		3.94E+00
	1167.97	1.79	-8.96E-01		3.00E+00
	1365.19	3.02	2.27E-01		1.09E+00
Cs-137	661.66	85.10	-1.85E-02	4.44E-02	4.44E-02
Eu-152	121.78	28.67	-1.14E-02	1.03E-01	1.06E-01
	244.70	7.61	-3.54E-01		3.94E-01
	295.94	0.45	3.93E-01		8.86E+00
	344.28	26.60	-2.15E-01		1.03E-01
	367.79	0.86	-1.10E+00		3.30E+00
	411.12	2.24	5.96E-01		1.44E+00
	443.96	2.83	-4.23E-01		9.67E-01
	488.68	0.42	-3.54E+00		7.98E+00
	563.99	0.49	-5.81E-01		6.60E+00
	586.26	0.46	6.17E+00		1.03E+01
	678.62	0.47	8.98E-01		7.84E+00
	688.67	0.86	-1.12E+00		3.49E+00
	719.35	0.28	-6.11E+00		1.29E+01
	778.90	12.96	-3.83E-02		2.91E-01
	810.45	0.32	4.08E-01		9.92E+00
	867.37	4.26	-7.89E-02		7.46E-01
	919.33	0.43	-1.23E+00		9.09E+00
	964.08	14.65	3.90E-03		3.44E-01
	1085.87	10.24	2.31E-01		5.00E-01
	1089.74	1.73	6.82E-01		2.78E+00
	1112.07	13.69	-1.71E-02		3.56E-01
	1212.95	1.43	-1.33E+00		3.40E+00
	1249.94	0.19	3.71E+00		3.16E+01
	1299.14	1.63	9.20E-02		2.97E+00
	1408.01	21.07	-8.93E-02		1.73E-01
	1457.64	0.50	-1.38E+00		3.98E+01
	1528.10	0.28	-4.69E+00		7.87E+00
Eu-154	123.07	40.40	-2.76E-02	7.28E-02	7.28E-02
	247.93	6.89	-6.12E-02		3.97E-01
	591.76	4.95	-5.86E-02		7.95E-01
	692.42	1.78	4.88E-01		2.06E+00
	723.30	20.06	8.53E-02		2.11E-01
	756.80	4.52	-3.84E-01		7.04E-01
	873.18	12.08	-3.13E-02		2.83E-01

Analysis Report for 17-Sep-19-10017

L1-12111A-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.06E-01	7.28E-02	4.23E-01
	1004.76	18.01	8.81E-02		2.61E-01
	1274.43	34.80	-8.48E-02		1.32E-01
	1596.48	1.80	4.56E-01		1.42E+00
Eu-155	45.30	1.31	2.73E+00	1.64E-01	1.16E+01
	60.01	1.22	6.61E+00		1.30E+01
	86.55	30.70	-7.79E-02		1.64E-01
	105.31	21.10	2.29E-02		1.79E-01
Ra-226	186.21	3.64	8.74E-01	1.02E+00	1.02E+00
Pa-231	27.36	10.30	7.67E-01	1.18E+00	1.25E+00
	283.69	1.70	-3.56E-01		1.57E+00
	300.07	2.47	6.47E-02		1.18E+00
	302.65	2.20	1.50E-01		1.29E+00
	330.06	1.40	4.44E-01		2.38E+00
U-235	143.76	10.96	1.67E-02	6.43E-02	2.86E-01
	163.33	5.08	-3.40E-01		6.57E-01
	185.71	57.20	3.72E-02		6.43E-02
	202.11	1.08	1.23E+00		3.15E+00
	205.31	5.01	1.27E-01		7.04E-01
Am-241	59.54	35.90	9.56E-02	4.41E-01	4.41E-01

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

Apex-Gamma

Analysis Report for 17-Sep-19-10018
L1-12111A-FSGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10018
Sample Description	: L1-12111A-FSGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.664E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:26:00AM
Acquisition Started	: 9/17/2019 9:35:00AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79560
Fill Height	: 1663.57 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:50:03AM

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

Data Validated
0800 9-18-19

Analysis Report for 17-Sep-19-10018

L1-12111A-FSGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.50	948 -	960	954.10	8.92E+01	15.20	5.38E+01	1.02
2	295.22	1174 -	1187	1180.77	4.05E+01	10.79	2.75E+01	0.96
3	351.93	1399 -	1413	1407.44	6.06E+01	12.97	3.74E+01	1.21
4	582.80	2325 -	2337	2330.41	4.15E+01	7.66	6.50E+00	1.05
5	609.01	2429 -	2442	2435.21	4.55E+01	8.63	1.05E+01	0.79
6	911.00	3638 -	3648	3642.96	2.79E+01	6.32	5.08E+00	1.06
7	1460.34	5830 -	5851	5841.20	3.13E+02	17.69	0.00E+00	1.58

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.82	*	10.66	7.62E+00	5.43E-01
Tl-208	0.97	583.19	*	85.00	6.80E-02	1.32E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.57E-01	2.96E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.43E-01	2.85E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 17-Sep-19-10018

L1-12111A-FSGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.90E-01	5.29E-02
		351.93	*	35.60	1.67E-01	3.81E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.04E-01	4.69E-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 17-Sep-19-10018

L1-12111A-FSGS-013SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.964	7.62E+00	5.43E-01	
	Tl-208	0.976	6.80E-02	1.32E-02	
X	Bi-211	0.889			
	Pb-212	0.998	1.57E-01	2.96E-02	
	Bi-214	0.994	1.43E-01	2.85E-02	
	Pb-214	1.000	1.75E-01	3.09E-02	
	Ac-228	0.998	2.04E-01	4.69E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 17-Sep-19-10018

L1-12111A-FSGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:50:03AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	9.26E-02	6.07E-02	6.07E-02
	BE-7	477.60		10.44	3.55E-01	4.61E-01	4.61E-01
+	K-40	1460.82	*	10.66	7.62E+00	7.01E-02	7.01E-02
	Mn-54	834.85		99.98	-1.73E-02	4.42E-02	4.42E-02
	Co-60	1173.23		99.85	-2.97E-02	5.63E-02	5.77E-02
		1332.49		99.98	1.46E-02		5.63E-02
	Nb-94	702.65		99.81	4.58E-03	4.34E-02	4.47E-02
		871.09		99.89	-3.19E-02		4.34E-02
	Ag-108m	79.13		6.60	-9.74E-02	4.17E-02	1.90E+00
		433.94		90.50	-4.71E-03		4.17E-02
		614.28		89.80	-3.08E-02		5.45E-02
		722.94		90.80	3.08E-02		5.96E-02
	Sb-125	176.31		6.84	-8.17E-03	1.29E-01	5.87E-01
		380.45		1.52	-4.56E-03		2.40E+00
		427.87		29.60	-6.66E-03		1.29E-01
		463.36		10.49	1.07E-01		4.25E-01
		600.60		17.65	1.01E-01		2.04E-01
		606.71		4.98	1.15E+00		1.24E+00
		635.95		11.22	1.04E-01		3.34E-01

Analysis Report for 17-Sep-19-10018

L1-12111A-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.05E+00	1.29E-01	2.38E+00
Ba-133	79.61	2.65	-1.60E+00	7.63E-02	4.50E+00
	81.00	32.90	-8.54E-02		3.22E-01
	276.40	7.16	2.41E-02		5.04E-01
	302.85	18.34	-1.00E-02		2.15E-01
	356.01	62.05	-1.77E-02		7.63E-02
	383.85	8.94	-1.86E-01		4.13E-01
Cs-134	475.36	1.48	1.24E+00	4.44E-02	3.20E+00
	563.25	8.34	7.26E-02		4.22E-01
	569.33	15.37	9.19E-02		2.60E-01
	604.72	97.62	-2.90E-02		5.90E-02
	795.86	85.46	-5.20E-02		4.44E-02
	801.95	8.69	-6.34E-02		5.24E-01
	1038.61	0.99	-1.09E+00		6.58E+00
	1167.97	1.79	2.08E+00		3.56E+00
	1365.19	3.02	-3.79E-01		1.76E+00
Cs-137	661.66	85.10	-1.28E-02	5.65E-02	5.65E-02
Eu-152	121.78	28.67	-1.26E-02	1.37E-01	1.54E-01
	244.70	7.61	1.17E-02		5.38E-01
	295.94	0.45	9.32E-01		9.74E+00
	344.28	26.60	-1.72E-01		1.37E-01
	367.79	0.86	-1.26E+00		3.90E+00
	411.12	2.24	7.57E-01		1.61E+00
	443.96	2.83	-9.58E-01		1.32E+00
	488.68	0.42	4.66E+00		9.53E+00
	563.99	0.49	2.45E+00		7.17E+00
	586.26	0.46	-8.04E+00		1.32E+01
	678.62	0.47	1.65E+00		8.63E+00
	688.67	0.86	3.18E+00		5.82E+00
	719.35	0.28	-1.09E+01		1.46E+01
	778.90	12.96	-1.09E-02		3.44E-01
	810.45	0.32	-3.65E+00		1.43E+01
	867.37	4.26	-3.44E-01		9.91E-01
	919.33	0.43	3.81E+00		1.19E+01
	964.08	14.65	1.81E-01		4.68E-01
	1085.87	10.24	4.52E-01		5.75E-01
	1089.74	1.73	-1.06E+00		3.41E+00
	1112.07	13.69	2.75E-02		5.03E-01
	1212.95	1.43	-1.80E+00		5.71E+00
	1249.94	0.19	-2.80E+01		3.41E+01
	1299.14	1.63	-3.24E+00		3.94E+00
	1408.01	21.07	-7.99E-02		2.34E-01
	1457.64	0.50	1.61E+02		4.57E+01
	1528.10	0.28	-4.09E-01		1.48E+01
Eu-154	123.07	40.40	5.98E-03	1.12E-01	1.12E-01
	247.93	6.89	-1.82E-01		5.09E-01
	591.76	4.95	1.15E-01		8.88E-01
	692.42	1.78	-1.19E+00		2.60E+00
	723.30	20.06	5.03E-02		2.67E-01
	756.80	4.52	-1.62E-01		1.10E+00
	873.18	12.08	2.75E-01		3.84E-01

Analysis Report for 17-Sep-19-10018

L1-12111A-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.67E-01	1.12E-01	5.13E-01
	1004.76	18.01	6.12E-02		2.89E-01
	1274.43	34.80	1.09E-01		1.75E-01
	1596.48	1.80	-1.99E+00		1.93E+00
Eu-155	45.30	1.31	1.21E+01	2.63E-01	3.17E+01
	60.01	1.22	-1.53E+01		3.17E+01
	86.55	30.70	-5.84E-02		2.63E-01
	105.31	21.10	2.04E-01		2.90E-01
Ra-226	186.21	3.64	9.82E-01	1.20E+00	1.20E+00
Pa-231	27.36	10.30	2.29E+00	1.60E+00	3.15E+00
	283.69	1.70	1.39E+00		2.21E+00
	300.07	2.47	8.80E-01		1.60E+00
	302.65	2.20	3.08E-01		1.78E+00
	330.06	1.40	1.72E+00		2.82E+00
U-235	143.76	10.96	-1.55E-01	7.60E-02	3.75E-01
	163.33	5.08	1.40E-01		7.46E-01
	185.71	57.20	3.76E-02		7.60E-02
	202.11	1.08	-3.38E-01		3.57E+00
	205.31	5.01	-1.43E-01		8.10E-01
Am-241	59.54	35.90	1.34E-01	1.16E+00	1.16E+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 17-Sep-19-10019

L1-12111A-FSGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10019
Sample Description	: L1-12111A-FSGS-014SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.372E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:28:00AM
Acquisition Started	: 9/17/2019 9:35:08AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79561
Fill Height	: 1371.77 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:50:22AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0800 9-18-19

Analysis Report for 17-Sep-19-10019

L1-12111A-FSGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.71	949 -	960	954.40	1.19E+02	16.66	6.24E+01	1.16
2	295.34	1174 -	1188	1180.64	6.75E+01	12.28	2.85E+01	0.96
3	352.00	1399 -	1414	1407.03	7.30E+01	11.28	1.80E+01	0.99
4	582.97	2325 -	2335	2329.99	3.96E+01	7.89	9.45E+00	0.71
5	609.19	2427 -	2441	2434.80	4.27E+01	10.63	2.43E+01	0.56
6	1460.32	5826 -	5851	5839.23	3.33E+02	20.05	1.63E+01	1.26

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	7.73E+00	5.74E-01
Tl-208	0.99	583.19	*	85.00	6.13E-02	1.28E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.93E-01	3.12E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.27E-01	3.26E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 17-Sep-19-10019

L1-12111A-FSGS-014SS

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	2.96E-01	5.88E-02
		351.93	*	35.60	1.89E-01	3.28E-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	0.961	7.73E+00	5.74E-01	
	Tl-208	0.992	6.13E-02	1.28E-02	
X	Bi-211	0.870			
	Pb-212	0.999	1.93E-01	3.12E-02	
	Bi-214	0.999	1.27E-01	3.26E-02	
	Pb-214	0.999	2.14E-01	2.87E-02	

Analysis Report for 17-Sep-19-10019

L1-12111A-FSGS-014SS

? = 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-19-10019

L1-12111A-FSGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:50:22AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.93E-02	5.76E-02	5.76E-02
	BE-7	477.60		10.44	3.83E-03	3.90E-01	3.90E-01
+	K-40	1460.82	*	10.66	7.73E+00	7.23E-01	7.23E-01
	Mn-54	834.85		99.98	1.36E-02	4.84E-02	4.84E-02
	Co-60	1173.23		99.85	1.50E-02	5.62E-02	6.72E-02
		1332.49		99.98	1.46E-02		5.62E-02
	Nb-94	702.65		99.81	3.28E-03	3.83E-02	3.88E-02
		871.09		99.89	-4.36E-03		3.83E-02
	Ag-108m	79.13		6.60	8.20E-01	3.84E-02	1.16E+00
		433.94		90.50	7.01E-03		3.84E-02
		614.28		89.80	-1.91E-02		5.54E-02
		722.94		90.80	2.94E-02		5.46E-02
	Sb-125	176.31		6.84	1.73E-01	1.15E-01	4.85E-01
		380.45		1.52	-5.61E-01		2.34E+00
		427.87		29.60	2.29E-02		1.15E-01
		463.36		10.49	1.09E-01		3.75E-01
		600.60		17.65	2.20E-02		2.59E-01
		606.71		4.98	1.70E+00		1.34E+00
		635.95		11.22	-1.71E-03		3.69E-01

Analysis Report for 17-Sep-19-10019

L1-12111A-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	6.04E-01	1.15E-01	2.22E+00
Ba-133	79.61	2.65	1.18E+00	6.17E-02	2.83E+00
	81.00	32.90	-3.83E-01		1.72E-01
	276.40	7.16	6.52E-02		5.04E-01
	302.85	18.34	1.11E-01		1.94E-01
	356.01	62.05	-5.03E-02		6.17E-02
	383.85	8.94	1.40E-01		4.11E-01
Cs-134	475.36	1.48	1.18E+00	5.56E-02	2.74E+00
	563.25	8.34	-4.25E-01		5.18E-01
	569.33	15.37	-6.75E-02		2.42E-01
	604.72	97.62	-1.21E-02		6.00E-02
	795.86	85.46	-3.21E-03		5.56E-02
	801.95	8.69	-1.27E-01		4.98E-01
	1038.61	0.99	-1.89E-01		4.48E+00
	1167.97	1.79	-5.69E+00		3.39E+00
	1365.19	3.02	9.36E-01		1.52E+00
Cs-137	661.66	85.10	1.43E-02	5.07E-02	5.07E-02
Eu-152	121.78	28.67	2.02E-02	1.11E-01	1.11E-01
	244.70	7.61	1.43E-01		5.09E-01
	295.94	0.45	1.18E+01		1.03E+01
	344.28	26.60	-2.42E-02		1.26E-01
	367.79	0.86	-3.69E+00		3.62E+00
	411.12	2.24	1.24E-01		1.38E+00
	443.96	2.83	-1.16E+00		1.14E+00
	488.68	0.42	-6.96E-01		8.99E+00
	563.99	0.49	-5.39E+00		8.30E+00
	586.26	0.46	-6.37E+00		1.24E+01
	678.62	0.47	3.47E-01		8.02E+00
	688.67	0.86	1.54E+00		4.45E+00
	719.35	0.28	-5.76E-01		1.61E+01
	778.90	12.96	-3.06E-02		3.21E-01
	810.45	0.32	1.20E+00		1.33E+01
	867.37	4.26	-2.99E-01		9.42E-01
	919.33	0.43	4.95E+00		1.23E+01
	964.08	14.65	2.75E-01		4.41E-01
	1085.87	10.24	6.88E-02		5.47E-01
	1089.74	1.73	2.36E+00		3.50E+00
	1112.07	13.69	1.27E-01		4.09E-01
	1212.95	1.43	5.40E-01		5.38E+00
	1249.94	0.19	-2.17E+01		3.03E+01
	1299.14	1.63	-4.04E-01		3.16E+00
	1408.01	21.07	-2.93E-02		1.88E-01
	1457.64	0.50	1.67E+02		4.59E+01
	1528.10	0.28	-4.55E-01		1.13E+01
Eu-154	123.07	40.40	-1.85E-02	7.66E-02	7.66E-02
	247.93	6.89	1.15E-01		4.62E-01
	591.76	4.95	-9.14E-02		8.62E-01
	692.42	1.78	-4.34E-01		2.24E+00
	723.30	20.06	3.69E-02		2.41E-01
	756.80	4.52	4.51E-02		1.06E+00
	873.18	12.08	-3.63E-01		3.08E-01

Analysis Report for 17-Sep-19-10019

L1-12111A-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.75E-01	7.66E-02	5.45E-01
	1004.76	18.01	3.29E-01		3.14E-01
	1274.43	34.80	-9.60E-03		1.88E-01
	1596.48	1.80	1.05E+00		2.88E+00
Eu-155	45.30	1.31	3.50E+00	1.66E-01	1.18E+01
	60.01	1.22	-7.87E-01		1.20E+01
	86.55	30.70	-7.76E-02		1.66E-01
	105.31	21.10	-4.73E-02		1.89E-01
Ra-226	186.21	3.64	-3.50E-01	8.76E-01	8.76E-01
Pa-231	27.36	10.30	9.11E-01	1.20E+00	1.20E+00
	283.69	1.70	7.45E-01		1.81E+00
	300.07	2.47	-3.23E-02		1.52E+00
	302.65	2.20	9.54E-01		1.63E+00
	330.06	1.40	1.76E+00		2.47E+00
U-235	143.76	10.96	9.92E-02	5.64E-02	3.10E-01
	163.33	5.08	2.83E-01		6.56E-01
	185.71	57.20	-4.91E-03		5.64E-02
	202.11	1.08	-1.97E+00		2.84E+00
	205.31	5.01	-9.08E-02		6.28E-01
Am-241	59.54	35.90	-2.02E-01	3.99E-01	3.99E-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-19-10020
L1-12111A-FSGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10020
Sample Description	: L1-12111A-FSGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.424E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:30:00AM
Acquisition Started	: 9/17/2019 9:35:17AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79562
Fill Height	: 1424.37 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 9:50:21AM

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

Data Validated
0800 9-18-19

Analysis Report for 17-Sep-19-10020

L1-12111A-FSGS-015SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.67	947 -	961	955.16	1.06E+02	16.43	5.68E+01	0.97
2	295.34	1176 -	1187	1181.56	4.86E+01	9.86	1.94E+01	0.74
3	338.25	1348 -	1358	1353.03	2.48E+01	8.88	2.22E+01	0.50
4	351.91	1399 -	1415	1407.62	9.13E+01	11.45	1.28E+01	1.28
5	583.27	2326 -	2339	2332.42	5.03E+01	9.37	1.37E+01	0.93
6	609.28	2428 -	2443	2436.40	5.79E+01	10.93	2.01E+01	0.77
7	1460.91	5829 -	5855	5844.02	3.94E+02	20.97	1.03E+01	1.87

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.41E+00	5.78E-01
Tl-208	0.99	583.19	*	85.00	7.32E-02	1.43E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.69E-01	2.94E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.62E-01	3.21E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 17-Sep-19-10020

L1-12111A-FSGS-015SS

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	4.47E-02
		351.93	*	35.60	2.25E-01	3.35E-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	1.88E-01	6.91E-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 17-Sep-19-10020

L1-12111A-FSGS-015SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	8.41E+00	5.78E-01	
	Tl-208	0.999	7.32E-02	1.43E-02	
X	Bi-211	0.894			
	Pb-212	1.000	1.69E-01	2.94E-02	
	Bi-214	1.000	1.62E-01	3.21E-02	
	Pb-214	0.999	2.18E-01	2.68E-02	
	Ac-228	1.000	1.88E-01	6.91E-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-19-10020

L1-12111A-FSGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 9:50:21AM
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	5.47E-02	5.35E-02	5.35E-02
	BE-7	477.60		10.44	7.93E-02	4.01E-01	4.01E-01
+	K-40	1460.82	*	10.66	8.41E+00	5.53E-01	5.53E-01
	Mn-54	834.85		99.98	1.03E-02	5.27E-02	5.27E-02
	Co-60	1173.23		99.85	-9.02E-03	4.82E-02	6.05E-02
		1332.49		99.98	-3.26E-02		4.82E-02
	Nb-94	702.65		99.81	1.29E-02	4.26E-02	4.26E-02
		871.09		99.89	2.33E-02		4.90E-02
	Ag-108m	79.13		6.60	3.96E-01	3.81E-02	1.59E+00
		433.94		90.50	-3.10E-03		3.81E-02
		614.28		89.80	-3.37E-02		7.18E-02
		722.94		90.80	7.94E-03		5.33E-02
	Sb-125	176.31		6.84	-4.51E-03	1.19E-01	4.61E-01
		380.45		1.52	-2.38E-01		2.38E+00
		427.87		29.60	3.52E-02		1.19E-01
		463.36		10.49	-5.36E-02		3.16E-01
		600.60		17.65	1.46E-01		2.77E-01
		606.71		4.98	1.73E+00		1.42E+00
		635.95		11.22	-1.81E-01		3.35E-01

Analysis Report for 17-Sep-19-10020

L1-12111A-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-8.34E-01	1.19E-01	2.11E+00
Ba-133	79.61	2.65	1.92E+00	7.33E-02	3.83E+00
	81.00	32.90	6.03E-02		2.76E-01
	276.40	7.16	-8.95E-02		5.01E-01
	302.85	18.34	-5.48E-02		1.79E-01
	356.01	62.05	9.41E-03		7.33E-02
	383.85	8.94	-2.02E-01		3.85E-01
Cs-134	475.36	1.48	-2.27E-01	5.97E-02	2.64E+00
	563.25	8.34	-2.91E-01		4.03E-01
	569.33	15.37	5.96E-02		2.31E-01
	604.72	97.62	-1.55E-02		6.60E-02
	795.86	85.46	1.85E-02		5.97E-02
	801.95	8.69	5.17E-02		5.56E-01
	1038.61	0.99	-2.66E+00		5.41E+00
	1167.97	1.79	2.26E+00		3.71E+00
	1365.19	3.02	4.56E-01		1.54E+00
Cs-137	661.66	85.10	2.26E-02	4.74E-02	4.74E-02
Eu-152	121.78	28.67	5.80E-02	1.35E-01	1.36E-01
	244.70	7.61	-1.53E-02		4.97E-01
	295.94	0.45	4.45E+00		9.36E+00
	344.28	26.60	3.13E-02		1.35E-01
	367.79	0.86	-1.57E+00		3.94E+00
	411.12	2.24	-3.56E-01		1.58E+00
	443.96	2.83	7.85E-02		1.32E+00
	488.68	0.42	-6.67E+00		8.28E+00
	563.99	0.49	-2.39E+00		6.96E+00
	586.26	0.46	1.27E+01		1.26E+01
	678.62	0.47	-4.09E+00		7.92E+00
	688.67	0.86	5.00E-01		5.52E+00
	719.35	0.28	2.50E+00		1.57E+01
	778.90	12.96	-4.71E-02		3.47E-01
	810.45	0.32	-6.78E+00		1.48E+01
	867.37	4.26	-7.47E-01		1.10E+00
	919.33	0.43	-1.11E+01		1.24E+01
	964.08	14.65	0.00E+00		4.37E-01
	1085.87	10.24	2.52E-01		5.54E-01
	1089.74	1.73	-1.24E+00		3.15E+00
	1112.07	13.69	-2.74E-01		4.32E-01
	1212.95	1.43	2.32E+00		4.55E+00
	1249.94	0.19	6.37E+00		3.05E+01
	1299.14	1.63	6.49E-01		3.64E+00
	1408.01	21.07	5.75E-02		2.12E-01
	1457.64	0.50	1.79E+02		4.52E+01
	1528.10	0.28	1.67E+00		8.08E+00
Eu-154	123.07	40.40	-2.87E-02	9.60E-02	9.60E-02
	247.93	6.89	-6.01E-01		4.64E-01
	591.76	4.95	3.35E-01		8.57E-01
	692.42	1.78	2.49E+00		2.65E+00
	723.30	20.06	1.63E-01		2.44E-01
	756.80	4.52	-4.68E-01		9.89E-01
	873.18	12.08	-1.17E-01		3.77E-01

Analysis Report for 17-Sep-19-10020

L1-12111A-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.27E-01	9.60E-02	4.60E-01
	1004.76	18.01	-6.03E-02		2.69E-01
	1274.43	34.80	-6.90E-02		1.51E-01
	1596.48	1.80	-2.77E+00		2.34E+00
Eu-155	45.30	1.31	7.41E+00	1.94E-01	1.93E+01
	60.01	1.22	-2.23E+01		2.11E+01
	86.55	30.70	-6.19E-02		2.17E-01
	105.31	21.10	-7.74E-02		1.94E-01
Ra-226	186.21	3.64	-2.76E-01	9.96E-01	9.96E-01
Pa-231	27.36	10.30	1.89E+00	1.42E+00	2.37E+00
	283.69	1.70	2.87E+00		2.22E+00
	300.07	2.47	-5.00E-01		1.42E+00
	302.65	2.20	3.02E-02		1.50E+00
	330.06	1.40	1.14E+00		2.55E+00
U-235	143.76	10.96	1.07E-01	6.27E-02	3.65E-01
	163.33	5.08	-3.55E-01		5.98E-01
	185.71	57.20	-2.44E-02		6.27E-02
	202.11	1.08	-2.16E+00		3.23E+00
	205.31	5.01	-4.80E-01		6.72E-01
Am-241	59.54	35.90	-7.05E-01	7.31E-01	7.31E-01

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

Apex-Gamma

Analysis Report for 17-Sep-19-10021
L1-12111A-FSGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10021
Sample Description	: L1-12111A-FSGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.563E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:32:00AM
Acquisition Started	: 9/17/2019 10:16:29AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79563
Fill Height	: 1562.58 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 10:31:32AM

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

Data Validated
0800 9-18-19

Analysis Report for 17-Sep-19-10021

L1-12111A-FSGS-016SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.58	472 -	481	477.34	1.01E+02	19.53	1.20E+02	0.88
2	295.21	585 -	594	590.47	3.99E+01	13.55	6.21E+01	0.95
3	351.80	699 -	707	703.55	7.71E+01	13.15	4.49E+01	1.07
4	583.40	1161 -	1169	1166.41	4.62E+01	9.41	1.98E+01	1.25
5	609.24	1212 -	1222	1218.07	6.61E+01	11.41	2.69E+01	1.51
6	911.08	1816 -	1828	1821.61	5.28E+01	9.08	1.12E+01	1.59
7	1460.90	2914 -	2929	2921.86	5.03E+02	22.43	0.00E+00	2.26
8	1764.56	3524 -	3534	3529.97	2.06E+01	4.90	1.39E+00	1.19

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.40E+00	5.85E-01
Tl-208	0.99	583.19	*	85.00	5.93E-02	1.26E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.41E-01	2.96E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.63E-01	2.98E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 17-Sep-19-10021

L1-12111A-FSGS-016SS

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	3.09E-01	7.45E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.49E-01	5.19E-02
		351.93	*	35.60	1.68E-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	2.99E-01	5.30E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 17-Sep-19-10021

L1-12111A-FSGS-016SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	9.40E+00	5.85E-01	
	Tl-208	0.993	5.93E-02	1.26E-02	
X	Bi-211	0.918			
	Pb-212	1.000	1.41E-01	2.96E-02	
	Bi-214	1.000	1.83E-01	2.77E-02	
	Pb-214	0.998	1.63E-01	2.70E-02	
	Ac-228	0.999	2.99E-01	5.30E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 17-Sep-19-10021

L1-12111A-FSGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 10:31:32AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.28E-02	5.15E-02	5.15E-02
	BE-7	477.60		10.44	-7.63E-02	3.25E-01	3.25E-01
+	K-40	1460.82	*	10.66	9.40E+00	5.38E-02	5.38E-02
	Mn-54	834.85		99.98	1.25E-03	4.32E-02	4.32E-02
	Co-60	1173.23		99.85	3.54E-03	4.11E-02	5.83E-02
		1332.49		99.98	6.11E-04		4.11E-02
	Nb-94	702.65		99.81	-2.96E-02	3.43E-02	3.43E-02
		871.09		99.89	-7.74E-03		4.31E-02
	Ag-108m	79.13		6.60	7.90E-02	3.84E-02	1.10E+00
		433.94		90.50	-2.06E-03		3.84E-02
		614.28		89.80	-4.25E-02		5.22E-02
		722.94		90.80	-1.14E-02		4.59E-02
	Sb-125	176.31		6.84	7.64E-03	1.15E-01	4.71E-01
		380.45		1.52	1.50E+00		2.20E+00
		427.87		29.60	2.07E-02		1.15E-01
		463.36		10.49	6.87E-03		3.32E-01
		600.60		17.65	-1.37E-02		1.97E-01
		606.71		4.98	-6.51E-02		1.17E+00
		635.95		11.22	1.20E-01		3.34E-01

Analysis Report for 17-Sep-19-10021

L1-12111A-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-6.79E-01	1.15E-01	1.95E+00
Ba-133	79.61	2.65	1.55E+00	7.16E-02	2.71E+00
	81.00	32.90	-1.82E-01		1.81E-01
	276.40	7.16	2.08E-02		4.18E-01
	302.85	18.34	-7.97E-03		1.79E-01
	356.01	62.05	-6.18E-02		7.16E-02
	383.85	8.94	4.12E-03		3.58E-01
Cs-134	475.36	1.48	8.00E-02	5.02E-02	2.28E+00
	563.25	8.34	1.33E-01		4.58E-01
	569.33	15.37	-4.85E-02		2.24E-01
	604.72	97.62	2.58E-04		5.21E-02
	795.86	85.46	3.32E-02		5.02E-02
	801.95	8.69	-2.13E-01		4.37E-01
	1038.61	0.99	-1.33E-01		4.68E+00
	1167.97	1.79	1.58E+00		3.06E+00
	1365.19	3.02	-1.55E-01		1.39E+00
Cs-137	661.66	85.10	-3.92E-03	4.52E-02	4.52E-02
Eu-152	121.78	28.67	-6.01E-02	1.08E-01	1.08E-01
	244.70	7.61	-1.14E-01		4.64E-01
	295.94	0.45	-3.89E-01		8.68E+00
	344.28	26.60	-1.24E-01		1.13E-01
	367.79	0.86	-1.13E-01		3.51E+00
	411.12	2.24	4.51E-01		1.45E+00
	443.96	2.83	-3.94E-01		1.09E+00
	488.68	0.42	-3.35E+00		7.31E+00
	563.99	0.49	1.47E+00		7.77E+00
	586.26	0.46	-9.38E+00		1.15E+01
	678.62	0.47	3.66E-01		7.44E+00
	688.67	0.86	5.08E-01		4.07E+00
	719.35	0.28	-4.17E+00		1.33E+01
	778.90	12.96	-1.32E-01		2.73E-01
	810.45	0.32	-4.95E+00		1.19E+01
	867.37	4.26	-5.12E-01		9.22E-01
	919.33	0.43	-7.89E+00		8.17E+00
	964.08	14.65	-3.58E-02		3.77E-01
	1085.87	10.24	-1.90E-01		4.99E-01
	1089.74	1.73	-1.67E+00		2.80E+00
	1112.07	13.69	-3.63E-02		4.16E-01
	1212.95	1.43	-1.67E+00		3.84E+00
	1249.94	0.19	-1.25E+01		2.76E+01
	1299.14	1.63	-2.25E-02		3.29E+00
	1408.01	21.07	4.93E-03		1.92E-01
	1457.64	0.50	0.00E+00		4.36E+01
	1528.10	0.28	4.38E+00		1.07E+01
Eu-154	123.07	40.40	9.89E-04	7.98E-02	7.98E-02
	247.93	6.89	1.43E-01		4.70E-01
	591.76	4.95	-1.13E-01		7.56E-01
	692.42	1.78	-7.41E-01		1.97E+00
	723.30	20.06	2.11E-02		2.15E-01
	756.80	4.52	-4.76E-01		7.68E-01
	873.18	12.08	1.59E-01		3.67E-01

Analysis Report for 17-Sep-19-10021

L1-12111A-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.03E-01	7.98E-02	4.43E-01
	1004.76	18.01	-2.06E-02		2.52E-01
	1274.43	34.80	8.84E-04		1.40E-01
	1596.48	1.80	9.39E-01		2.39E+00
Eu-155	45.30	1.31	8.28E-01	1.74E-01	1.12E+01
	60.01	1.22	-3.09E+00		1.18E+01
	86.55	30.70	4.37E-02		1.74E-01
	105.31	21.10	-1.66E-02		1.88E-01
Ra-226	186.21	3.64	4.20E-01	1.00E+00	1.00E+00
Pa-231	27.36	10.30	7.02E-01	1.20E+00	1.20E+00
	283.69	1.70	-1.51E-01		1.71E+00
	300.07	2.47	-5.14E-02		1.35E+00
	302.65	2.20	-6.64E-02		1.49E+00
	330.06	1.40	1.99E+00		2.48E+00
U-235	143.76	10.96	1.29E-01	6.50E-02	2.85E-01
	163.33	5.08	4.23E-01		7.22E-01
	185.71	57.20	3.73E-02		6.50E-02
	202.11	1.08	-1.38E-01		3.09E+00
	205.31	5.01	-4.05E-01		6.56E-01
Am-241	59.54	35.90	-1.12E-01	4.08E-01	4.08E-01

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

Apex-Gamma

Analysis Report for 17-Sep-19-10022

L1-12111A-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 17-Sep-19-10022
Sample Description	: L1-12111A-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.509E+03 grams
Facility	: Default
Sample Taken On	: 9/16/2019 8:34:00AM
Acquisition Started	: 9/17/2019 10:16:36AM
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	: 9/17/2019
Efficiency Calibration Description	:
Sample Number	: 79564
Fill Height	: 1508.83 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/17/2019 10:31:39AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated

0800 9-18-19

Analysis Report for 17-Sep-19-10022

L1-12111A-FSGS-017SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.61	947 -	959	954.55	1.14E+02	16.14	5.59E+01	0.78
2	295.35	1175 -	1186	1181.32	4.91E+01	10.57	2.49E+01	0.55
3	338.22	1347 -	1357	1352.65	2.61E+01	9.26	2.49E+01	0.42
4	351.86	1401 -	1412	1407.19	7.67E+01	12.16	2.83E+01	0.85
5	583.07	2326 -	2336	2331.50	3.14E+01	8.43	1.66E+01	1.12
6	609.23	2429 -	2441	2436.10	5.12E+01	8.78	9.76E+00	1.04
7	1460.40	5832 -	5852	5841.41	3.60E+02	19.41	4.79E+00	1.98

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.82	*	10.66	9.02E+00	6.24E-01
Tl-208	0.99	583.19	*	85.00	5.27E-02	1.45E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.05E-01	3.33E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.65E-01	3.00E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 17-Sep-19-10022

L1-12111A-FSGS-017SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.35E-01	5.39E-02
		351.93	*	35.60	2.15E-01	3.82E-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	2.25E-01	8.19E-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 17-Sep-19-10022

L1-12111A-FSGS-017SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.971	9.02E+00	6.24E-01	
	Tl-208	0.998	5.27E-02	1.45E-02	
X	Bi-211	0.904			
	Pb-212	1.000	2.05E-01	3.33E-02	
	Bi-214	1.000	1.65E-01	3.00E-02	
	Pb-214	0.999	2.22E-01	3.12E-02	
	Ac-228	1.000	2.25E-01	8.19E-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-19-10022

L1-12111A-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/17/2019 10:31:39AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.62E-02	5.55E-02	5.55E-02
	BE-7	477.60		10.44	2.86E-01	4.43E-01	4.43E-01
+	K-40	1460.82	*	10.66	9.02E+00	4.16E-01	4.16E-01
	Mn-54	834.85		99.98	-2.56E-04	5.46E-02	5.46E-02
	Co-60	1173.23		99.85	-5.77E-02	5.49E-02	7.15E-02
		1332.49		99.98	-2.98E-02		5.49E-02
	Nb-94	702.65		99.81	3.24E-02	4.35E-02	4.35E-02
		871.09		99.89	-1.64E-02		5.02E-02
	Ag-108m	79.13		6.60	3.31E-01	4.30E-02	1.85E+00
		433.94		90.50	-1.41E-02		4.30E-02
		614.28		89.80	-3.41E-02		6.42E-02
		722.94		90.80	2.06E-02		5.96E-02
	Sb-125	176.31		6.84	9.37E-02	1.30E-01	5.76E-01
		380.45		1.52	1.54E+00		2.75E+00
		427.87		29.60	7.31E-03		1.30E-01
		463.36		10.49	2.40E-01		4.14E-01
		600.60		17.65	4.12E-03		2.00E-01
		606.71		4.98	1.37E+00		1.31E+00
		635.95		11.22	1.10E-01		4.10E-01

Analysis Report for 17-Sep-19-10022

L1-12111A-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.58E+00	1.30E-01	2.59E+00
Ba-133	79.61	2.65	-2.94E+00	8.02E-02	4.34E+00
	81.00	32.90	-2.11E-01		3.17E-01
	276.40	7.16	-1.28E-01		5.06E-01
	302.85	18.34	-1.13E-02		2.13E-01
	356.01	62.05	-6.32E-02		8.02E-02
	383.85	8.94	-1.30E-01		4.00E-01
Cs-134	475.36	1.48	7.44E-01	6.13E-02	2.90E+00
	563.25	8.34	-1.51E-01		5.67E-01
	569.33	15.37	-2.72E-02		2.99E-01
	604.72	97.62	-2.54E-02		6.13E-02
	795.86	85.46	3.33E-02		6.99E-02
	801.95	8.69	-2.15E-01		5.84E-01
	1038.61	0.99	3.57E+00		6.02E+00
	1167.97	1.79	-6.96E-01		3.77E+00
	1365.19	3.02	8.29E-01		1.95E+00
Cs-137	661.66	85.10	8.67E-03	5.63E-02	5.63E-02
Eu-152	121.78	28.67	2.68E-02	1.34E-01	1.51E-01
	244.70	7.61	2.41E-01		5.61E-01
	295.94	0.45	3.61E+00		1.07E+01
	344.28	26.60	4.07E-02		1.34E-01
	367.79	0.86	-2.93E+00		4.28E+00
	411.12	2.24	9.62E-01		1.80E+00
	443.96	2.83	-2.84E-01		1.41E+00
	488.68	0.42	1.67E-01		9.37E+00
	563.99	0.49	-2.00E-01		9.52E+00
	586.26	0.46	-9.96E+00		1.32E+01
	678.62	0.47	1.12E+00		9.90E+00
	688.67	0.86	-1.30E+00		5.16E+00
	719.35	0.28	5.38E+00		1.82E+01
	778.90	12.96	9.97E-02		3.84E-01
	810.45	0.32	1.07E+01		1.49E+01
	867.37	4.26	-9.65E-01		1.13E+00
	919.33	0.43	-4.34E+00		1.36E+01
	964.08	14.65	3.97E-01		4.90E-01
	1085.87	10.24	2.08E-01		5.27E-01
	1089.74	1.73	2.30E+00		3.67E+00
	1112.07	13.69	-8.46E-02		4.70E-01
	1212.95	1.43	2.44E+00		5.05E+00
	1249.94	0.19	-2.16E+01		3.20E+01
	1299.14	1.63	-3.61E-01		3.41E+00
	1408.01	21.07	1.85E-01		2.64E-01
	1457.64	0.50	1.97E+02		5.07E+01
	1528.10	0.28	4.90E-01		1.10E+01
Eu-154	123.07	40.40	-1.11E-01	1.04E-01	1.04E-01
	247.93	6.89	2.80E-01		5.34E-01
	591.76	4.95	3.47E-01		8.08E-01
	692.42	1.78	9.49E-01		2.46E+00
	723.30	20.06	1.69E-01		2.73E-01
	756.80	4.52	3.67E-01		9.15E-01
	873.18	12.08	-2.38E-01		4.09E-01

Analysis Report for 17-Sep-19-10022

L1-12111A-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.06E-01	1.04E-01	5.44E-01
	1004.76	18.01	3.45E-02		3.39E-01
	1274.43	34.80	-1.04E-01		1.53E-01
	1596.48	1.80	2.79E-01		2.48E+00
Eu-155	45.30	1.31	-5.21E+00	2.71E-01	2.91E+01
	60.01	1.22	-1.97E+01		2.97E+01
	86.55	30.70	-1.78E-02		2.71E-01
	105.31	21.10	1.32E-02		2.86E-01
Ra-226	186.21	3.64	2.59E-01	1.08E+00	1.08E+00
Pa-231	27.36	10.30	2.42E+00	1.48E+00	3.60E+00
	283.69	1.70	9.59E-01		2.33E+00
	300.07	2.47	-3.50E-01		1.48E+00
	302.65	2.20	-1.43E-01		1.78E+00
	330.06	1.40	1.20E+00		3.01E+00
U-235	143.76	10.96	-1.01E-01	6.94E-02	3.70E-01
	163.33	5.08	-1.03E-01		8.05E-01
	185.71	57.20	2.75E-02		6.94E-02
	202.11	1.08	-1.00E+00		3.23E+00
	205.31	5.01	4.14E-01		7.71E-01
Am-241	59.54	35.90	-8.67E-01	1.06E+00	1.06E+00

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

Apex-Gamma

Analysis Report for 25-Sep-19-10019

L1-12111A-FSGS-003SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 25-Sep-19-10019
Sample Description	: L1-12111A-FSGS-003SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.662E+03 grams
Facility	: Default
Sample Taken On	: 9/17/2019 9:25:00AM
Acquisition Started	: 9/25/2019 8:04:11AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/25/2019
Efficiency Calibration Description	:
Sample Number	: 79877
Fill Height	: 1662.16 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/25/2019 8:19:13AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated
1600 9-25-19

Analysis Report for 25-Sep-19-10019

L1-12111A-FSGS-003SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.69	474 -	481	477.56	1.09E+02	17.99	1.02E+02	1.07
2	338.33	672 -	681	676.64	3.21E+01	10.45	3.39E+01	0.94
3	351.84	698 -	708	703.62	9.70E+01	14.86	5.20E+01	1.05
4	582.79	1160 -	1170	1165.19	5.24E+01	10.06	2.06E+01	1.14
5	609.29	1212 -	1223	1218.16	6.10E+01	9.54	1.20E+01	1.47
6	968.79	1934 -	1943	1937.04	2.68E+01	6.56	7.22E+00	0.96
7	1460.74	2915 -	2927	2921.54	4.87E+02	22.54	7.99E+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	0.99	1460.82	*	10.66	8.96E+00	5.68E-01
Tl-208	0.97	583.19	*	85.00	6.64E-02	1.34E-02
Bi-211	0.91	351.07	*	13.02	5.72E-01	9.91E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.50E-01	2.77E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.49E-01	2.49E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 25-Sep-19-10019

L1-12111A-FSGS-003SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.09E-01	3.62E-02
		785.96		1.06		
Ac-228	0.57	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.13E-01	7.15E-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	2.54E-01	6.32E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 25-Sep-19-10019

L1-12111A-FSGS-003SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	8.96E+00	5.68E-01	
	Tl-208	0.975	6.64E-02	1.34E-02	
?	Bi-211	0.910	5.72E-01	9.91E-02	
	Pb-212	1.000	1.50E-01	2.77E-02	
	Bi-214	1.000	1.49E-01	2.49E-02	
?	Pb-214	0.999	2.09E-01	3.62E-02	
	Ac-228	0.571	2.36E-01	4.74E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 25-Sep-19-10019

L1-12111A-FSGS-003SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/25/2019 8:19:13AM
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	7.36E-02	5.48E-02	5.48E-02
	BE-7	477.60		10.44	-3.66E-02	3.44E-01	3.44E-01
+	K-40	1460.82	*	10.66	8.96E+00	3.38E-01	3.38E-01
	Mn-54	834.85		99.98	1.04E-02	3.97E-02	3.97E-02
	Co-60	1173.23		99.85	1.29E-02	4.57E-02	5.82E-02
		1332.49		99.98	-5.91E-04		4.57E-02
	Nb-94	702.65		99.81	1.43E-02	4.01E-02	4.05E-02
		871.09		99.89	-7.24E-03		4.01E-02
	Ag-108m	79.13		6.60	6.06E-01	3.29E-02	1.14E+00
		433.94		90.50	-2.96E-02		3.29E-02
		614.28		89.80	-1.69E-02		4.30E-02
		722.94		90.80	6.66E-03		4.32E-02
	Sb-125	176.31		6.84	1.56E-02	1.11E-01	4.94E-01
		380.45		1.52	-6.57E-01		1.79E+00
		427.87		29.60	-1.14E-02		1.11E-01
		463.36		10.49	7.37E-02		3.41E-01
		600.60		17.65	2.61E-02		1.90E-01
		606.71		4.98	-5.16E-02		1.04E+00
		635.95		11.22	-2.09E-02		2.79E-01

Analysis Report for 25-Sep-19-10019

L1-12111A-FSGS-003SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-8.02E-01	1.11E-01	1.96E+00
Ba-133	79.61	2.65	1.84E-01	6.82E-02	2.67E+00
	81.00	32.90	-2.01E-01		1.83E-01
	276.40	7.16	1.65E-01		4.60E-01
	302.85	18.34	2.50E-02		1.70E-01
	356.01	62.05	-2.88E-02		6.82E-02
	383.85	8.94	9.86E-02		3.10E-01
Cs-134	475.36	1.48	-6.15E-01	4.59E-02	2.16E+00
	563.25	8.34	2.27E-01		4.27E-01
	569.33	15.37	-8.85E-02		2.25E-01
	604.72	97.62	-1.20E-02		4.59E-02
	795.86	85.46	5.85E-03		5.22E-02
	801.95	8.69	-2.13E-01		4.61E-01
	1038.61	0.99	2.01E+00		4.43E+00
	1167.97	1.79	-3.16E-01		3.00E+00
	1365.19	3.02	-5.06E-01		1.30E+00
Cs-137	661.66	85.10	3.35E-02	4.62E-02	4.62E-02
Eu-152	121.78	28.67	3.26E-02	1.14E-01	1.14E-01
	244.70	7.61	3.35E-02		4.52E-01
	295.94	0.45	2.29E+00		8.53E+00
	344.28	26.60	-2.77E-02		1.16E-01
	367.79	0.86	3.46E-01		3.74E+00
	411.12	2.24	-3.14E-01		1.34E+00
	443.96	2.83	1.94E-01		1.26E+00
	488.68	0.42	-2.59E+00		7.14E+00
	563.99	0.49	2.40E+00		7.05E+00
	586.26	0.46	-2.81E+00		1.14E+01
	678.62	0.47	-1.95E+00		6.77E+00
	688.67	0.86	6.46E-01		4.48E+00
	719.35	0.28	4.36E-01		1.29E+01
	778.90	12.96	2.03E-02		2.97E-01
	810.45	0.32	3.69E+00		1.25E+01
	867.37	4.26	2.03E-01		9.68E-01
	919.33	0.43	-4.80E+00		9.88E+00
	964.08	14.65	-2.41E-01		3.06E-01
	1085.87	10.24	-2.03E-01		4.59E-01
	1089.74	1.73	1.09E-01		2.84E+00
	1112.07	13.69	-4.17E-01		3.37E-01
	1212.95	1.43	-1.55E+00		3.98E+00
	1249.94	0.19	2.22E+00		2.99E+01
	1299.14	1.63	4.20E-01		3.04E+00
	1408.01	21.07	-3.40E-02		1.95E-01
	1457.64	0.50	-1.45E+01		4.31E+01
	1528.10	0.28	-3.87E+00		8.98E+00
Eu-154	123.07	40.40	3.99E-03	7.75E-02	7.75E-02
	247.93	6.89	-2.53E-01		4.34E-01
	591.76	4.95	1.84E-01		7.63E-01
	692.42	1.78	3.55E-01		2.20E+00
	723.30	20.06	5.46E-02		1.98E-01
	756.80	4.52	8.27E-02		9.06E-01
	873.18	12.08	-4.02E-02		3.12E-01

Analysis Report for 25-Sep-19-10019

L1-12111A-FSGS-003SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.28E-01	7.75E-02	4.05E-01
	1004.76	18.01	7.23E-02		2.29E-01
	1274.43	34.80	4.70E-02		1.52E-01
	1596.48	1.80	-6.30E-01		1.82E+00
Eu-155	45.30	1.31	-8.51E-01	1.65E-01	1.07E+01
	60.01	1.22	-5.45E+00		1.19E+01
	86.55	30.70	-1.12E-02		1.65E-01
	105.31	21.10	9.48E-02		1.96E-01
Ra-226	186.21	3.64	4.00E-01	9.66E-01	9.66E-01
Pa-231	27.36	10.30	4.14E-01	1.08E+00	1.08E+00
	283.69	1.70	-2.78E-01		1.64E+00
	300.07	2.47	-1.21E+00		1.29E+00
	302.65	2.20	2.08E-01		1.42E+00
	330.06	1.40	8.96E-01		2.34E+00
U-235	143.76	10.96	9.51E-02	6.27E-02	2.94E-01
	163.33	5.08	2.70E-01		7.05E-01
	185.71	57.20	4.08E-02		6.27E-02
	202.11	1.08	1.09E+00		3.24E+00
	205.31	5.01	-1.51E-01		6.86E-01
Am-241	59.54	35.90	-1.02E-01	4.24E-01	4.24E-01

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

Apex-Gamma

Analysis Report for 25-Sep-19-10020
L1-12111A-FSGS-007SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 25-Sep-19-10020
Sample Description	: L1-12111A-FSGS-007SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.658E+03 grams
Facility	: Default
Sample Taken On	: 9/17/2019 9:20:00AM
Acquisition Started	: 9/25/2019 8:04:18AM
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	: 9/25/2019
Efficiency Calibration Description	:
Sample Number	: 79878
Fill Height	: 1658.19 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/25/2019 8:19:21AM

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

Data Validated
1600 9-25-19

Analysis Report for 25-Sep-19-10020

L1-12111A-FSGS-007SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.61	950 -	958	954.55	8.48E+01	14.24	5.52E+01	1.00
2	337.87	1347 -	1357	1351.25	2.83E+01	7.82	1.38E+01	0.44
3	351.89	1402 -	1413	1407.31	6.43E+01	12.34	3.47E+01	0.65
4	582.94	2326 -	2335	2330.99	3.20E+01	7.49	1.00E+01	0.61
5	609.10	2430 -	2441	2435.59	3.46E+01	6.74	4.37E+00	0.93
6	1460.37	5830 -	5852	5841.30	3.12E+02	18.27	5.58E+00	1.19

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.82	*	10.66	7.62E+00	5.55E-01
Tl-208	0.99	583.19	*	85.00	5.24E-02	1.27E-02
Bi-211	0.89	351.07	*	13.02	4.85E-01	1.01E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.50E-01	2.79E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.09E-01	2.23E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 25-Sep-19-10020

L1-12111A-FSGS-007SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.77E-01	3.68E-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	2.39E-01	6.89E-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 25-Sep-19-10020

L1-12111A-FSGS-007SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.967	7.62E+00	5.55E-01	
	Tl-208	0.991	5.24E-02	1.27E-02	
?	Bi-211	0.897	4.85E-01	1.01E-01	
	Pb-212	1.000	1.50E-01	2.79E-02	
	Bi-214	0.997	1.09E-01	2.23E-02	
?	Pb-214	1.000	1.77E-01	3.68E-02	
	Ac-228	0.996	2.39E-01	6.89E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 25-Sep-19-10020

L1-12111A-FSGS-007SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/25/2019 8:19:21AM
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	3.44E-02	5.99E-02	5.99E-02
	BE-7	477.60		10.44	4.76E-02	3.98E-01	3.98E-01
+	K-40	1460.82	*	10.66	7.62E+00	4.51E-01	4.51E-01
	Mn-54	834.85		99.98	3.19E-02	4.76E-02	4.76E-02
	Co-60	1173.23		99.85	-6.10E-02	4.74E-02	6.90E-02
		1332.49		99.98	1.47E-02		4.74E-02
	Nb-94	702.65		99.81	-2.64E-02	4.48E-02	4.48E-02
		871.09		99.89	1.19E-02		6.00E-02
	Ag-108m	79.13		6.60	1.49E+00	4.99E-02	1.88E+00
		433.94		90.50	-2.83E-03		4.99E-02
		614.28		89.80	-5.31E-03		5.46E-02
		722.94		90.80	7.64E-03		5.96E-02
	Sb-125	176.31		6.84	-1.14E-01	1.47E-01	5.55E-01
		380.45		1.52	-3.17E+00		2.20E+00
		427.87		29.60	1.24E-02		1.47E-01
		463.36		10.49	-1.85E-01		4.00E-01
		600.60		17.65	1.37E-01		2.72E-01
		606.71		4.98	1.19E+00		1.20E+00
		635.95		11.22	1.52E-01		3.92E-01

Analysis Report for 25-Sep-19-10020

L1-12111A-FSGS-007SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.36E-01	1.47E-01	2.47E+00
Ba-133	79.61	2.65	-8.12E-02	7.81E-02	4.34E+00
	81.00	32.90	-2.30E-01		3.12E-01
	276.40	7.16	1.66E-02		5.16E-01
	302.85	18.34	-8.28E-03		2.06E-01
	356.01	62.05	-2.83E-02		7.81E-02
	383.85	8.94	-1.50E-01		4.14E-01
Cs-134	475.36	1.48	-1.75E+00	5.24E-02	2.48E+00
	563.25	8.34	1.59E-02		5.00E-01
	569.33	15.37	-2.18E-03		2.70E-01
	604.72	97.62	-4.81E-03		6.17E-02
	795.86	85.46	-5.72E-02		5.24E-02
	801.95	8.69	3.55E-02		5.18E-01
	1038.61	0.99	2.53E+00		5.82E+00
	1167.97	1.79	1.44E+00		3.96E+00
	1365.19	3.02	1.57E+00		1.96E+00
Cs-137	661.66	85.10	-2.67E-02	3.94E-02	3.94E-02
Eu-152	121.78	28.67	-2.10E-02	1.34E-01	1.66E-01
	244.70	7.61	1.80E-01		5.58E-01
	295.94	0.45	8.51E+00		1.03E+01
	344.28	26.60	2.87E-02		1.34E-01
	367.79	0.86	4.92E+00		4.85E+00
	411.12	2.24	6.73E-01		1.61E+00
	443.96	2.83	-5.27E-01		1.36E+00
	488.68	0.42	5.01E+00		1.05E+01
	563.99	0.49	-4.46E+00		8.09E+00
	586.26	0.46	-1.03E+01		1.26E+01
	678.62	0.47	3.20E+00		1.01E+01
	688.67	0.86	-1.75E+00		5.05E+00
	719.35	0.28	-7.80E+00		1.57E+01
	778.90	12.96	3.11E-01		4.03E-01
	810.45	0.32	1.18E+01		1.63E+01
	867.37	4.26	1.13E+00		1.47E+00
	919.33	0.43	8.55E+00		1.40E+01
	964.08	14.65	3.61E-01		4.74E-01
	1085.87	10.24	3.99E-01		6.13E-01
	1089.74	1.73	-1.38E+00		3.53E+00
	1112.07	13.69	1.73E-02		4.85E-01
	1212.95	1.43	-2.60E+00		5.60E+00
	1249.94	0.19	-1.03E+01		3.18E+01
	1299.14	1.63	-2.96E+00		3.94E+00
	1408.01	21.07	1.23E-01		2.65E-01
	1457.64	0.50	1.68E+02		4.62E+01
	1528.10	0.28	3.98E-02		1.40E+01
Eu-154	123.07	40.40	4.01E-03	1.17E-01	1.17E-01
	247.93	6.89	5.45E-02		5.27E-01
	591.76	4.95	2.56E-01		8.67E-01
	692.42	1.78	9.27E-01		2.61E+00
	723.30	20.06	7.42E-02		2.76E-01
	756.80	4.52	1.85E-01		9.89E-01
	873.18	12.08	2.42E-01		4.80E-01

Analysis Report for 25-Sep-19-10020

L1-12111A-FSGS-007SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	4.35E-02	1.17E-01	5.58E-01
	1004.76	18.01	-1.45E-01		3.11E-01
	1274.43	34.80	-6.43E-02		1.49E-01
	1596.48	1.80	9.31E-01		2.27E+00
Eu-155	45.30	1.31	8.63E+00	2.77E-01	2.92E+01
	60.01	1.22	6.01E+00		3.11E+01
	86.55	30.70	-1.54E-01		2.77E-01
	105.31	21.10	6.20E-02		2.78E-01
Ra-226	186.21	3.64	1.13E+00	1.13E+00	1.13E+00
Pa-231	27.36	10.30	2.74E+00	1.63E+00	3.51E+00
	283.69	1.70	-6.44E-01		2.18E+00
	300.07	2.47	7.56E-02		1.63E+00
	302.65	2.20	4.15E-01		1.73E+00
	330.06	1.40	-3.51E-01		2.71E+00
U-235	143.76	10.96	8.26E-02	7.13E-02	3.88E-01
	163.33	5.08	8.64E-02		8.34E-01
	185.71	57.20	5.00E-02		7.13E-02
	202.11	1.08	-6.47E-01		3.29E+00
	205.31	5.01	6.94E-02		7.36E-01
Am-241	59.54	35.90	-5.28E-02	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 25-Sep-19-10039

L1-12111A-FJGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 25-Sep-19-10039
Sample Description	: L1-12111A-FJGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.593E+03 grams
Facility	: Default
Sample Taken On	: 9/23/2019 1:30:00PM
Acquisition Started	: 9/25/2019 10:12:05AM
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	: 9/25/2019
Efficiency Calibration Description	:
Sample Number	: 79897
Fill Height	: 1593.15 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/25/2019 10:27:24AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated
1600 9-25-19

Analysis Report for 25-Sep-19-10039

L1-12111A-FJGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.39	307 -	316	310.08	6.18E+01	13.01	4.62E+01	0.47
2	238.78	949 -	962	954.69	7.46E+01	17.21	7.94E+01	1.04
3	338.20	1347 -	1356	1351.89	2.18E+01	7.53	1.52E+01	0.68
4	351.94	1400 -	1415	1406.76	7.96E+01	13.40	3.34E+01	0.86
5	582.89	2325 -	2336	2329.70	4.10E+01	8.36	1.10E+01	0.59
6	608.94	2427 -	2440	2433.81	6.10E+01	9.98	1.40E+01	1.33
7	910.92	3635 -	3647	3641.12	3.29E+01	6.89	5.09E+00	1.30
8	1460.29	5827 -	5850	5839.10	3.84E+02	20.79	1.20E+01	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	0.95	1460.82	*	10.66	8.52E+00	5.91E-01
Tl-208	0.98	583.19	*	85.00	6.11E-02	1.30E-02
Bi-211	0.88	351.07	*	13.02	5.44E-01	1.01E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.18E-01	2.88E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	4.32E-01	1.01E-01
		87.35		3.97		

Analysis Report for 25-Sep-19-10039

L1-12111A-FJGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.75E-01	3.05E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.99E-01	3.71E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	7.61E-01	1.82E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.67E-01	5.92E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.19E-01	4.68E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

Analysis Report for 25-Sep-19-10039

L1-12111A-FJGS-001SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.956	8.52E+00	5.91E-01	
	Tl-208	0.986	6.11E-02	1.30E-02	
?	Bi-211	0.887	5.44E-01	1.01E-01	
	Pb-212	0.997	1.18E-01	2.88E-02	
?	Pb212-XR	0.993	4.32E-01	1.01E-01	
	Bi-214	0.991	1.75E-01	3.05E-02	
?	Pb-214	1.000	1.99E-01	3.71E-02	
?	Pb214-XR	0.993	7.61E-01	1.82E-01	
	Ac-228	0.996	1.99E-01	3.67E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 25-Sep-19-10039

L1-12111A-FJGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/25/2019 10:27:24AM
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	2.88E-02	4.99E-02	4.99E-02
	BE-7	477.60		10.44	5.10E-01	4.66E-01	4.66E-01
+	K-40	1460.82	*	10.66	8.52E+00	5.85E-01	5.85E-01
	Mn-54	834.85		99.98	2.27E-02	4.66E-02	4.66E-02
	Co-60	1173.23		99.85	2.00E-02	5.82E-02	6.75E-02
		1332.49		99.98	-3.31E-02		5.82E-02
	Nb-94	702.65		99.81	-1.04E-03	4.39E-02	4.39E-02
		871.09		99.89	-2.86E-02		4.55E-02
	Ag-108m	79.13		6.60	-1.49E-01	3.96E-02	1.08E+00
		433.94		90.50	-9.69E-03		3.96E-02
		614.28		89.80	-6.52E-02		5.23E-02
		722.94		90.80	6.46E-03		5.66E-02
	Sb-125	176.31		6.84	-4.38E-02	1.12E-01	4.34E-01
		380.45		1.52	-1.42E+00		2.15E+00
		427.87		29.60	-1.99E-02		1.12E-01
		463.36		10.49	9.78E-02		3.42E-01
		600.60		17.65	1.12E-01		2.38E-01
		606.71		4.98	1.84E+00		1.32E+00
		635.95		11.22	-1.67E-01		3.22E-01

Analysis Report for 25-Sep-19-10039

L1-12111A-FJGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.67E-01	1.12E-01	1.86E+00
Ba-133	79.61	2.65	-6.25E-01	6.77E-02	2.66E+00
	81.00	32.90	-6.55E-02		1.62E-01
	276.40	7.16	7.57E-02		4.51E-01
	302.85	18.34	1.68E-02		1.60E-01
	356.01	62.05	-2.74E-02		6.77E-02
	383.85	8.94	-1.67E-01		3.93E-01
Cs-134	475.36	1.48	2.76E+00	5.80E-02	3.25E+00
	563.25	8.34	-2.92E-01		5.16E-01
	569.33	15.37	8.87E-02		2.79E-01
	604.72	97.62	-2.99E-02		5.99E-02
	795.86	85.46	2.84E-02		5.80E-02
	801.95	8.69	4.53E-03		5.36E-01
	1038.61	0.99	1.56E+00		5.00E+00
	1167.97	1.79	-4.11E+00		3.76E+00
	1365.19	3.02	-7.00E-01		1.29E+00
Cs-137	661.66	85.10	-5.57E-03	4.94E-02	4.94E-02
Eu-152	121.78	28.67	2.82E-02	1.10E-01	1.10E-01
	244.70	7.61	8.92E-02		5.01E-01
	295.94	0.45	5.27E+00		8.94E+00
	344.28	26.60	3.52E-02		1.33E-01
	367.79	0.86	5.50E-01		3.62E+00
	411.12	2.24	-1.87E-01		1.49E+00
	443.96	2.83	-6.61E-01		1.22E+00
	488.68	0.42	-6.44E+00		7.66E+00
	563.99	0.49	-6.61E+00		8.66E+00
	586.26	0.46	-3.21E+00		1.20E+01
	678.62	0.47	1.64E+00		8.00E+00
	688.67	0.86	-3.99E+00		4.67E+00
	719.35	0.28	6.09E+00		1.57E+01
	778.90	12.96	5.06E-02		3.20E-01
	810.45	0.32	-5.61E+00		1.28E+01
	867.37	4.26	6.04E-01		1.15E+00
	919.33	0.43	1.92E+00		1.08E+01
	964.08	14.65	1.12E-01		5.06E-01
	1085.87	10.24	1.60E-01		5.65E-01
	1089.74	1.73	1.62E+00		3.62E+00
	1112.07	13.69	-1.04E-01		4.04E-01
	1212.95	1.43	-1.45E-01		5.25E+00
	1249.94	0.19	2.44E-01		3.31E+01
	1299.14	1.63	3.23E+00		3.89E+00
	1408.01	21.07	9.22E-02		2.34E-01
	1457.64	0.50	1.86E+02		4.64E+01
	1528.10	0.28	3.47E+00		1.08E+01
Eu-154	123.07	40.40	-3.10E-02	7.63E-02	7.63E-02
	247.93	6.89	2.59E-03		4.76E-01
	591.76	4.95	-2.36E-01		6.70E-01
	692.42	1.78	1.14E+00		2.63E+00
	723.30	20.06	1.12E-01		2.59E-01
	756.80	4.52	-4.36E-01		8.66E-01
	873.18	12.08	5.91E-03		3.89E-01

Analysis Report for 25-Sep-19-10039

L1-12111A-FJGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-7.83E-02	7.63E-02	4.04E-01
	1004.76	18.01	7.81E-02		3.01E-01
	1274.43	34.80	6.99E-02		1.82E-01
	1596.48	1.80	7.05E-01		1.92E+00
Eu-155	45.30	1.31	4.68E+00	1.83E-01	1.18E+01
	60.01	1.22	-5.47E+00		1.11E+01
	86.55	30.70	1.20E-01		1.84E-01
	105.31	21.10	3.71E-02		1.83E-01
Ra-226	186.21	3.64	-5.76E-02	8.90E-01	8.90E-01
Pa-231	27.36	10.30	5.80E-01	1.34E+00	1.34E+00
	283.69	1.70	-1.43E+00		1.59E+00
	300.07	2.47	-1.11E+00		1.34E+00
	302.65	2.20	4.03E-01		1.35E+00
	330.06	1.40	6.81E-01		2.61E+00
U-235	143.76	10.96	-1.14E-02	5.75E-02	2.97E-01
	163.33	5.08	-4.57E-01		6.15E-01
	185.71	57.20	4.28E-02		5.75E-02
	202.11	1.08	3.45E-01		2.88E+00
	205.31	5.01	1.10E-01		6.36E-01
Am-241	59.54	35.90	-3.85E-01	3.67E-01	3.67E-01

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

Apex-Gamma

Analysis Report for 25-Sep-19-10040
L1-12111A-QJGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 25-Sep-19-10040
Sample Description	: L1-12111A-QJGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.604E+03 grams
Facility	: Default
Sample Taken On	: 9/23/2019 1:30:00PM
Acquisition Started	: 9/25/2019 1:11:42PM
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	: 9/25/2019
Efficiency Calibration Description	:
Sample Number	: 79924
Fill Height	: 1604.06 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/25/2019 1:26:46PM

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

Data Validated
1600 9-25-19

Analysis Report for 25-Sep-19-10040

L1-12111A-QJGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.37	305 -	315	310.00	4.71E+01	14.92	7.19E+01	0.86
2	238.83	946 -	961	954.88	1.30E+02	17.36	5.71E+01	0.94
3	295.37	1173 -	1187	1180.75	3.99E+01	12.81	4.31E+01	0.78
4	352.07	1400 -	1414	1407.27	6.51E+01	12.77	3.39E+01	0.95
5	462.76	1846 -	1854	1849.60	1.33E+01	5.46	7.65E+00	0.71
6	583.07	2324 -	2336	2330.41	4.39E+01	8.07	8.11E+00	1.32
7	609.26	2429 -	2441	2435.09	4.01E+01	10.04	2.29E+01	0.59
8	1460.33	5826 -	5850	5839.26	3.89E+02	20.04	3.09E+00	2.00

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.82	*	10.66	8.61E+00	5.80E-01
Sb-125	0.41	176.31		6.84		
		380.45		1.52		
		427.87		29.60		
		463.36	*	10.49	1.38E-01	5.72E-02
		600.60		17.65		
		606.71		4.98		
		635.95		11.22		
		671.44		1.79		

Analysis Report for 25-Sep-19-10040

L1-12111A-QJGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Tl-208	0.99	583.19	*	85.00	6.53E-02	1.26E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.05E-01	3.19E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.28E-01	1.09E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	1.15E-01	2.96E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.69E-01	5.59E-02
		351.93	*	35.60	1.62E-01	3.44E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	5.78E-01	1.94E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.57	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00	*	4.40	3.28E-01	1.36E-01
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

Analysis Report for 25-Sep-19-10040

L1-12111A-QJGS-001SS

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.962	8.61E+00	5.80E-01	
?	Sb-125	0.414	1.38E-01	5.72E-02	
	Tl-208	0.998	6.53E-02	1.26E-02	
X	Bi-211	0.853			
	Pb-212	0.994	2.05E-01	3.19E-02	
?	Pb212-XR	0.994	3.28E-01	1.09E-01	
	Bi-214	1.000	1.15E-01	2.96E-02	
	Pb-214	0.997	1.64E-01	2.93E-02	
?	Pb214-XR	0.994	5.78E-01	1.94E-01	
?	Ac-228	0.574	3.28E-01	1.36E-01	

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

Errors quoted at 1.000sigma

Analysis Report for 25-Sep-19-10040

L1-12111A-QJGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/25/2019 1:26:46PM
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	5.03E-02	5.34E-02	5.34E-02
	BE-7	477.60		10.44	3.23E-02	3.30E-01	3.30E-01
+	K-40	1460.82	*	10.66	8.61E+00	3.31E-01	3.31E-01
	Mn-54	834.85		99.98	2.91E-02	4.93E-02	4.93E-02
	Co-60	1173.23		99.85	9.01E-03	5.24E-02	6.26E-02
		1332.49		99.98	4.18E-02		5.24E-02
	Nb-94	702.65		99.81	-6.03E-02	4.50E-02	4.50E-02
		871.09		99.89	1.72E-02		4.62E-02
	Ag-108m	79.13		6.60	-1.64E-01	3.79E-02	1.09E+00
		433.94		90.50	5.58E-03		3.79E-02
		614.28		89.80	-3.35E-02		5.66E-02
		722.94		90.80	6.15E-03		4.56E-02
+	Sb-125	176.31		6.84	7.97E-02	1.15E-01	4.57E-01
		380.45		1.52	-1.70E+00		1.99E+00
		427.87		29.60	-6.08E-02		1.15E-01
		463.36	*	10.49	1.38E-01		1.72E-01
		600.60		17.65	1.59E-02		2.29E-01
		606.71		4.98	1.55E+00		1.28E+00
		635.95		11.22	-1.69E-01		3.16E-01

Analysis Report for 25-Sep-19-10040

L1-12111A-QJGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.48E+00	1.15E-01	2.05E+00
Ba-133	79.61	2.65	-4.91E-01	6.45E-02	2.61E+00
	81.00	32.90	-7.78E-02		1.61E-01
	276.40	7.16	-4.30E-01		4.47E-01
	302.85	18.34	3.06E-02		1.84E-01
	356.01	62.05	1.09E-03		6.45E-02
	383.85	8.94	3.02E-01		3.71E-01
Cs-134	475.36	1.48	6.07E-01	5.49E-02	2.51E+00
	563.25	8.34	-7.10E-01		4.76E-01
	569.33	15.37	-6.84E-02		2.47E-01
	604.72	97.62	-4.46E-02		5.49E-02
	795.86	85.46	4.53E-02		5.72E-02
	801.95	8.69	-2.56E-01		5.03E-01
	1038.61	0.99	-4.71E-01		5.17E+00
	1167.97	1.79	6.21E-01		3.24E+00
	1365.19	3.02	-5.77E-01		1.45E+00
Cs-137	661.66	85.10	-1.46E-02	4.65E-02	4.65E-02
Eu-152	121.78	28.67	8.71E-02	1.16E-01	1.16E-01
	244.70	7.61	7.10E-02		4.70E-01
	295.94	0.45	1.03E+01		9.71E+00
	344.28	26.60	-7.57E-02		1.21E-01
	367.79	0.86	-1.43E-01		3.24E+00
	411.12	2.24	-3.57E-01		1.53E+00
	443.96	2.83	-2.93E-01		1.17E+00
	488.68	0.42	-1.88E+00		7.05E+00
	563.99	0.49	-4.66E+00		8.08E+00
	586.26	0.46	-8.73E+00		1.14E+01
	678.62	0.47	-2.28E+00		6.74E+00
	688.67	0.86	6.87E-01		5.09E+00
	719.35	0.28	-1.22E+00		1.22E+01
	778.90	12.96	-2.00E-01		3.46E-01
	810.45	0.32	4.06E+00		1.41E+01
	867.37	4.26	-8.08E-01		8.57E-01
	919.33	0.43	-1.56E+00		9.13E+00
	964.08	14.65	5.91E-02		3.85E-01
	1085.87	10.24	-6.33E-01		4.96E-01
	1089.74	1.73	-2.79E-02		3.49E+00
	1112.07	13.69	1.99E-02		4.22E-01
	1212.95	1.43	-2.06E+00		5.24E+00
	1249.94	0.19	-6.34E+00		3.58E+01
	1299.14	1.63	3.45E+00		4.00E+00
	1408.01	21.07	-1.91E-02		2.05E-01
	1457.64	0.50	1.80E+02		4.61E+01
	1528.10	0.28	-7.43E-01		1.35E+01
Eu-154	123.07	40.40	-2.83E-02	7.96E-02	7.96E-02
	247.93	6.89	-1.34E-01		4.80E-01
	591.76	4.95	-2.93E-01		6.42E-01
	692.42	1.78	7.57E-01		2.75E+00
	723.30	20.06	3.43E-02		2.10E-01
	756.80	4.52	-3.15E-01		9.13E-01
	873.18	12.08	1.72E-01		4.13E-01

Analysis Report for 25-Sep-19-10040

L1-12111A-QJGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.76E-01	7.96E-02	5.06E-01
	1004.76	18.01	8.89E-02		2.47E-01
	1274.43	34.80	6.20E-02		1.94E-01
	1596.48	1.80	-2.64E-01		2.31E+00
Eu-155	45.30	1.31	-1.89E-01	1.70E-01	1.17E+01
	60.01	1.22	7.04E+00		1.31E+01
	86.55	30.70	2.15E-02		1.70E-01
	105.31	21.10	1.16E-02		1.80E-01
Ra-226	186.21	3.64	-5.05E-01	8.70E-01	8.70E-01
Pa-231	27.36	10.30	8.40E-01	1.33E+00	1.33E+00
	283.69	1.70	-3.31E-01		1.83E+00
	300.07	2.47	-5.51E-01		1.42E+00
	302.65	2.20	-1.19E-01		1.53E+00
	330.06	1.40	1.74E+00		2.35E+00
U-235	143.76	10.96	-4.89E-03	5.70E-02	2.98E-01
	163.33	5.08	-1.60E-01		5.81E-01
	185.71	57.20	2.36E-04		5.70E-02
	202.11	1.08	-8.16E-01		2.76E+00
	205.31	5.01	-1.06E-01		6.19E-01
Am-241	59.54	35.90	1.10E-01	4.46E-01	4.46E-01

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

Apex-Gamma

Analysis Report for 25-Sep-19-10041

L1-12111A-FJGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 25-Sep-19-10041
Sample Description	: L1-12111A-FJGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.620E+03 grams
Facility	: Default
Sample Taken On	: 9/23/2019 1:32:00PM
Acquisition Started	: 9/25/2019 10:35:15AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/25/2019
Efficiency Calibration Description	:
Sample Number	: 79899
Fill Height	: 1619.80 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/25/2019 10:50:18AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated
1600 9-25-19

Analysis Report for 25-Sep-19-10041

L1-12111A-FJGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.69	473 -	481	477.56	1.67E+02	21.63	1.37E+02	1.11
2	295.06	585 -	594	590.19	9.30E+01	15.49	6.50E+01	1.48
3	338.29	671 -	680	676.55	3.50E+01	12.88	5.60E+01	1.03
4	351.88	700 -	708	703.70	1.41E+02	14.99	3.86E+01	1.54
5	583.08	1160 -	1171	1165.77	9.25E+01	12.81	2.85E+01	1.05
6	609.21	1212 -	1223	1218.00	8.15E+01	12.06	2.55E+01	1.68
7	911.43	1816 -	1827	1822.32	5.27E+01	10.44	2.23E+01	1.69
8	1460.74	2914 -	2929	2921.53	5.64E+02	24.10	5.66E+00	2.12

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	1.04E+01	6.36E-01
Tl-208	0.99	583.19	*	85.00	1.18E-01	1.78E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.32E-01	3.54E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.99E-01	3.19E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 25-Sep-19-10041

L1-12111A-FJGS-002SS

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	3.44E-01	6.37E-02
		351.93	*	35.60	3.07E-01	4.07E-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	2.33E-01	8.79E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.96E-01	6.00E-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 25-Sep-19-10041

L1-12111A-FJGS-002SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	1.04E+01	6.36E-01	
	Tl-208	0.998	1.18E-01	1.78E-02	
X	Bi-211	0.901			
	Pb-212	1.000	2.32E-01	3.54E-02	
	Bi-214	0.999	1.99E-01	3.19E-02	
	Pb-214	0.999	3.18E-01	3.43E-02	
	Ac-228	0.997	2.76E-01	4.96E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 25-Sep-19-10041

L1-12111A-FJGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/25/2019 10:50:18AM
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	4.04E-02	5.19E-02	5.19E-02
	BE-7	477.60		10.44	6.74E-02	4.00E-01	4.00E-01
+	K-40	1460.82	*	10.66	1.04E+01	3.08E-01	3.08E-01
	Mn-54	834.85		99.98	7.28E-03	4.51E-02	4.51E-02
	Co-60	1173.23		99.85	9.36E-03	5.05E-02	6.97E-02
		1332.49		99.98	6.60E-03		5.05E-02
	Nb-94	702.65		99.81	-1.82E-03	3.71E-02	3.97E-02
		871.09		99.89	-1.11E-03		3.71E-02
	Ag-108m	79.13		6.60	4.39E-01	3.55E-02	1.19E+00
		433.94		90.50	-1.36E-02		3.55E-02
		614.28		89.80	-8.09E-03		5.64E-02
		722.94		90.80	4.25E-02		5.00E-02
	Sb-125	176.31		6.84	2.01E-01	1.05E-01	5.31E-01
		380.45		1.52	1.07E+00		2.28E+00
		427.87		29.60	-6.16E-03		1.05E-01
		463.36		10.49	1.10E-01		3.74E-01
		600.60		17.65	-4.61E-02		2.10E-01
		606.71		4.98	-1.08E-01		1.24E+00
		635.95		11.22	-1.27E-01		2.65E-01

Analysis Report for 25-Sep-19-10041

L1-12111A-FJGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-5.56E-01	1.05E-01	2.23E+00
Ba-133	79.61	2.65	-4.31E-01	7.58E-02	2.74E+00
	81.00	32.90	-2.63E-01		1.88E-01
	276.40	7.16	1.20E-01		4.82E-01
	302.85	18.34	1.09E-01		1.96E-01
	356.01	62.05	-5.17E-02		7.58E-02
	383.85	8.94	-1.69E-01		4.00E-01
Cs-134	475.36	1.48	1.15E+00	4.59E-02	2.86E+00
	563.25	8.34	-3.43E-01		4.17E-01
	569.33	15.37	1.20E-01		2.53E-01
	604.72	97.62	-1.12E-02		5.44E-02
	795.86	85.46	3.88E-03		4.59E-02
	801.95	8.69	-1.75E-02		4.61E-01
	1038.61	0.99	3.43E+00		6.18E+00
	1167.97	1.79	8.49E-01		3.80E+00
	1365.19	3.02	-2.67E-01		1.45E+00
Cs-137	661.66	85.10	2.22E-02	4.94E-02	4.94E-02
Eu-152	121.78	28.67	-8.80E-03	1.25E-01	1.25E-01
	244.70	7.61	2.20E-02		5.25E-01
	295.94	0.45	-1.88E+00		1.02E+01
	344.28	26.60	-2.49E-02		1.35E-01
	367.79	0.86	-2.96E+00		3.97E+00
	411.12	2.24	-1.09E-01		1.57E+00
	443.96	2.83	2.52E-01		1.27E+00
	488.68	0.42	1.12E+00		8.74E+00
	563.99	0.49	-3.32E+00		7.32E+00
	586.26	0.46	-6.72E+00		1.39E+01
	678.62	0.47	6.33E-02		8.60E+00
	688.67	0.86	4.21E-01		4.72E+00
	719.35	0.28	-2.64E+00		1.22E+01
	778.90	12.96	9.45E-04		3.35E-01
	810.45	0.32	-3.02E+00		1.27E+01
	867.37	4.26	-8.70E-01		8.00E-01
	919.33	0.43	-4.85E+00		9.93E+00
	964.08	14.65	-1.46E-01		3.60E-01
	1085.87	10.24	-1.66E-01		4.81E-01
	1089.74	1.73	-1.49E+00		2.85E+00
	1112.07	13.69	-8.30E-02		3.80E-01
	1212.95	1.43	-1.67E-01		4.35E+00
	1249.94	0.19	4.98E+00		3.00E+01
	1299.14	1.63	6.07E-01		3.44E+00
	1408.01	21.07	1.07E-01		2.17E-01
	1457.64	0.50	6.53E-02		4.63E+01
	1528.10	0.28	4.34E+00		1.06E+01
Eu-154	123.07	40.40	-2.72E-02	8.61E-02	8.61E-02
	247.93	6.89	2.10E-01		5.32E-01
	591.76	4.95	2.23E-01		8.35E-01
	692.42	1.78	6.16E-01		2.31E+00
	723.30	20.06	1.69E-01		2.26E-01
	756.80	4.52	-2.53E-01		8.27E-01
	873.18	12.08	-2.25E-01		3.01E-01

Analysis Report for 25-Sep-19-10041

L1-12111A-FJGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.29E-02	8.61E-02	4.81E-01
	1004.76	18.01	1.69E-01		2.78E-01
	1274.43	34.80	-2.35E-02		1.63E-01
	1596.48	1.80	4.15E-01		2.37E+00
Eu-155	45.30	1.31	1.42E+00	1.92E-01	1.15E+01
	60.01	1.22	-3.16E+00		1.36E+01
	86.55	30.70	3.31E-02		1.92E-01
	105.31	21.10	1.21E-01		2.05E-01
Ra-226	186.21	3.64	8.15E-01	1.11E+00	1.11E+00
Pa-231	27.36	10.30	9.30E-01	1.29E+00	1.29E+00
	283.69	1.70	-5.20E-01		1.78E+00
	300.07	2.47	-1.35E+00		1.42E+00
	302.65	2.20	9.04E-01		1.63E+00
	330.06	1.40	6.54E-01		2.60E+00
U-235	143.76	10.96	1.33E-01	7.04E-02	3.06E-01
	163.33	5.08	-5.05E-01		6.98E-01
	185.71	57.20	5.01E-02		7.04E-02
	202.11	1.08	7.65E-01		3.38E+00
	205.31	5.01	-1.80E-01		7.12E-01
Am-241	59.54	35.90	9.75E-03	4.82E-01	4.82E-01

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

Apex-Gamma

Analysis Report for 25-Sep-19-10042

L1-12111A-FJGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 25-Sep-19-10042
Sample Description	: L1-12111A-FJGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.531E+03 grams
Facility	: Default
Sample Taken On	: 9/23/2019 1:34:00PM
Acquisition Started	: 9/25/2019 10:35:22AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.5 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 9/25/2019
Efficiency Calibration Description	:
Sample Number	: 79900
Fill Height	: 1530.97 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/25/2019 10:50:26AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated
1600 9-25-19

Analysis Report for 25-Sep-19-10042

L1-12111A-FJGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.54	948 -	959	954.25	1.19E+02	16.50	6.15E+01	0.92
2	295.31	1172 -	1188	1181.16	7.71E+01	15.22	4.89E+01	0.65
3	351.81	1401 -	1411	1406.96	8.14E+01	11.42	2.06E+01	0.96
4	477.08	1903 -	1912	1907.73	1.64E+01	6.79	1.26E+01	0.73
5	582.82	2326 -	2335	2330.50	3.11E+01	8.60	1.89E+01	1.14
6	609.06	2429 -	2443	2435.39	5.08E+01	10.98	2.42E+01	0.82
7	1460.39	5829 -	5854	5841.40	3.89E+02	20.03	3.03E+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
BE-7	0.95	477.60	*	10.44	1.99E-01	8.36E-02
K-40	0.97	1460.82	*	10.66	9.69E+00	6.53E-01
Tl-208	0.97	583.19	*	85.00	5.20E-02	1.47E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.12E-01	3.41E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.63E-01	3.66E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 25-Sep-19-10042

L1-12111A-FJGS-003SS

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	3.68E-01	7.83E-02
		351.93	*	35.60	2.28E-01	3.68E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.957	1.99E-01	8.36E-02	
	K-40	0.971	9.69E+00	6.53E-01	
	Tl-208	0.979	5.20E-02	1.47E-02	
X	Bi-211	0.917			
	Pb-212	0.999	2.12E-01	3.41E-02	
	Bi-214	0.995	1.63E-01	3.66E-02	
	Pb-214	0.998	2.53E-01	3.33E-02	

Analysis Report for 25-Sep-19-10042

L1-12111A-FJGS-003SS

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

Errors quoted at 1.000sigma

Analysis Report for 25-Sep-19-10042

L1-12111A-FJGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/25/2019 10:50:26AM
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	3.04E-02	6.36E-02	6.36E-02
+	BE-7	477.60	*	10.44	1.99E-01	2.60E-01	2.60E-01
+	K-40	1460.82	*	10.66	9.69E+00	3.67E-01	3.67E-01
	Mn-54	834.85		99.98	-1.05E-02	5.53E-02	5.53E-02
	Co-60	1173.23		99.85	3.37E-02	6.41E-02	8.07E-02
		1332.49		99.98	1.02E-02		6.41E-02
	Nb-94	702.65		99.81	2.88E-02	5.35E-02	5.60E-02
		871.09		99.89	-1.82E-02		5.35E-02
	Ag-108m	79.13		6.60	4.26E-01	4.88E-02	2.12E+00
		433.94		90.50	1.37E-02		4.88E-02
		614.28		89.80	-4.26E-02		6.50E-02
		722.94		90.80	4.64E-03		5.80E-02
	Sb-125	176.31		6.84	-5.28E-01	1.47E-01	5.82E-01
		380.45		1.52	-7.13E-01		2.87E+00
		427.87		29.60	-3.80E-03		1.47E-01
		463.36		10.49	2.18E-01		4.56E-01
		600.60		17.65	-7.40E-02		2.70E-01
		606.71		4.98	2.04E+00		1.49E+00
		635.95		11.22	-4.94E-02		4.25E-01

Analysis Report for 25-Sep-19-10042

L1-12111A-FJGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	9.79E-01	1.47E-01	2.73E+00
Ba-133	79.61	2.65	-5.35E-03	7.76E-02	5.13E+00
	81.00	32.90	-3.39E-01		3.52E-01
	276.40	7.16	2.32E-01		5.98E-01
	302.85	18.34	-2.08E-02		2.11E-01
	356.01	62.05	-1.51E-01		7.76E-02
	383.85	8.94	1.80E-01		4.79E-01
Cs-134	475.36	1.48	2.71E-01	6.97E-02	3.58E+00
	563.25	8.34	-3.58E-01		5.59E-01
	569.33	15.37	-9.53E-02		3.02E-01
	604.72	97.62	-3.11E-02		7.29E-02
	795.86	85.46	2.53E-02		6.97E-02
	801.95	8.69	-1.47E-01		5.83E-01
	1038.61	0.99	2.19E-01		6.28E+00
	1167.97	1.79	-9.52E-02		4.02E+00
	1365.19	3.02	-1.47E-01		1.57E+00
Cs-137	661.66	85.10	4.19E-02	5.76E-02	5.76E-02
Eu-152	121.78	28.67	8.08E-02	1.52E-01	1.72E-01
	244.70	7.61	1.65E-01		6.38E-01
	295.94	0.45	9.31E+00		1.25E+01
	344.28	26.60	-9.36E-02		1.52E-01
	367.79	0.86	-1.04E+00		4.82E+00
	411.12	2.24	8.58E-01		1.93E+00
	443.96	2.83	8.65E-02		1.69E+00
	488.68	0.42	-1.40E+00		1.03E+01
	563.99	0.49	-3.87E+00		9.59E+00
	586.26	0.46	-1.04E+01		1.43E+01
	678.62	0.47	-3.08E+00		1.03E+01
	688.67	0.86	3.24E-01		5.47E+00
	719.35	0.28	7.33E-01		1.76E+01
	778.90	12.96	2.76E-01		3.94E-01
	810.45	0.32	1.45E+01		1.75E+01
	867.37	4.26	-1.34E+00		1.27E+00
	919.33	0.43	-3.79E+00		9.70E+00
	964.08	14.65	4.93E-01		5.20E-01
	1085.87	10.24	2.59E-01		5.57E-01
	1089.74	1.73	-7.10E-01		3.24E+00
	1112.07	13.69	-2.66E-01		5.08E-01
	1212.95	1.43	1.51E+00		5.78E+00
	1249.94	0.19	-2.62E+01		3.12E+01
	1299.14	1.63	-5.71E-01		4.30E+00
	1408.01	21.07	-1.84E-02		2.78E-01
	1457.64	0.50	2.01E+02		5.21E+01
	1528.10	0.28	-3.52E-01		1.69E+01
Eu-154	123.07	40.40	-3.90E-02	1.18E-01	1.18E-01
	247.93	6.89	-2.65E-01		6.01E-01
	591.76	4.95	8.51E-01		9.51E-01
	692.42	1.78	-9.10E-01		2.45E+00
	723.30	20.06	1.43E-01		2.66E-01
	756.80	4.52	4.22E-01		1.27E+00
	873.18	12.08	9.57E-02		4.50E-01

Analysis Report for 25-Sep-19-10042

L1-12111A-FJGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.55E-01	1.18E-01	4.95E-01
	1004.76	18.01	1.46E-01		2.71E-01
	1274.43	34.80	-4.11E-02		1.89E-01
	1596.48	1.80	-2.75E+00		2.74E+00
Eu-155	45.30	1.31	-8.01E+00	2.89E-01	3.47E+01
	60.01	1.22	-1.15E+00		3.45E+01
	86.55	30.70	-2.16E-02		2.89E-01
	105.31	21.10	9.17E-02		3.03E-01
Ra-226	186.21	3.64	7.95E-01	1.26E+00	1.26E+00
Pa-231	27.36	10.30	2.94E+00	1.70E+00	3.85E+00
	283.69	1.70	-1.58E+00		2.33E+00
	300.07	2.47	6.29E-01		1.70E+00
	302.65	2.20	-7.61E-01		1.75E+00
	330.06	1.40	5.72E-01		3.15E+00
U-235	143.76	10.96	1.03E-01	8.06E-02	4.29E-01
	163.33	5.08	1.79E-01		8.73E-01
	185.71	57.20	4.59E-02		8.06E-02
	202.11	1.08	-4.66E-01		3.75E+00
	205.31	5.01	-7.53E-01		7.69E-01
Am-241	59.54	35.90	5.22E-01	1.24E+00	1.24E+00

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

ATTACHMENT 8
EBERLINE ANALYTICAL REPORTS

EBERLINE ANALYTICAL

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

EBS-OR-46634

January 22, 2020

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

CASE NARRATIVE
Work Order # 19-10093-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
L1-12107-A-FSGS-012-SS-A	19-10093-04	L1-12104-A-FSGS-013-SS-A	19-10093-10
L1-12105-A-FSGS-016-SS-A	19-10093-05	L1-12205-A-FSGS-101-SB-A	19-10093-11
L1-12105-A-FSGS-002-SS-A	19-10093-06	L1-12109-A-FSGS-012-SS-A	19-10093-12
L1-12107-A-FSGS-010-SB-A	19-10093-07	L1-12205-C-FSGS-105-SS-A	19-10093-13
L1-12205-A-FSGS-111-SS-A	19-10093-08	L1-12111-A-FSGS-003-SS-A	19-10093-14
L1-12104-A-FSGS-011-SS-A	19-10093-09	L1-12205-D-FSGS-111-SB-A	19-10093-15

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 a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Tritium laboratory control sample demonstrated an acceptable percent recovery.

NICKEL-63

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

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

GAMMA SPECTROSCOPY

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

ANALYTICAL RESULTS CONTINUED

GAMMA SPECTROSCOPY CONTINUED

Samples demonstrated acceptable results for all gamma-emitting radionuclides as reported. The method blank demonstrated acceptable results for all radionuclides as reported. Results for the Actinium-228, Bismuth-214 and Potassium-40 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Cobalt-60 and Cesium-137 laboratory control sample demonstrated an acceptable percent recovery.

CERTIFICATION OF ACCURACY

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

M.R. McDougall
Laboratory Manager

Date: 1/22/2020

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: 19-10093
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
19-10093-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	2.04E+02	7.36E+00				pCi/g
19-10093-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.85E+02	7.36E+00	1.27E+01	5.48E+00		pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	3.02E+00	3.29E+00	3.30E+00	5.53E+00	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.47E+00	3.16E+00	3.16E+00	5.39E+00	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.99E+00	3.12E+00	3.13E+00	5.30E+00	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	-1.72E-01	2.89E+00	2.89E+00	5.04E+00	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	2.46E+00	3.06E+00	3.06E+00	5.15E+00	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.40E+00	3.00E+00	3.01E+00	5.13E+00	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	3.68E-01	3.11E+00	3.11E+00	5.38E+00	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.26E+00	3.09E+00	3.09E+00	5.28E+00	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	2.76E+00	3.21E+00	3.21E+00	5.39E+00	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	-5.42E-01	3.03E+00	3.03E+00	5.30E+00	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	9.18E-01	3.13E+00	3.13E+00	5.37E+00	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.50E+00	3.22E+00	3.22E+00	5.49E+00	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.64E+00	3.13E+00	3.13E+00	5.33E+00	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	-3.56E-01	2.99E+00	2.99E+00	5.21E+00	U	pCi/g
19-10093-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.51E+03	4.54E+01				pCi/g
19-10093-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.56E+03	1.34E+01	9.26E+01	3.17E+00		pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	4.38E-01	1.83E+00	1.83E+00	3.13E+00	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.14E+00	1.72E+00	1.73E+00	2.92E+00	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	4.93E-01	1.72E+00	1.72E+00	2.94E+00	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.16E+00	1.75E+00	1.75E+00	2.95E+00	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-9.21E-02	1.90E+00	1.90E+00	3.29E+00	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.96E+00	1.99E+00	1.99E+00	3.33E+00	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-4.57E-01	1.88E+00	1.88E+00	3.26E+00	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	9.68E-01	1.85E+00	1.85E+00	3.14E+00	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-6.24E-01	2.13E+00	2.13E+00	3.71E+00	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-4.37E-01	1.79E+00	1.79E+00	3.12E+00	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	9.06E-01	1.90E+00	1.90E+00	3.23E+00	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-1.02E+00	1.89E+00	1.89E+00	3.31E+00	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	12/28/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.85E-01	1.92E+00	1.92E+00	3.30E+00	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	12/28/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-1.61E+00	2.33E+00	2.33E+00	4.11E+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: 19-10093
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
19-10093-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	5.06E+01	2.83E-01				pCi/g
19-10093-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	5.71E+01	3.42E+00	2.02E+01	1.22E+00		pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	3.78E-01	3.95E-01	4.16E-01	8.02E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	6.37E-02	3.07E-01	3.08E-01	6.49E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	-1.58E-01	2.93E-01	2.98E-01	6.42E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	3.56E-01	2.94E-01	3.19E-01	5.89E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	2.83E-02	3.31E-01	3.31E-01	7.05E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	1.61E-01	3.00E-01	3.05E-01	6.23E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	9.02E-02	2.72E-01	2.74E-01	5.74E-01	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	3.74E-01	2.89E-01	3.17E-01	5.72E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	2.44E-01	3.04E-01	3.15E-01	6.22E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	3.63E-02	3.22E-01	3.22E-01	6.85E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	3.50E-01	2.96E-01	3.20E-01	5.94E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	-1.34E-01	3.46E-01	3.50E-01	7.53E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	8.98E-02	2.56E-01	2.58E-01	5.39E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	9.69E-02	3.10E-01	3.12E-01	6.53E-01	U	pCi/g
19-10093-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
19-10093-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
19-10093-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	1.31E+02	7.49E+00	1.01E+01	1.08E+00		pCi/g
19-10093-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	8.62E+01	7.30E+00	8.53E+00	1.47E+00		pCi/g

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0020

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	-3.61E-02	1.09E-01	1.09E-01	1.75E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	7.53E-03	2.99E-02	2.99E-02	4.13E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-2.61E-02	3.86E-02	3.86E-02	5.37E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	7.61E-03	5.08E-02	5.08E-02	5.80E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	4.74E-02	7.87E-02	7.87E-02	1.26E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-1.07E-02	3.21E-02	3.21E-02	5.04E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-1.32E-02	4.28E-02	4.28E-02	5.70E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	4.74E-03	3.80E-02	3.80E-02	5.63E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	3.83E-02	1.10E-01	1.10E-01	9.02E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	2.99E-02	8.81E-02	8.81E-02	4.62E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	-5.49E-02	4.85E-02	4.86E-02	6.08E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	5.20E-02	4.75E-02	4.76E-02	3.64E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	6.62E-02	8.55E-02	8.56E-02	1.36E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	2.20E-01	3.55E-01	3.55E-01	7.41E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-2.14E-02	3.82E-02	3.82E-02	5.10E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	2.47E-02	3.16E-02	3.16E-02	4.77E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	4.42E-03	2.53E-02	2.53E-02	4.81E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	6.37E-01	3.93E-01	3.95E-01	6.78E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	1.97E-02	3.91E-02	3.91E-02	6.38E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	1.04E-01	9.35E-02	9.36E-02	1.44E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-5.31E-02	6.47E-02	6.48E-02	8.82E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	4.74E-02	7.87E-02	7.87E-02	1.26E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	5.57E-02	8.37E-02	8.37E-02	1.35E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	1.54E-01	3.53E-01	3.53E-01	5.49E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	-5.79E-03	9.81E-02	9.81E-02	1.23E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	-5.60E-02	1.42E-01	1.42E-01	2.06E-01	U	pCi/g

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0021

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	2.86E-01	1.43E-01	1.44E-01	3.26E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	1.76E-03	2.91E-02	2.91E-02	5.05E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-6.95E-02	6.88E-02	6.89E-02	1.04E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-3.10E-02	4.07E-02	4.07E-02	7.76E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.92E-01	9.57E-02	9.68E-02	1.62E-01		pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-3.29E-03	5.18E-02	5.18E-02	7.53E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	4.62E-03	1.32E-02	1.32E-02	5.48E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	-7.32E-03	3.65E-02	3.65E-02	5.47E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	5.44E-03	8.68E-02	8.68E-02	1.71E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	1.12E-02	1.16E-01	1.16E-01	8.59E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	1.05E-01	8.54E-02	8.55E-02	1.31E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-5.03E-02	6.62E-02	6.63E-02	5.20E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	3.43E-02	1.72E-01	1.72E-01	2.80E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.27E+01	1.69E+00	1.81E+00	6.54E-01		pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-1.35E-02	3.32E-02	3.32E-02	4.79E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	1.10E-02	3.11E-02	3.11E-02	5.14E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	2.70E-02	3.52E-02	3.52E-02	5.28E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	1.10E+00	7.19E-01	7.21E-01	1.24E+00	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	1.81E-01	6.93E-02	6.99E-02	1.23E-01		pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.11E-01	8.42E-02	8.49E-02	1.10E-01		pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	3.94E-02	1.19E-01	1.19E-01	1.96E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.92E-01	9.57E-02	9.68E-02	1.62E-01		pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	2.91E-02	9.73E-02	9.73E-02	1.54E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	7.00E-01	6.03E-01	6.04E-01	1.02E+00	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	1.29E-01	9.00E-02	9.03E-02	1.70E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	1.18E-01	2.15E-01	2.15E-01	3.28E-01	U	pCi/g

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0022

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	2.70E-01	1.23E-01	1.23E-01	3.72E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-1.80E-02	4.13E-02	4.13E-02	4.65E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	2.19E-02	4.45E-02	4.45E-02	1.05E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-6.22E-03	1.57E-02	1.57E-02	7.63E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.88E-01	1.12E-01	1.13E-01	1.59E-01		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	9.06E-03	2.90E-02	2.90E-02	6.22E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-1.52E-01	7.02E-02	7.07E-02	5.43E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	-1.73E-02	3.68E-02	3.68E-02	5.32E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-4.14E-03	1.09E-01	1.09E-01	1.60E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-9.99E-03	1.19E-01	1.19E-01	8.03E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	-2.85E-02	9.02E-02	9.02E-02	1.28E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-2.39E-02	6.33E-02	6.33E-02	5.03E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	-1.48E-02	1.66E-01	1.66E-01	2.66E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.25E+01	1.69E+00	1.80E+00	8.30E-01		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-2.76E-02	4.18E-02	4.18E-02	5.57E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	-4.09E-02	3.53E-02	3.54E-02	4.40E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-2.13E-02	3.98E-02	3.98E-02	5.02E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	6.82E-01	7.44E-01	7.45E-01	1.24E+00	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.71E-01	8.89E-02	9.00E-02	1.21E-01		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.45E-01	1.03E-01	1.04E-01	1.83E-01		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	1.99E-02	1.14E-01	1.14E-01	1.87E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.88E-01	1.12E-01	1.13E-01	1.59E-01		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-4.69E-02	9.63E-02	9.63E-02	1.36E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	8.11E-01	8.08E-01	8.09E-01	1.35E+00	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.27E-01	9.64E-02	9.71E-02	4.48E-02		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	6.89E-02	2.06E-01	2.06E-01	3.11E-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:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-10093
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
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	5.49E-02	2.06E-01	2.06E-01	3.47E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	4.72E-04	4.47E-02	4.47E-02	6.35E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-6.98E-02	7.31E-02	7.32E-02	1.01E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	1.26E-02	1.87E-02	1.87E-02	1.05E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.12E-01	1.18E-01	1.18E-01	8.99E-02		pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-3.27E-02	7.97E-02	7.97E-02	9.94E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-6.94E-03	2.59E-02	2.59E-02	7.68E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	1.85E-02	5.79E-02	5.79E-02	8.38E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-3.77E-02	1.85E-01	1.85E-01	1.47E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-1.34E-01	1.99E-01	1.99E-01	7.57E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	1.06E-01	7.90E-02	7.92E-02	1.22E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	6.63E-02	7.51E-02	7.51E-02	5.93E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	2.32E-03	1.33E-01	1.33E-01	1.98E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.14E+01	1.83E+00	1.92E+00	1.04E+00		pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	6.50E-03	2.45E-02	2.45E-02	8.31E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	2.23E-02	4.19E-02	4.19E-02	7.20E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	2.21E-02	4.44E-02	4.45E-02	6.60E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	1.11E+00	6.99E-01	7.01E-01	1.12E+00	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	3.79E-01	1.61E-01	1.62E-01	2.00E-01		pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.15E-01	1.05E-01	1.05E-01	1.81E-01		pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-1.33E-01	1.05E-01	1.06E-01	1.39E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.12E-01	1.18E-01	1.18E-01	8.99E-02		pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-1.97E-02	1.31E-01	1.31E-01	1.80E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	7.35E-01	6.33E-01	6.34E-01	9.92E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	1.67E-01	1.69E-01	1.69E-01	2.66E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	2.92E-02	2.30E-01	2.30E-01	3.45E-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: 19-10093
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
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	9.19E-02	5.03E-02	5.05E-02	1.59E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-9.55E-04	3.62E-02	3.62E-02	4.07E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-9.37E-02	7.79E-02	7.80E-02	1.04E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-1.86E-02	5.89E-02	5.89E-02	6.50E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.38E-01	8.80E-02	8.88E-02	1.46E-01		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-1.35E-02	3.63E-02	3.63E-02	3.97E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-4.98E-03	1.19E-02	1.19E-02	6.06E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	-2.80E-02	3.58E-02	3.58E-02	4.42E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-8.76E-02	1.24E-01	1.24E-01	1.34E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-2.42E-02	9.29E-02	9.29E-02	6.62E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	2.52E-02	6.11E-02	6.11E-02	1.18E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	2.27E-02	6.01E-02	6.01E-02	4.95E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	4.24E-02	1.13E-01	1.13E-01	1.70E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.14E+01	1.44E+00	1.56E+00	7.80E-01		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-3.48E-03	9.29E-03	9.29E-03	4.87E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	-1.21E-02	3.26E-02	3.26E-02	4.29E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-4.27E-02	3.85E-02	3.86E-02	4.34E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	9.29E-02	6.93E-01	6.93E-01	1.02E+00	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	3.21E-01	9.06E-02	9.20E-02	1.21E-01		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.03E-01	8.88E-02	8.94E-02	1.64E-01		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-4.37E-02	9.84E-02	9.85E-02	1.40E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.38E-01	8.80E-02	8.88E-02	1.46E-01		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-1.86E-02	7.77E-02	7.77E-02	1.15E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	7.86E-01	8.40E-01	8.41E-01	1.40E+00	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.58E-01	8.80E-02	8.90E-02	8.32E-02		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	-1.88E-02	2.02E-01	2.02E-01	2.97E-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

0025

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	5.64E-01	1.64E-01	1.67E-01	2.37E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	9.35E-03	2.39E-02	2.39E-02	4.32E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-6.06E-02	1.03E-01	1.03E-01	1.23E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-1.03E-02	2.39E-02	2.39E-02	6.60E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	4.21E-01	1.02E-01	1.04E-01	1.32E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	1.79E-02	5.34E-02	5.34E-02	7.01E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-6.64E-03	1.80E-02	1.80E-02	4.79E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	3.82E-03	4.16E-02	4.16E-02	6.50E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-1.76E-02	9.03E-02	9.03E-02	1.75E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	3.57E-02	1.25E-01	1.25E-01	8.97E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	1.95E-02	1.16E-01	1.16E-01	1.51E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-1.80E-02	6.30E-02	6.30E-02	6.66E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	4.54E-01	1.99E-01	2.00E-01	2.80E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.39E+01	1.79E+00	1.92E+00	6.74E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-6.06E-03	4.61E-02	4.61E-02	6.89E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	9.10E-03	3.43E-02	3.43E-02	4.62E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	2.31E-02	3.55E-02	3.55E-02	6.07E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	9.41E-01	1.04E+00	1.05E+00	1.42E+00	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	4.85E-01	1.35E-01	1.37E-01	1.77E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	4.24E-01	1.20E-01	1.22E-01	1.97E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-6.33E-02	1.57E-01	1.58E-01	1.95E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	4.21E-01	1.02E-01	1.04E-01	1.32E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-4.28E-02	8.50E-02	8.50E-02	1.30E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	8.76E-01	9.70E-01	9.71E-01	1.30E+00	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	3.73E-01	1.13E-01	1.14E-01	1.33E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	2.70E-01	2.84E-01	2.84E-01	4.04E-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: 19-10093
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
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	7.56E-02	2.28E-01	2.28E-01	3.85E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-1.24E-02	5.36E-02	5.36E-02	6.67E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-4.85E-02	7.58E-02	7.58E-02	1.07E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	6.25E-03	2.58E-02	2.58E-02	1.12E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.91E-01	1.27E-01	1.28E-01	2.05E-01		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-6.67E-02	8.00E-02	8.01E-02	9.19E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	2.40E-02	3.19E-02	3.20E-02	8.38E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	-4.35E-02	6.47E-02	6.48E-02	7.81E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-3.49E-02	1.95E-01	1.95E-01	1.56E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	2.81E-02	8.22E-02	8.22E-02	7.92E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	-1.13E-02	8.29E-02	8.29E-02	1.21E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	4.02E-03	8.60E-02	8.60E-02	6.17E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	-8.91E-03	1.36E-01	1.36E-01	2.01E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.15E+01	1.85E+00	1.94E+00	1.04E+00		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-3.24E-02	5.96E-02	5.96E-02	8.32E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	1.08E-03	4.81E-02	4.81E-02	7.64E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	1.11E-02	4.83E-02	4.83E-02	7.63E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	6.50E-01	7.07E-01	7.08E-01	1.10E+00	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.38E-01	1.03E-01	1.04E-01	2.00E-01		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.37E-01	1.12E-01	1.13E-01	1.68E-01		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-2.42E-02	1.03E-01	1.03E-01	1.50E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.91E-01	1.27E-01	1.28E-01	2.05E-01		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-1.17E-01	1.49E-01	1.49E-01	1.80E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	8.60E-01	6.64E-01	6.65E-01	1.04E+00	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.58E-01	1.25E-01	1.26E-01	2.32E-01		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	-1.58E-02	9.48E-02	9.49E-02	3.58E-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

0027

Eberline Analytical
Final Report of Analysis

Report To:
Jeffrey Graham
Zion Solutions
2701 Deborah Ave
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Work Order Details:
SDG: 19-10093
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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
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	2.90E-02	1.80E-02	1.80E-02	3.30E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-2.96E-03	4.19E-03	4.19E-03	4.89E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-3.72E-03	6.98E-03	6.98E-03	1.05E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	6.19E-04	1.79E-03	1.79E-03	8.09E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.99E-02	1.01E-02	1.02E-02	6.28E-03		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-1.09E-03	5.32E-03	5.32E-03	5.49E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	1.49E-04	1.29E-03	1.29E-03	5.78E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	2.17E-03	3.38E-03	3.39E-03	5.82E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-1.10E-02	1.42E-02	1.42E-02	1.63E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	6.57E-03	5.08E-03	5.09E-03	9.70E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	4.81E-03	8.81E-03	8.81E-03	1.31E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	4.73E-03	4.75E-03	4.75E-03	5.57E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	8.69E-03	1.74E-02	1.74E-02	2.84E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.23E+00	1.64E-01	1.76E-01	7.28E-02		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-2.75E-04	2.95E-03	2.95E-03	5.77E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	2.37E-03	2.69E-03	2.69E-03	3.36E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	1.35E-03	3.50E-03	3.50E-03	5.20E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	1.36E-01	7.25E-02	7.29E-02	1.25E-01	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.08E-02	7.45E-03	7.52E-03	1.55E-02		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.90E-02	1.03E-02	1.04E-02	1.78E-02		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-3.45E-04	1.12E-02	1.12E-02	1.82E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.99E-02	1.01E-02	1.02E-02	6.28E-03		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-1.07E-02	1.04E-02	1.04E-02	1.33E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	-1.33E-02	6.10E-02	6.10E-02	9.78E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.09E-02	9.44E-03	9.50E-03	4.37E-03		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	1.51E-02	2.06E-02	2.07E-02	3.17E-02	U	pCi/g

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

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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: 19-10093
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
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	2.15E-01	1.34E-01	1.35E-01	2.54E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-9.26E-03	1.66E-02	1.66E-02	3.55E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-6.62E-02	7.86E-02	7.87E-02	1.08E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-6.21E-03	2.53E-02	2.53E-02	6.48E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	1.58E-01	7.50E-02	7.54E-02	1.48E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-7.45E-03	4.03E-02	4.03E-02	5.08E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	1.05E-02	1.76E-02	1.76E-02	5.26E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	1.25E-02	3.38E-02	3.39E-02	5.08E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-3.62E-02	1.19E-01	1.19E-01	1.38E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	2.61E-02	9.81E-02	9.81E-02	7.01E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	8.59E-02	7.76E-02	7.77E-02	1.19E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-7.00E-03	5.85E-02	5.85E-02	5.28E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	2.40E-02	1.19E-01	1.19E-01	1.78E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.23E+01	1.54E+00	1.67E+00	5.49E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	8.16E-03	3.61E-02	3.61E-02	5.28E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	-4.95E-03	3.07E-02	3.07E-02	3.35E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-1.69E-02	3.07E-02	3.07E-02	3.87E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	7.78E-01	6.93E-01	6.94E-01	1.14E+00	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.35E-01	8.25E-02	8.34E-02	1.19E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.89E-01	7.75E-02	7.89E-02	2.50E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	1.56E-02	9.58E-02	9.58E-02	1.43E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	1.58E-01	7.50E-02	7.54E-02	1.48E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	4.30E-02	7.65E-02	7.65E-02	1.24E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	9.69E-01	6.87E-01	6.88E-01	1.07E+00	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.33E-01	9.24E-02	9.31E-02	1.71E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	1.18E-02	2.01E-01	2.01E-01	2.99E-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:	Work Order Details:	
Jeffrey Graham	SDG:	19-10093
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
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	3.35E-01	1.57E-01	1.58E-01	2.80E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	3.35E-04	4.49E-02	4.49E-02	4.66E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-2.36E-02	1.05E-01	1.05E-01	1.28E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	8.04E-03	2.70E-02	2.70E-02	5.70E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	4.21E-01	1.03E-01	1.05E-01	1.30E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	8.00E-03	3.44E-02	3.44E-02	5.39E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-1.03E-03	2.10E-02	2.10E-02	5.26E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	-1.99E-02	4.12E-02	4.12E-02	5.84E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	2.96E-02	1.39E-01	1.39E-01	1.74E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-1.15E-02	1.11E-01	1.11E-01	8.89E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	-2.20E-02	1.08E-01	1.08E-01	1.39E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-3.17E-02	6.41E-02	6.42E-02	6.61E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	5.31E-01	2.00E-01	2.02E-01	2.73E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.21E+01	1.61E+00	1.73E+00	7.35E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	2.62E-02	2.83E-02	2.83E-02	5.28E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	5.38E-03	2.44E-02	2.44E-02	4.40E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-9.87E-03	4.12E-02	4.12E-02	5.36E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	8.82E-01	8.07E-01	8.08E-01	1.33E+00	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	4.39E-01	1.19E-01	1.21E-01	1.53E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	5.03E-01	1.14E-01	1.17E-01	1.42E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	1.42E-02	1.49E-01	1.49E-01	1.92E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	4.21E-01	1.03E-01	1.05E-01	1.30E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-3.59E-02	7.54E-02	7.54E-02	1.15E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	1.33E+00	8.76E-01	8.79E-01	1.26E+00	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.49E-01	9.46E-02	9.55E-02	1.77E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	-1.99E-01	2.76E-01	2.77E-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

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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: 19-10093
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
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	3.10E-01	1.38E-01	1.39E-01	2.14E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-2.82E-02	4.46E-02	4.46E-02	4.16E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-1.23E-01	7.07E-02	7.09E-02	1.01E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	7.09E-03	2.12E-02	2.12E-02	7.51E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.08E-01	9.31E-02	9.37E-02	1.59E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-1.71E-03	4.56E-02	4.56E-02	5.54E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	7.18E-03	1.83E-02	1.83E-02	5.60E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	1.92E-02	3.52E-02	3.52E-02	5.91E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-2.05E-02	4.88E-02	4.88E-02	1.54E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	1.04E-01	1.20E-01	1.20E-01	7.85E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	1.05E-01	7.86E-02	7.88E-02	1.63E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-1.84E-02	6.48E-02	6.48E-02	5.54E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	-1.99E-03	1.63E-01	1.63E-01	2.64E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.09E+01	1.51E+00	1.61E+00	6.83E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-1.94E-02	4.10E-02	4.10E-02	5.90E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	1.61E-02	3.26E-02	3.26E-02	5.23E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	1.54E-02	3.12E-02	3.12E-02	4.78E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	9.52E-01	7.32E-01	7.34E-01	1.24E+00	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	3.34E-01	9.93E-02	1.01E-01	1.31E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.33E-01	9.26E-02	9.34E-02	1.61E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	2.86E-02	1.13E-01	1.13E-01	1.85E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.08E-01	9.31E-02	9.37E-02	1.59E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-1.71E-03	9.66E-02	9.66E-02	1.46E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	1.07E+00	6.19E-01	6.22E-01	1.06E+00	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.44E-01	1.07E-01	1.07E-01	4.38E-02		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	1.66E-01	2.12E-01	2.12E-01	3.26E-01	U	pCi/g

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

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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: 19-10093
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
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	1.91E-01	2.26E-01	2.26E-01	3.96E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	6.72E-03	2.15E-02	2.15E-02	6.12E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-2.40E-02	7.42E-02	7.42E-02	1.05E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	5.13E-03	3.96E-02	3.96E-02	1.04E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.89E-01	1.07E-01	1.08E-01	1.53E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	5.97E-02	6.90E-02	6.90E-02	1.03E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	1.02E-02	3.14E-02	3.14E-02	8.66E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	1.48E-02	3.26E-02	3.26E-02	7.38E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-2.67E-02	5.42E-02	5.42E-02	1.59E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-1.19E-01	1.88E-01	1.88E-01	7.97E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	6.20E-03	8.52E-02	8.52E-02	1.25E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-3.68E-02	7.89E-02	7.89E-02	6.02E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	-1.63E-01	1.41E-01	1.41E-01	1.81E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.26E+01	1.92E+00	2.02E+00	8.10E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	2.35E-02	5.43E-02	5.43E-02	9.27E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	1.64E-02	4.34E-02	4.34E-02	6.63E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-2.79E-03	4.32E-02	4.32E-02	7.02E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	4.80E-01	7.09E-01	7.09E-01	1.08E+00	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.87E-01	1.41E-01	1.42E-01	1.91E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	1.89E-01	1.07E-01	1.07E-01	1.70E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	1.69E-02	1.05E-01	1.05E-01	1.53E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.89E-01	1.07E-01	1.08E-01	1.53E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-5.41E-02	1.45E-01	1.45E-01	1.90E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	8.78E-01	6.46E-01	6.47E-01	1.02E+00	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.58E-01	1.00E-01	1.01E-01	1.25E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	3.26E-02	2.28E-01	2.28E-01	3.42E-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: 19-10093
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
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	3.11E-01	2.08E-01	2.09E-01	3.84E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-1.66E-02	5.63E-02	5.63E-02	5.71E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-5.51E-02	6.77E-02	6.78E-02	9.32E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-4.12E-02	3.93E-02	3.93E-02	1.01E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	8.43E-02	1.20E-01	1.20E-01	1.82E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-1.97E-02	6.98E-02	6.98E-02	8.37E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-8.46E-02	7.52E-02	7.53E-02	7.68E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	2.43E-02	5.57E-02	5.58E-02	8.53E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	1.48E-02	8.00E-02	8.00E-02	1.58E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-5.22E-02	1.71E-01	1.71E-01	8.05E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	5.63E-02	6.74E-02	6.74E-02	1.13E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	2.66E-02	7.92E-02	7.93E-02	5.89E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	-2.32E-03	1.24E-01	1.24E-01	1.83E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	9.59E+00	1.68E+00	1.75E+00	1.25E+00		pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-1.65E-02	5.49E-02	5.49E-02	8.28E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	-1.18E-03	3.99E-02	3.99E-02	6.27E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	2.88E-02	4.38E-02	4.38E-02	7.50E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	5.03E-01	6.54E-01	6.54E-01	1.01E+00	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.23E-01	1.00E-01	1.01E-01	1.75E-01		pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.80E-01	1.09E-01	1.10E-01	1.52E-01		pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-8.62E-02	9.92E-02	9.93E-02	1.36E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	8.43E-02	1.20E-01	1.20E-01	1.82E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	1.96E-02	1.27E-01	1.27E-01	1.82E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	-3.16E-01	6.31E-01	6.32E-01	8.98E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	3.10E-01	1.63E-01	1.64E-01	2.29E-01		pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	3.45E-02	2.19E-01	2.19E-01	3.28E-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: 19-10093
Purchase Order: 677118
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Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	3.26E-01	1.76E-01	1.77E-01	3.23E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-1.15E-02	4.44E-02	4.44E-02	5.05E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-1.31E-01	7.88E-02	7.91E-02	1.12E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	2.62E-02	2.66E-02	2.66E-02	8.71E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.96E-01	1.11E-01	1.12E-01	2.22E-01		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	5.36E-02	2.58E-02	2.60E-02	3.98E-02		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-2.72E-04	1.46E-02	1.46E-02	6.22E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	7.34E-03	4.69E-02	4.69E-02	7.15E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-1.47E-01	1.77E-01	1.77E-01	1.80E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	7.81E-03	1.15E-01	1.15E-01	9.19E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	7.78E-02	9.68E-02	9.69E-02	1.45E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-4.54E-02	5.67E-02	5.68E-02	5.75E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	3.14E-02	1.76E-01	1.76E-01	2.88E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	9.36E+00	1.43E+00	1.51E+00	8.93E-01		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-5.37E-03	4.30E-02	4.30E-02	6.35E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	1.57E-02	3.15E-02	3.15E-02	5.28E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-2.47E-02	3.46E-02	3.46E-02	5.42E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	5.59E-01	8.01E-01	8.01E-01	1.33E+00	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	4.05E-01	1.23E-01	1.25E-01	1.66E-01		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.85E-01	9.14E-02	9.26E-02	2.94E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-1.04E-01	1.28E-01	1.28E-01	1.95E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.96E-01	1.11E-01	1.12E-01	2.22E-01		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	8.40E-02	8.89E-02	8.90E-02	1.53E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	8.88E-01	6.66E-01	6.67E-01	1.13E+00	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	3.00E-01	1.22E-01	1.23E-01	2.40E-01		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	9.72E-02	2.22E-01	2.22E-01	3.36E-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
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ZION SOLUTIONS LLC
An EnergySolutions Company

REC'D OCT 21 2019

19-10093

ZS-WM-131
Revision 0
Information Use

Attachment 1 – Chain-of-Custody Form

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

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Rec. WS 10-21-19 @1100

[245]

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19-10093

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L1-12111-A-QJGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/23/2019	1330	5 ROC HTD	NA	1137.81
L1-12111-A-FJGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/23/2019	1334	5 ROC HTD	NA	1029.33
L1-12205-B-FSGS-105-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	0908	5 ROC HTD	NA	1044.71
L1-12106-A-FSGS-009-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/26/2019	1246	5 ROC HTD	NA	1127.18
L1-12205-A-FSGS-104-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1251	5 ROC HTD	NA	1135.95
L1-12205-A-FSGS-109-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1301	5 ROC HTD	NA	1130.91
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	Fed Ex Ground

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

Comments

PO # 67718 HTD's 30 Day turnaround

9000

[246]

EBERLINE ANALYTICAL

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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:
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
19-10094-04	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
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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:
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

0025

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:	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
19-10094-08	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

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
19-10094-09	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

0028

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:
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
19-10094-11	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

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

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:
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

0032

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
19-10094-14	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

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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
19-10094-15	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

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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

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

[267]