ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

NORTH GATE AREA

SURVEY UNIT 10204A

REVISION 1

PREPARED BY / DATE: Robert Yetter III — Robert F. Yetter III, Apr 29 2020 9:37 AM (cosign)

Final Status Survey Specialist

REVIEWED BY / DATE: Robert Yetter — Robert F. Yetter, Apr 29 2020 1:47 PM (cosign)

Director, Radiological Site Closure

APPROVED BY / DATE: Sarah Roberts — Sarah Roberts, Apr 29 2020 3:01 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 Soil Derived Concentration Guideline Level
BcSOF	Base Case Sum of Fractions
C/LT	Characterization/License Termination
cpm	Counts per minute
DQO	Data Quality Objective
DCGL	Derived Concentration Guideline Level
EMC	Elevated Measurement Comparison
FSS	Final Status Survey
GPS	Global Positioning System
HTD	Hard-to-Detect
HSA	Historical Site Assessment
IC	Insignificant Contributor
LBGR	Lower Bound of the Gray Region
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Count Rate
NAD	North American Datum
NaI	Sodium Iodide
OpDCGL	Operational Derived Concentration Guideline Level
OpSOF	Operational Sum of Fractions
QC	Quality Control
RE	Radiological Engineer
ROC	Radionuclides of Concern
SOF	Sum of Fractions
TEDE	Total Effective Dose Equivalent

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

1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for Survey Unit 10204A, "North Gate Area," has been generated for the Zion Station Restoration Project (ZSRP) in accordance with Zion*Solutions* procedure ZS-LT-300-001-005, *"Final Status Survey Data Reporting"* (Reference 1) and satisfies the requirements of Section 5.11 of the *"Zion Station Restoration Project License Termination Plan"* (LTP) (Reference 2).

An FSS package (L1-10204A-F) was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, *"Final Status Survey Package Development"* (Reference 3), the ZSRP LTP, and guidance from NUREG-1575, "*Multi-Agency Radiation Survey and Site Investigation Manual"* (MARSSIM) (Reference 4).

This open land survey unit has a MARSSIM classification of one. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I (α) and Type II (β) decision error rates were set at 0.05. Seventeen (17) systematic surface soil samples were acquired from the survey unit. In addition, surface scanning was performed on 100% of the total surface area in the survey unit. No areas of elevated activity were detected during the scans. The analytical results for systematic soil samples taken in survey unit 10204A 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. The maximum Operational SOF (OpSOF) for the systematic samples was 0.085. The mean OpSOF for the systematic samples was 0.043. The mean Base Case SOF (BcSOF) for the systematic samples, when the analytical results were compared to the Base Case DCGLs (BcDCGL), was 0.011, which results in a dose assigned to the survey unit of 0.283 mrem/year Total Effective Dose Equivalent (TEDE). Therefore, the null hypothesis is rejected and survey unit 10204A is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 10204A, "North Gate Area," is a Class 1 open land survey unit and is 2,231 m^2 in size. It is bounded on the west by survey unit 10205, the south by survey units 10206A and 10206B, on the east by survey unit 10204B, and the north by survey unit 10214C.

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

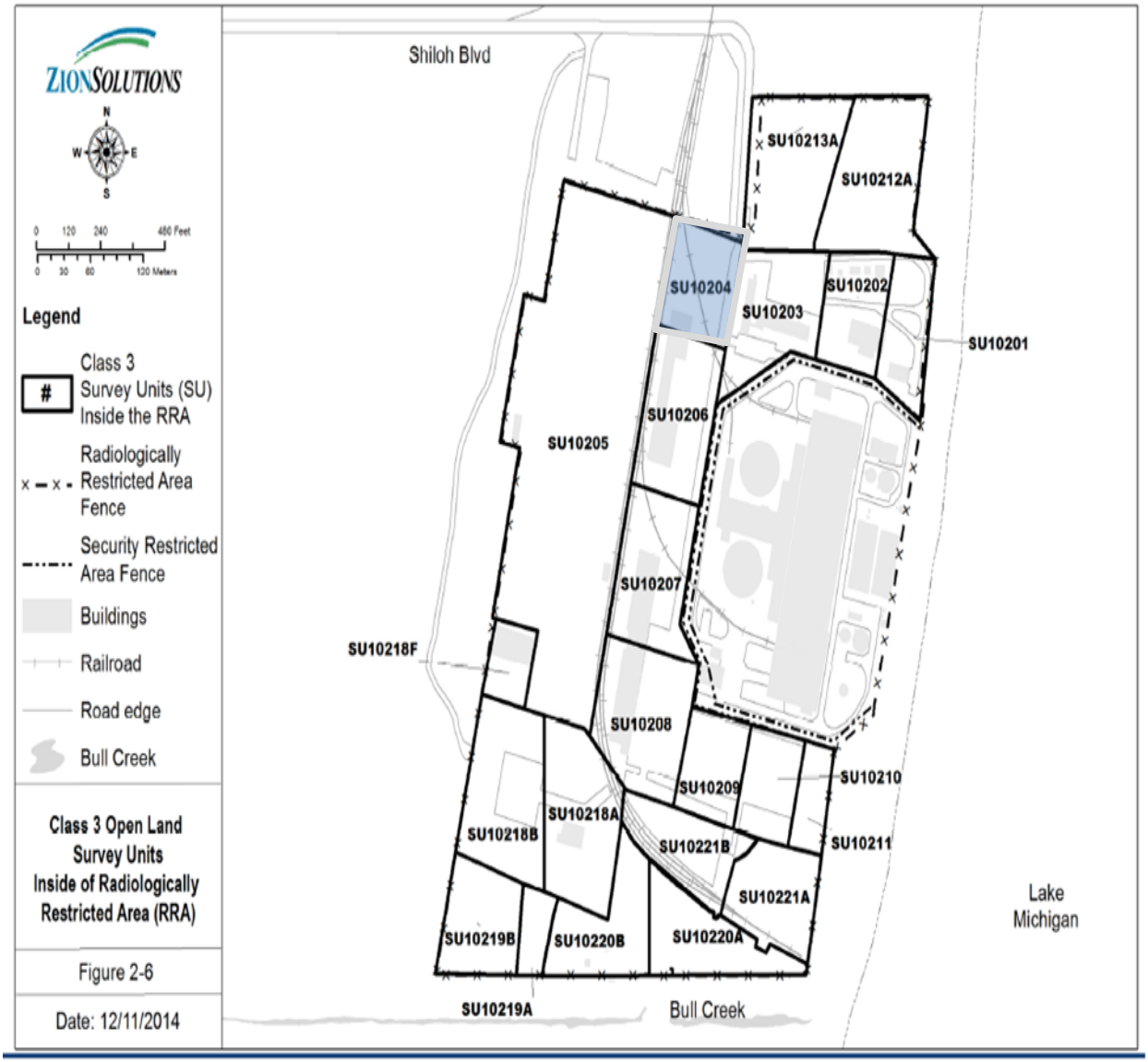
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 10204A was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 5).

The area encompassing this survey unit was formerly described as the "North Gate Area" and is located within survey unit 10204 as identified in the "*Zion Station Historical Site Assessment"* (HSA) (Reference 6). Subsequently, this area was described as the "North Gate Area" (survey unit 10204) in Table 2-29 of the LTP as represented in Figure 2-6 of the LTP, which is replicated below as Figure 1.

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



A characterization survey was performed in July, 2013, for the Class 3 survey unit 10204. The following data was obtained:

- Four (4) random surface samples.
- Thirteen (13) judgmental surface samples and two (2) judgmental subsurface samples taken at the direction of the cognizant Radiological Engineer (RE).
- One (1) investigation surface sample where a scan alarm occurred.
- Sodium iodide (NaI) walkover scans of approximately 26% of the survey unit.

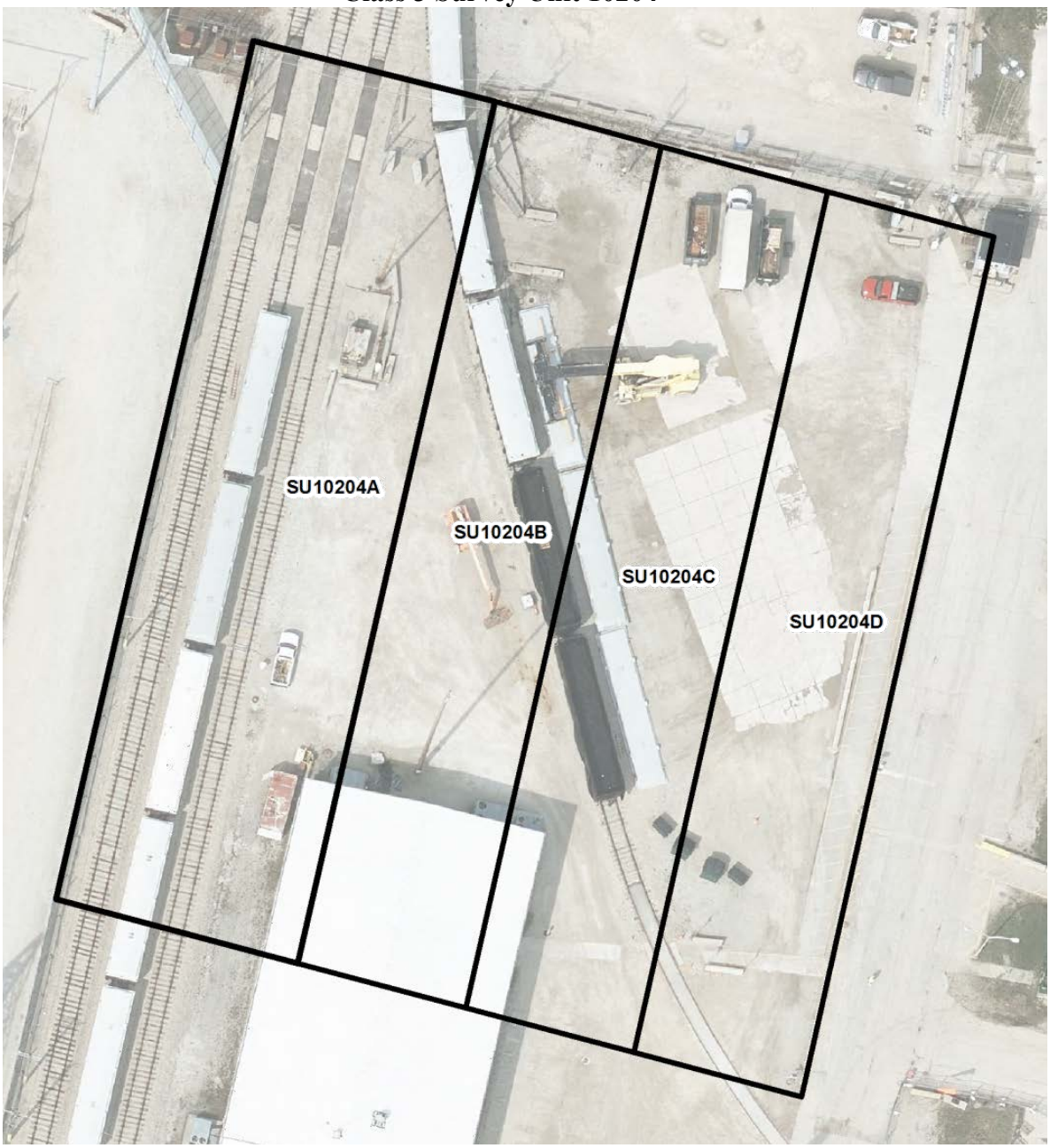
The results of the characterization survey were:

- The four (4) random surface samples were all less than Minimum Detectable Concentration (MDC) for the Radionuclides of Concern (ROC).
- One (1) of the thirteen (13) judgmental surface samples was positive for Cs-137 with an activity of 0.11 pCi/g.
- Both of the judgmental subsurface samples were less than the MDC for the ROC.

On July 15, 2016, due to changing radiological and operational conditions brought about by site decommissioning activities inside or adjacent to this area, survey units 10204 and 10206 were reclassified as Class 1 and divided into four (4) and five (5) survey units respectively.

Figure 2 below shows the boundaries of the resulting Class 1 survey unit along with the adjacent survey units 10204B through 10204D. The change in classification was a conservative response and ensured that the survey unit would be surveyed with the appropriate rigor.

Figure 2 - Class 1 Open Land Survey Units Created from the Original Class 3 Survey Unit 10204



An 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 10204A was correctly classified as Class 1.

4. DATA QUALITY OBJECTIVES

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

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

The primary objective of the FSS sample plan is to demonstrate that the level of residual radioactivity in survey unit 10204A does not exceed the release criteria specified in the LTP and that the potential dose from residual radioactivity is As Low As Reasonably Achievable (ALARA).

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

Zion*Solutions* TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* (Reference 8), was written to refine the initial selection of ROC for decommissioning at 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 is 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 10204A. 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 10204A, 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

$DCGL_{2,3...n}$ = 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 Chapter 5, Table 5-25, and are reproduced below in Table 7.

Table 7 - Investigation Levels

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

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

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

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

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

The number of soil samples for FSS was determined in accordance with ZS-LT-300-001-001. The relative shift (Δ/σ) for the survey unit data set is defined as shift (Δ), which is the Upper Bound of the Gray Region (UBGR), or the DCGL (SOF of 1), minus the Lower Bound of the Gray Region (LBGR) (SOF of 0.5), divided by sigma (σ), which is the standard deviation of the data set used for survey design. The optimal value for Δ/σ should range between one and three. The largest value the Δ/σ can have is three. If the Δ/σ exceeds three, then the value of three will be used for Δ/σ. 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 seventeen. However, since the survey unit had a surface area of 2,231 m^2, two (2) additional samples were added to maintain the grid spacing of 11.7 m. Therefore a total of nineteen (19) systematic soil samples were identified in the sample plan. 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: $A = \frac{A_{SU}}{N} = \frac{2231}{17} = 117.4\ m^2$
- From the LTP, Table 5-16, the Area Factors for the next larger area (300 m^2) were used:
  - Cs-137 - 1.46
  - Cs-134 - 1.30
  - Co-60 - 1.16
- The $DCGL_{EMC}$ is the Surrogate Base Case DCGL times the Area Factor:
  - The $DCGL_{EMC}$ for Cs-137 = $1.46 * 14.15 = 20.66\ pCi/g$
  - The $DCGL_{EMC}$ for Cs-134 = $1.30 * 6.77 = 8.80\ pCi/g$
  - The $DCGL_{EMC}$ for Co-60 = $1.16 * 3.51 = 4.07\ pCi/g$

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

The implementation of quality control (QC) measures as referenced by LTP, Section 5.9 and Zion*Solutions* procedure ZS-LT-01, "*Quality Assurance Project Plan (for Characterization and FSS)*" (Reference 12) includes the collection of a soil sample for "split sample" analysis on 5% of the soil samples taken in a survey unit with the locations selected at random. Two (2) surface soil samples (L1-10204A-FQGS-009-SS and L1-10204A-FQGS-019-SS) were 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 L1-10204A-FSGS-007-SB and L1-10204A-FSGS-012-SB were selected for this survey unit.

The locations of the nineteen (19) systematic samples and two (2) subsurface samples are listed in Table 8. A map of the systematic sample locations is included in Attachment 1.

Table 8 - Systematic Sample Measurement Locations

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L1-10204A-FSGS-001-SS	641949.41	343520.62
L1-10204A-FSGS-002-SS	641949.41	343532.27
L1-10204A-FSGS-003-SS	641949.41	343543.91
L1-10204A-FSGS-004-SS	641959.49	343526.45
L1-10204A-FSGS-005-SS	641959.49	343538.09
L1-10204A-FSGS-006-SS	641969.58	343532.27
L1-10204A-FSGS-007-SS	641969.58	343543.91
L1-10204A-FSGS-008-SS	641979.66	343526.45
L1-10204A-FSGS-009-SS	641979.66	343538.09
L1-10204A-FSGS-010-SS	641979.66	343549.73
L1-10204A-FSGS-011-SS	641989.74	343532.27
L1-10204A-FSGS-012-SS	641989.74	343543.91
L1-10204A-FSGS-013-SS	641999.83	343538.09
L1-10204A-FSGS-014-SS	641999.83	343549.73
L1-10204A-FSGS-015-SS	642009.91	343543.91
L1-10204A-FSGS-016-SS	642009.91	343555.55
L1-10204A-FSGS-017-SS	642019.99	343538.09
L1-10204A-FSGS-018-SS	642019.99	343549.73
L1-10204A-FSGS-019-SS	642030.08	343543.91
L1-10204A-FSGS-007-SB	641969.58	343543.91
L1-10204A-FSGS-012-SB	641989.74	343543.91

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 an OpSOF of 0.1 during the FSS of survey unit 10204A.

Three (3) samples met the requirement that 10% of the samples collected for the FSS of

survey unit 10204A be analyzed for HTD ROC. 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 10204A.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	2,231 m^2	GPS measurements of area
Number of Surface Soil Samples	17+2=19 (Systematic)(1)	• σ = 0.30 • UBGR = SOF of 1 • LBGR = SOF of 0.5 • Type I error = 0.05 • Type II error = 0.05 • Δ/σ = 1.67 (MARSSIM Table 5.5)
Grid Spacing	11.6 m	(LTP, Section 5.6.4.5.2)
DCGLs	• Co-60 – 1.091 pCi/g • Cs-134 – 1.733 pCi/g • Cs-137 – 3.630 pCi/g • Ni-63 – 914.458 pCi/g • Sr-90 – 3.095 pCi/g	Operational DCGLs for Surface Soils, (LTP Chapter 5, Table 5-7)
HTD ROC Analysis	Three (3) soil samples selected for HTD ROC analysis	(LTP, Section 5.1)
Measurement Investigation Level	Operational DCGL	(LTP Chapter 5, Table 5-25)
Scan Survey Area Coverage	100%	(LTP Chapter 5, Table 5-24)
QC	Two (2) 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 7 and 12	(LTP, Section 5.7.1.6.2)

(1) The sample plan identified a sample variability of 0.30, and N=17 for the number of systematic samples to be collected. However, since the survey unit had a surface area of 2,231 m^2, two (2) additional samples were added to maintain the grid spacing of 11.7 m.

6. SURVEY IMPLEMENTATION

Survey instructions for this FSS were incorporated into and performed in accordance with FSS sample plan L1-10204A-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 10204A, compliance with the unrestricted release criteria was demonstrated through a combination of surface scanning with a Ludlum Model 44-10 gamma detector and the sampling of surface soil for isotopic analysis. In accordance with the LTP Chapter 5, two (2) subsurface samples were obtained and analyzed. Also, if during the performance of FSS, the analysis of a surface soil sample, or the results of a surface gamma scan indicated the potential presence of residual radioactivity at a concentration of 75% of the subsurface OpDCGL, then a biased subsurface soil sample(s) would have been taken to the appropriate depth within the area of concern as part of the investigation. This threshold was not encountered during the FSS of survey unit 10204A.

FSS field activities were conducted under FSS sample plan L1-10204A-F. A "Field Log" (ZS-LT-300-001-001, Attachment 14) was used to document field activities and other information pertaining to the performance of the FSS. FSS field activities were projected to take four (4) working days to complete. Daily briefings were conducted to discuss the expectations for job performance and to review safety aspects of the job. The survey required field activities were performed during normal working hours starting on November 15, 2019, and concluding on November 16, 2019.

The nineteen (19) 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.

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

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

Table 10 - Instruments and Detectors

Instrument/Detector Type	Serial #	Calibration Due Date
Ludlum 2350-1/Ludlum 44-10	304730/PR375273	1/16/2020
Ludlum 2350-1/Ludlum 44-10	216173/ES0118	10/7/2020
Ludlum 2350-1/Ludlum 44-10	304718/PR363311	9/19/2020
Ludlum 2350-1/Ludlum 44-10	266669/PR311756	10/28/2020
Ludlum 2350-1/Ludlum 44-10	266656/PR311750	7/24/2020
Ludlum 2350-1/Ludlum 44-10	304708/PR321892	9/4/2020

In accordance with the survey design, nineteen (19) surface soil samples were collected at the designated systematic sample locations. In addition, two (2) subsurface samples were collected at the randomly selected sample locations.

Three (3) samples (L1-10204A-FSGS-017-SS, L1-10204A-FSGS-019-SS and L1-10204A-FQGS-019-SS were selected for HTD radionuclide analysis.

Two (2) surface soil samples (L1-10204A-FQGS-009-SS and L1-10204A-FQGS-019-SS) were selected randomly for QC sample analysis.

7. SURVEY RESULTS

One hundred percent (100%) of the surface of the survey unit was scanned for elevated radiation levels. Eighty-nine (89) 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 scans. 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	1887	2104	None	None
Row 2	1973	2104	None	None
Row 3	2026	2104	None	None
Row 4	1945	2104	None	None
Row 5	2056	2104	None	None
Row 6	2049	2104	None	None
Row 7	2008	2104	None	None
Row 8	1999	2104	None	None
Row 9	1909	2104	None	None
Row 10	1930	2104	None	None
Row 11	1846	2104	None	None
Row 12	2017	2104	None	None
Row 13	1757	2104	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 14	1761	2104	None	None
Row 15	1758	2104	None	None
Row 16	1682	1937	None	None
Row 17	1765	1937	None	None
Row 18	1332	1937	None	None
Row 19	2547	3145	None	None
Row 20	2645	3145	None	None
Row 21	2403	3145	None	None
Row 22	2424	3145	None	None
Row 23	2111	3145	None	None
Row 24	1550	1937	None	None
Row 25	1486	1937	None	None
Row 26	1414	1937	None	None
Row 27	1441	1937	None	None
Row 28	1380	1937	None	None
Row 29	1476	1937	None	None
Row 30	1486	1937	None	None
Row 31	1617	1856	None	None
Row 32	1518	1856	None	None
Row 33	1638	1856	None	None
Row 34	1576	1856	None	None
Row 35	1539	1856	None	None
Row 36	1548	1856	None	None
Row 37	1587	1856	None	None
Row 38	1728	1856	None	None
Row 39	1629	1856	None	None
Row 40	1597	1856	None	None
Row 41	1613	1856	None	None
Row 42	1697	1856	None	None
Row 43	1635	1856	None	None
Row 44	1834	1856	None	None
Row 45	1626	1856	None	None
Row 46	1794	2066	None	None
Row 47	1691	2066	None	None
Row 48	1754	2066	None	None
Row 49	1799	2066	None	None
Row 50	1903	2066	None	None
Row 51	1701	2066	None	None
Row 52	1831	2066	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 53	1798	2066	None	None
Row 54	1888	2066	None	None
Row 55	1422	1911	None	None
Row 56	1801	2066	None	None
Row 57	1750	2066	None	None
Row 58	1887	2066	None	None
Row 59	1886	2066	None	None
Row 60	1882	2066	None	None
Row 61	1766	2243	None	None
Row 62	1767	2243	None	None
Row 63	1733	2243	None	None
Row 64	1769	2243	None	None
Row 65	1913	2243	None	None
Row 66	1753	2243	None	None
Row 67	1824	2243	None	None
Row 68	1682	2243	None	None
Row 69	1835	2243	None	None
Row 70	1790	2243	None	None
Row 71	1867	2243	None	None
Row 72	2179	2243	None	None
Row 73	2071	2243	None	None
Row 74	2156	2243	None	None
Row 75	2165	2243	None	None
Row 76	3692	3875	None	None
Row 77	3655	3875	None	None
Row 78	3649	3875	None	None
Row 79	3536	3875	None	None
Row 80	3752	3875	None	None
Row 81	3617	3875	None	None
Row 82	3687	3875	None	None
Row 83	1889	2150	None	None
Row 84	1805	2150	None	None
Row 85	1839	2150	None	None
Row 86	1966	2150	None	None
Row 87	1917	2150	None	None
Row 88	1721	2150	None	None
Row 89	1865	2150	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 nineteen (19) soil samples taken for non-parametric statistical testing 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 and 13 respectively. The basic statistics for the systematic sample population are summarized in Table 20. The gamma spectroscopy results identified no samples with activity level above MDC for Co-60, Cs-134 and Cs-137. 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 systematic 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)
L1-10204A-FSGS-001-SS	2.28E-02	5.11E-02	4.04E-02	4.11E+00	8.08E-05
L1-10204A-FSGS-002-SS	1.14E-02	1.43E-02	1.67E-02	2.06E+00	3.34E-05
L1-10204A-FSGS-003-SS	0.00E+00	2.78E-02	2.94E-02	0.00E+00	5.88E-05
L1-10204A-FSGS-004-SS	3.19E-02	0.00E+00	3.41E-02	5.76E+00	6.82E-05
L1-10204A-FSGS-005-SS	1.17E-02	2.21E-02	7.70E-03	2.11E+00	1.54E-05
L1-10204A-FSGS-006-SS	1.46E-02	2.94E-02	3.18E-02	2.63E+00	6.36E-05
L1-10204A-FSGS-007-SS	1.50E-02	0.00E+00	1.48E-02	2.71E+00	2.96E-05
L1-10204A-FSGS-008-SS	1.29E-02	2.27E-02	7.09E-03	2.33E+00	1.42E-05
L1-10204A-FSGS-009-SS	2.04E-02	1.76E-02	1.08E-02	3.68E+00	2.16E-05
L1-10204A-FSGS-010-SS	3.47E-02	3.21E-02	3.81E-02	6.26E+00	7.62E-05
L1-10204A-FSGS-011-SS	4.04E-02	2.87E-02	5.51E-02	7.29E+00	1.10E-04
L1-10204A-FSGS-012-SS	5.06E-03	8.98E-03	1.47E-02	9.13E-01	2.94E-05
L1-10204A-FSGS-013-SS	4.18E-02	1.88E-02	6.17E-02	7.54E+00	1.23E-04
L1-10204A-FSGS-014-SS	2.25E-02	8.39E-03	1.38E-02	4.06E+00	2.76E-05
L1-10204A-FSGS-015-SS	1.96E-02	1.49E-02	5.06E-02	3.54E+00	1.01E-04
L1-10204A-FSGS-016-SS	1.40E-02	1.29E-02	2.06E-04	2.53E+00	4.12E-07
L1-10204A-FSGS-017-SS	2.59E-02	3.55E-02	3.83E-02	4.67E+00	7.66E-05
L1-10204A-FSGS-018-SS	1.01E-03	6.33E-03	3.77E-02	1.82E-01	7.54E-05
L1-10204A-FSGS-019-SS	5.57E-02	4.03E-02	0.00E+00	1.01E+01	0.00E+00

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

Table 13 - 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)
L1-10204A-FSGS-007-SB	3.43E-03	2.22E-02	9.08E-03	6.19E-01	1.82E-05
L1-10204A-FSGS-012-SB	2.46E-02	2.48E-02	0.00E+00	4.44E+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 L1-10204A-FSGS-017-SS, L1-10204A-FSGS-019-SS and L1-10204A-FQGS-019-SS 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 radionuclides were 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 14.

Table 14 - Off-Site Analysis Results

Sample # L1-10204A-FSGS-017-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	3.89E-02	3.92E-02	7.24E-02	No
Cs-134	1.44E-02	2.28E-02	5.89E-02	No
Cs-137	4.00E-02	4.60E-02	7.67E-02	No
Ni-63	1.01E+00	1.81E+00	3.07E+00	No
Sr-90	1.33E-01	3.50E-01	7.34E-01	No

Sample # L1-10204A-FSGS-019-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	-4.11E-03	3.62E-02	5.30E-02	No
Cs-134	-2.93E-03	1.60E-02	5.13E-02	No
Cs-137	1.08E-03	4.51E-02	6.64E-02	No
Ni-63	-6.18E-01	1.92E+00	3.35E+00	No
Sr-90	3.18E-01	3.22E-01	8.49E-01	No

Sample # L1-10204A-FQGS-019-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	2.25E-04	4.71E-02	7.11E-02	No
Cs-134	1.44E-02	2.07E-02	7.09E-02	No
Cs-137	1.01E-01	7.01E-02	1.12E-01	No
Ni-63	-1.00E+00	1.98E+00	3.45E+00	No
Sr-90	4.16E-01	2.96E-01	7.61E-01	No

The implementation of survey specific QC measures included the collection of two (2) systematic samples (L1-10204A-FQGS-009-SS and L1-10204A-FQGS-019-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 15) indicate that concentrations for Cs-137, Co-60 and Cs-134 were less than MDC in the sample. The concentration for Ni-63 and Sr-90 are inferred based on the maximum ratios as specified in Table 6.

Table 15 - Summary of Gamma Spectroscopy Results for QC Surface Soil Samples

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L1-10204A-FQGS-009-SS	0.00E+00	0.00E+00	1.79E-02	0.00E+00	3.58E-05
L1-10204A-FQGS-019-SS	7.18E-02	6.66E-03	3.64E-02	1.30E+01	7.28E-05

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

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

Equation 6

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

Where: C_n = concentration of radionuclide n

$DCGL_n$ = DCGL of radionuclide n.

The results of the unity rule calculations for the ROC in the systematic sample population when compared against the OpDCGLs for surface soils for survey unit 10204A are provided in Table 16. The results of the unity rule calculations for the subsurface samples are provided in Table 17, and the results for the QC samples are provided in Table 18.

Table 16 - 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	
L1-10204A-FSGS-001-SS	2.09E-02	2.95E-02	1.11E-02	4.50E-03	2.61E-05	0.066
L1-10204A-FSGS-002-SS	1.04E-02	8.25E-03	4.60E-03	2.25E-03	1.08E-05	0.026
L1-10204A-FSGS-003-SS	0.00E+00	1.60E-02	8.10E-03	0.00E+00	1.90E-05	0.024
L1-10204A-FSGS-004-SS	2.92E-02	0.00E+00	9.39E-03	6.29E-03	2.20E-05	0.045
L1-10204A-FSGS-005-SS	1.07E-02	1.28E-02	2.12E-03	2.31E-03	4.98E-06	0.028
L1-10204A-FSGS-006-SS	1.34E-02	1.70E-02	8.76E-03	2.88E-03	2.05E-05	0.042
L1-10204A-FSGS-007-SS	1.37E-02	0.00E+00	4.08E-03	2.96E-03	9.56E-06	0.021
L1-10204A-FSGS-008-SS	1.18E-02	1.31E-02	1.95E-03	2.55E-03	4.58E-06	0.029
L1-10204A-FSGS-009-SS	1.87E-02	1.02E-02	2.98E-03	4.03E-03	6.98E-06	0.036
L1-10204A-FSGS-010-SS	3.18E-02	1.85E-02	1.05E-02	6.85E-03	2.46E-05	0.068
L1-10204A-FSGS-011-SS	3.70E-02	1.66E-02	1.52E-02	7.97E-03	3.56E-05	0.077
L1-10204A-FSGS-012-SS	4.64E-03	5.18E-03	4.05E-03	9.98E-04	9.50E-06	0.015
L1-10204A-FSGS-013-SS	3.83E-02	1.08E-02	1.70E-02	8.25E-03	3.99E-05	0.074
L1-10204A-FSGS-014-SS	2.06E-02	4.84E-03	3.80E-03	4.44E-03	8.92E-06	0.034
L1-10204A-FSGS-015-SS	1.80E-02	8.60E-03	1.39E-02	3.87E-03	3.27E-05	0.044
L1-10204A-FSGS-016-SS	1.28E-02	7.44E-03	5.67E-05	2.76E-03	1.33E-07	0.023
L1-10204A-FSGS-017-SS	2.37E-02	2.05E-02	1.06E-02	5.11E-03	2.47E-05	0.060
L1-10204A-FSGS-018-SS	9.26E-04	3.65E-03	1.04E-02	1.99E-04	2.44E-05	0.015
L1-10204A-FSGS-019-SS	5.11E-02	2.33E-02	0.00E+00	1.10E-02	0.00E+00	0.085

Systematic Measurements

Number of Systematic Measurements =	19
# of Systematic Measurements with OpSOF $\geq$ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	0
Max Individual Systematic Measurement OpSOF =	0.085
Mean Systematic Measurement OpSOF =	0.044

Table 17 - 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	
L1-10204A-FSGS-007-SB	3.89E-03	1.95E-02	4.58E-03	3.17E-03	4.27E-05	0.031
L1-10204A-FSGS-012-SB	2.79E-02	2.18E-02	0.00E+00	2.27E-02	0.00E+00	0.072

Table 18 - 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	
L1-10204A-FQGS-009-SS	0.00E+00	0.00E+00	4.93E-03	0.00E+00	1.16E-05	0.005
L1-10204A-FQGS-019-SS	6.58E-02	3.84E-03	1.00E-02	1.42E-02	2.35E-05	0.094

Table 19 - Basic Statistical Properties of Systematic Sample Population

ROC	Mean (pCi/g)	Median (pCi/g)	Max (pCi/g)	Min (pCi/g)	Std. Dev. (pCi/g)	BcDCGL (pCi/g)	Avg. SOF per ROC	Avg. Dose Per ROC
Co-60	2.29E-02	2.04E-02	5.57E-02	0.00E+00	0.014	4.26	5.38E-03	1.35E-01
Cs-134	2.06E-02	1.88E-02	5.11E-02	0.00E+00	0.014	6.77	3.05E-03	7.62E-02
Cs-137	2.45E-02	1.67E-02	6.17E-02	0.00E+00	0.019	14.18	1.73E-03	4.33E-02
Ni-63	4.14E+00	3.68E+00	1.01E+01	0.00E+00	2.576	3572.1	1.16E-03	2.89E-02
Sr-90	4.91E-05	3.34E-05	1.23E-04	0.00E+00	0.000	12.09	4.06E-06	1.01E-04

The mean BcSOF for survey unit 10204A is 0.011, which equates to a dose of 0.283 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, L1-10204A-FQGS-009-SS and L1-10204A-FQGS-019-SS, from the systematic population using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in ZS-LT-01, *"Quality Assurance Project Plan (for Characterization and FSS)."* There was acceptable agreement between standard and comparison results. Refer to Attachment 5 for data and QC analysis results.

9. INVESTIGATIONS AND RESULTS

There were no investigations in survey unit 10204A.

10. REMEDIATION AND RESULTS

No remediation was performed in this survey unit.

11. CHANGES FROM THE SURVEY PLAN

There were no addendums to the FSS plan.

12. DATA QUALITY ASSESSMENT

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

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

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

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

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

13. ANOMALIES

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

14. CONCLUSION

Survey unit 10204A 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 exceeds 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 0.011, which results in a dose contribution from soil in survey unit 10204A of 0.283 mrem/year, 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 10204A is acceptable for unrestricted release.

15. REFERENCES

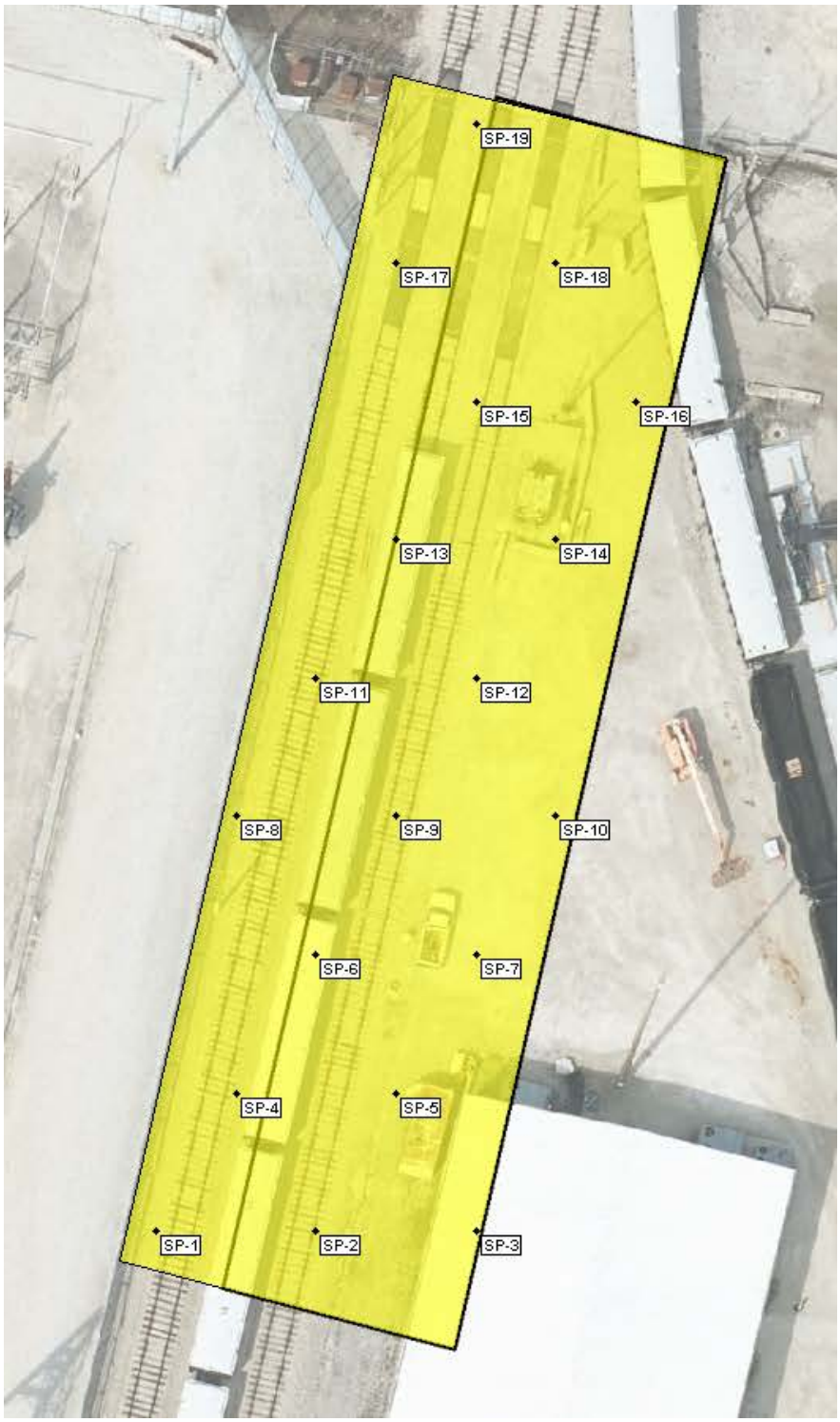
1. Zion*Solutions* procedure ZS-LT-300-001-005, "Final Status Survey Data Reporting"
2. Zion Station Restoration Project License Termination Plan
3. Zion*Solutions* procedure ZS-LT-300-001-001, "Final Status Survey Package Development"
4. NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation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

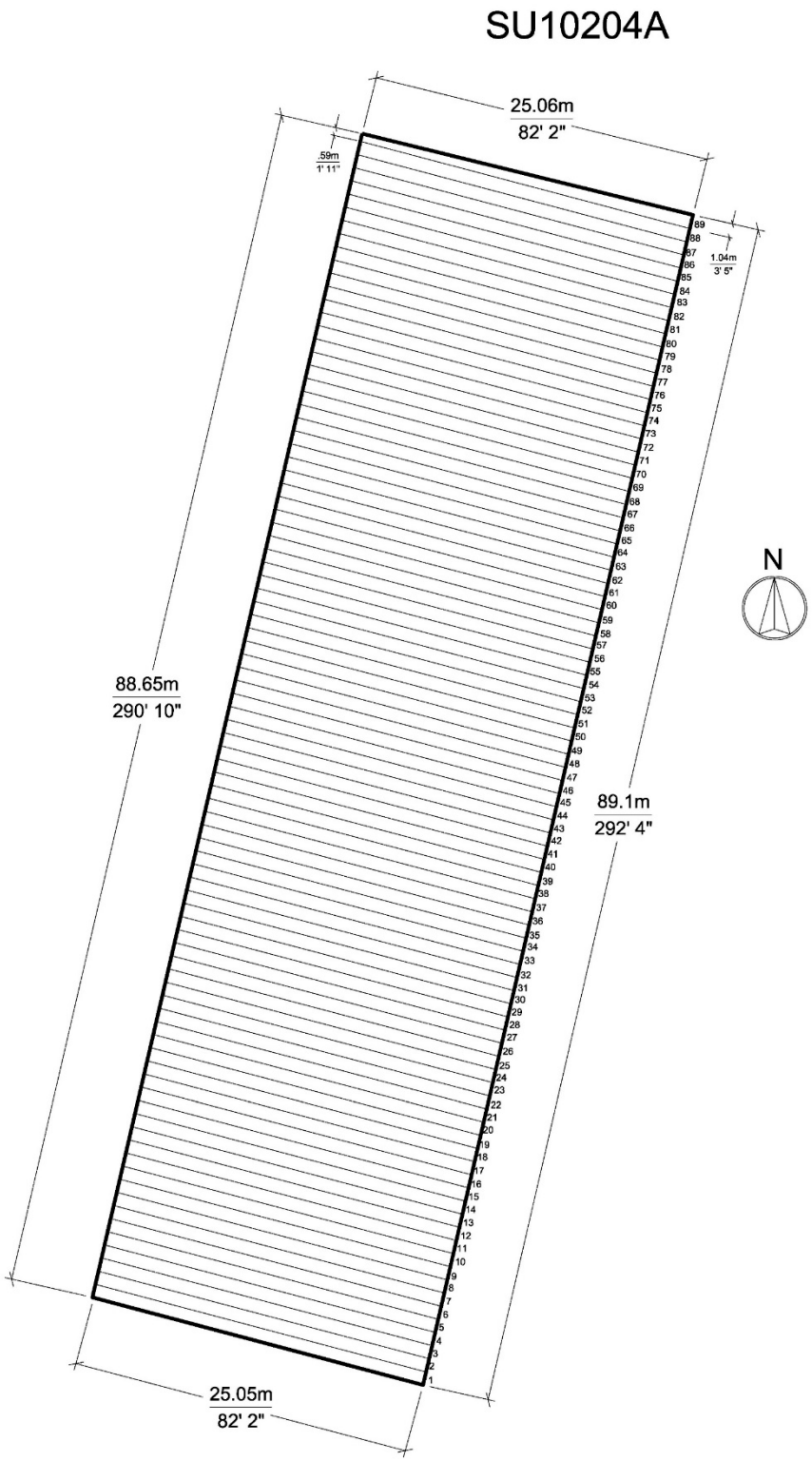
1. Attachment 1 - Figure and Map
2. Attachment 2 - Scan Data
3. Attachment 3 - Consultation Triggers for Residential and Commercial/Industrial Soil Contamination
4. Attachment 4 - Sign Test
5. Attachment 5 - QC Sample Assessment
6. Attachment 6 - Graphical Presentations
7. Attachment 7 - Sample Analytical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

ATTACHMENT 1
FIGURE AND MAP

Survey Unit 10204A Final Status Survey Boundaries and Systematic Sample Points



Survey Unit 10204A 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	ES0118	216173	10204A	GS001	11/15/2019 7:50	1887	1516	2104	No
44-10	ES0118	216173	10204A	GS002	11/15/2019 7:53	1973	1516	2104	No
44-10	ES0118	216173	10204A	GS003	11/15/2019 7:55	2026	1516	2104	No
44-10	ES0118	216173	10204A	GS004	11/15/2019 8:02	1945	1516	2104	No
44-10	ES0118	216173	10204A	GS005	11/15/2019 8:05	2056	1516	2104	No
44-10	ES0118	216173	10204A	GS006	11/15/2019 8:08	2049	1516	2104	No
44-10	ES0118	216173	10204A	GS007	11/15/2019 8:10	2008	1516	2104	No
44-10	ES0118	216173	10204A	GS008	11/15/2019 8:13	1999	1516	2104	No
44-10	ES0118	216173	10204A	GS009	11/15/2019 8:15	1909	1516	2104	No
44-10	ES0118	216173	10204A	GS010	11/15/2019 8:18	1930	1516	2104	No
44-10	ES0118	216173	10204A	GS011	11/15/2019 8:22	1846	1516	2104	No
44-10	ES0118	216173	10204A	GS012	11/15/2019 8:24	2017	1516	2104	No
44-10	ES0118	216173	10204A	GS013	11/15/2019 8:27	1757	1516	2104	No
44-10	ES0118	216173	10204A	GS014	11/15/2019 8:29	1761	1516	2104	No
44-10	ES0118	216173	10204A	GS015	11/15/2019 8:32	1758	1516	2104	No
44-10	PR311756	266669	10204A	GS016	11/15/2019 11:17	1682	1376	1937	No
44-10	PR311756	266669	10204A	GS016	11/15/2019 11:19	1170	949	1414	No
44-10	PR311756	266669	10204A	GS016	11/15/2019 11:20	1320	949	1414	No
44-10	PR311756	266669	10204A	GS017	11/15/2019 11:24	1765	1376	1937	No
44-10	PR311756	266669	10204A	GS017	11/15/2019 11:26	1060	949	1414	No
44-10	PR311756	266669	10204A	GS017	11/15/2019 11:27	1194	949	1414	No
44-10	PR311756	266669	10204A	GS018	11/15/2019 11:32	1332	1376	1937	No
44-10	PR311756	266669	10204A	GS018	11/15/2019 11:34	1116	949	1414	No
44-10	PR311756	266669	10204A	GS018	11/15/2019 11:36	1156	949	1414	No
44-10	PR311756	266669	10204A	GS019	11/15/2019 12:31	2547	2404	3145	No
44-10	PR311756	266669	10204A	GS019	11/15/2019 12:33	1137	949	1414	No
44-10	PR311756	266669	10204A	GS019	11/15/2019 12:34	1188	949	1414	No
44-10	PR311756	266669	10204A	GS020	11/15/2019 12:38	2645	2404	3145	No
44-10	PR311756	266669	10204A	GS020	11/15/2019 12:40	1117	949	1414	No
44-10	PR311756	266669	10204A	GS020	11/15/2019 12:42	1214	949	1414	No
44-10	PR311756	266669	10204A	GS021	11/15/2019 12:48	2403	2404	3145	No
44-10	PR311756	266669	10204A	GS021	11/15/2019 12:50	1158	949	1414	No
44-10	PR311756	266669	10204A	GS021	11/15/2019 12:51	1203	949	1414	No
44-10	PR311756	266669	10204A	GS022	11/15/2019 12:55	2424	2404	3145	No
44-10	PR311756	266669	10204A	GS022	11/15/2019 12:57	1359	949	1414	No
44-10	PR311756	266669	10204A	GS022	11/15/2019 12:58	1202	949	1414	No
44-10	PR311756	266669	10204A	GS023	11/15/2019 13:03	2111	2404	3145	No
44-10	PR311756	266669	10204A	GS023	11/15/2019 13:05	1374	949	1414	No
44-10	PR311756	266669	10204A	GS023	11/15/2019 13:07	1258	949	1414	No
44-10	PR311756	266669	10204A	GS024	11/15/2019 13:11	1550	1376	1937	No
44-10	PR311756	266669	10204A	GS024	11/15/2019 13:14	1407	949	1414	No
44-10	PR311756	266669	10204A	GS024	11/15/2019 13:15	1139	949	1414	No
44-10	PR311756	266669	10204A	GS025	11/15/2019 13:19	1486	1376	1937	No
44-10	PR311756	266669	10204A	GS025	11/15/2019 13:21	958	949	1414	No
44-10	PR311756	266669	10204A	GS025	11/15/2019 13:23	1210	949	1414	No
44-10	PR311756	266669	10204A	GS026	11/15/2019 13:36	1414	1376	1937	No
44-10	PR311756	266669	10204A	GS026	11/15/2019 13:38	1058	949	1414	No
44-10	PR311756	266669	10204A	GS027	11/15/2019 13:43	1441	1376	1937	No
44-10	PR311756	266669	10204A	GS027	11/15/2019 13:45	1167	949	1414	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	PR311756	266669	10204A	GS027	11/15/2019 13:47	1226	949	1414	No
44-10	PR311756	266669	10204A	GS028	11/15/2019 13:51	1380	1376	1937	No
44-10	PR311756	266669	10204A	GS028	11/15/2019 13:54	1039	949	1414	No
44-10	PR311756	266669	10204A	GS028	11/15/2019 13:56	1171	949	1414	No
44-10	PR311756	266669	10204A	GS029	11/15/2019 14:00	1476	1376	1937	No
44-10	PR311756	266669	10204A	GS029	11/15/2019 14:02	1018	949	1414	No
44-10	PR311756	266669	10204A	GS029	11/15/2019 14:04	1256	949	1414	No
44-10	PR311756	266669	10204A	GS030	11/15/2019 14:07	1486	1376	1937	No
44-10	PR311756	266669	10204A	GS030	11/15/2019 14:09	1000	949	1414	No
44-10	PR311756	266669	10204A	GS030	11/15/2019 14:11	1154	949	1414	No
44-10	PR311750	266656	10204A	GS031	11/15/2019 9:33	1617	1309	1856	No
44-10	PR311750	266656	10204A	GS032	11/15/2019 9:43	1518	1309	1856	No
44-10	PR311750	266656	10204A	GS033	11/15/2019 9:46	1638	1309	1856	No
44-10	PR311750	266656	10204A	GS034	11/15/2019 9:49	1576	1309	1856	No
44-10	PR311750	266656	10204A	GS035	11/15/2019 9:51	1539	1309	1856	No
44-10	PR311750	266656	10204A	BS036	11/15/2019 9:55	1548	1309	1856	No
44-10	PR311750	266656	10204A	GS037	11/15/2019 9:57	1587	1309	1856	No
44-10	PR311750	266656	10204A	GS038	11/15/2019 10:00	1728	1309	1856	No
44-10	PR311750	266656	10204A	GS039	11/15/2019 10:02	1629	1309	1856	No
44-10	PR311750	266656	10204A	GS040	11/15/2019 10:04	1597	1309	1856	No
44-10	PR311750	266656	10204A	GS041	11/15/2019 10:07	1613	1309	1856	No
44-10	PR311750	266656	10204A	GS042	11/15/2019 10:10	1697	1309	1856	No
44-10	PR311750	266656	10204A	GS043	11/15/2019 10:12	1635	1309	1856	No
44-10	PR311750	266656	10204A	GS044	11/15/2019 10:14	1834	1309	1856	No
44-10	PR311750	266656	10204A	GS045	11/15/2019 10:17	1626	1309	1856	No
44-10	PR311750	266656	10204A	GS031	11/15/2019 12:26	1255	1089	1588	No
44-10	PR311750	266656	10204A	GS031	11/15/2019 12:28	1380	1089	1588	No
44-10	PR311750	266656	10204A	GS032	11/15/2019 12:30	1293	1089	1588	No
44-10	PR311750	266656	10204A	GS032	11/15/2019 12:33	1192	1089	1588	No
44-10	PR311750	266656	10204A	GS033	11/15/2019 12:35	1306	1089	1588	No
44-10	PR311750	266656	10204A	GS033	11/15/2019 12:38	1260	1089	1588	No
44-10	PR311750	266656	10204A	GS034	11/15/2019 12:40	1366	1089	1588	No
44-10	PR311750	266656	10204A	GS034	11/15/2019 12:42	1356	1089	1588	No
44-10	PR311750	266656	10204A	GS035	11/15/2019 12:45	1432	1089	1588	No
44-10	PR311750	266656	10204A	GS035	11/15/2019 12:47	1297	1089	1588	No
44-10	PR311750	266656	10204A	GS036	11/15/2019 12:49	1337	1089	1588	No
44-10	PR311750	266656	10204A	GS036	11/15/2019 12:51	1169	1089	1588	No
44-10	PR311750	266656	10204A	GS037	11/15/2019 12:54	1323	1089	1588	No
44-10	PR311750	266656	10204A	GS037	11/15/2019 12:56	1316	1089	1588	No
44-10	PR311750	266656	10204A	GS038	11/15/2019 12:59	1296	1089	1588	No
44-10	PR311750	266656	10204A	GS038	11/15/2019 13:01	1228	1089	1588	No
44-10	PR311750	266656	10204A	GS039	11/15/2019 13:03	1364	1089	1588	No
44-10	PR311750	266656	10204A	GS039	11/15/2019 13:05	1328	1089	1588	No
44-10	PR311750	266656	10204A	GS040	11/15/2019 13:07	1384	1089	1588	No
44-10	PR311750	266656	10204A	GS040	11/15/2019 13:10	1226	1089	1588	No
44-10	PR311750	266656	10204A	GS041	11/15/2019 13:13	1393	1089	1588	No
44-10	PR311750	266656	10204A	GS041	11/15/2019 13:15	1396	1089	1588	No
44-10	PR311750	266656	10204A	GS042	11/15/2019 13:17	1301	1089	1588	No
44-10	PR311750	266656	10204A	GS042	11/15/2019 13:19	1219	1089	1588	No
44-10	PR311750	266656	10204A	GS043	11/15/2019 13:27	1317	1089	1588	No
44-10	PR311750	266656	10204A	GS043	11/15/2019 13:31	1259	1089	1588	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR311750	266656	10204A	GS044	11/15/2019 13:35	1244	1089	1588	No
44-10	PR311750	266656	10204A	GS044	11/15/2019 13:37	1221	1089	1588	No
44-10	PR311750	266656	10204A	GS045	11/15/2019 13:40	1372	1089	1588	No
44-10	PR311750	266656	10204A	GS045	11/15/2019 13:42	1278	1089	1588	No
44-10	PR375273	304730	10204A	GS046	11/15/2019 9:52	1794	1483	2066	No
44-10	PR375273	304730	10204A	GS047	11/15/2019 9:54	1691	1483	2066	No
44-10	PR375273	304730	10204A	GS048	11/15/2019 9:56	1754	1483	2066	No
44-10	PR375273	304730	10204A	GS049	11/15/2019 9:58	1799	1483	2066	No
44-10	PR375273	304730	10204A	GS050	11/15/2019 10:00	1903	1483	2066	No
44-10	PR375273	304730	10204A	GS051	11/15/2019 10:02	1701	1483	2066	No
44-10	PR375273	304730	10204A	GS052	11/15/2019 10:04	1831	1483	2066	No
44-10	PR375273	304730	10204A	GS053	11/15/2019 10:06	1798	1483	2066	No
44-10	PR375273	304730	10204A	GS054	11/15/2019 10:08	1888	1483	2066	No
44-10	PR375273	304730	10204A	GS055	11/15/2019 10:10	1695	1483	2066	No
44-10	PR375273	304730	10204A	GS056	11/15/2019 10:12	1801	1483	2066	No
44-10	PR375273	304730	10204A	GS057	11/15/2019 10:14	1750	1483	2066	No
44-10	PR375273	304730	10204A	GS058	11/15/2019 10:16	1887	1483	2066	No
44-10	PR375273	304730	10204A	GS059	11/15/2019 10:18	1886	1483	2066	No
44-10	PR375273	304730	10204A	GS060	11/15/2019 10:20	1882	1483	2066	No
44-10	PR375273	304730	10204A	GS046	11/15/2019 10:32	1181	1000	1479	No
44-10	PR375273	304730	10204A	GS046	11/15/2019 10:34	1453	1000	1479	No
44-10	PR375273	304730	10204A	GS047	11/15/2019 10:36	1393	1000	1479	No
44-10	PR375273	304730	10204A	GS047	11/15/2019 10:38	1320	1000	1479	No
44-10	PR375273	304730	10204A	GS048	11/15/2019 12:30	1371	1000	1479	No
44-10	PR375273	304730	10204A	GS048	11/15/2019 12:32	1384	1000	1479	No
44-10	PR375273	304730	10204A	GS049	11/15/2019 12:34	1441	1000	1479	No
44-10	PR375273	304730	10204A	GS049	11/15/2019 12:36	1260	1000	1479	No
44-10	PR375273	304730	10204A	GS050	11/15/2019 12:38	1228	1000	1479	No
44-10	PR375273	304730	10204A	GS050	11/15/2019 12:40	1358	1000	1479	No
44-10	PR375273	304730	10204A	GS051	11/15/2019 12:44	1271	1000	1479	No
44-10	PR375273	304730	10204A	GS051	11/15/2019 12:46	1285	1000	1479	No
44-10	PR375273	304730	10204A	GS052	11/15/2019 12:48	1300	1000	1479	No
44-10	PR375273	304730	10204A	GS052	11/15/2019 12:50	1136	1000	1479	No
44-10	PR375273	304730	10204A	GS053	11/15/2019 12:52	1172	1000	1479	No
44-10	PR375273	304730	10204A	GS053	11/15/2019 12:54	1129	1000	1479	No
44-10	PR375273	304730	10204A	GS054	11/15/2019 12:56	1312	1000	1479	No
44-10	PR375273	304730	10204A	GS054	11/15/2019 12:58	1475	1000	1479	No
44-10	PR375273	304730	10204A	GS055	11/15/2019 13:00	1246	1000	1479	No
44-10	PR375273	304730	10204A	GS056	11/15/2019 13:04	1140	1000	1479	No
44-10	PR375273	304730	10204A	GS056	11/15/2019 13:06	1352	1000	1479	No
44-10	PR375273	304730	10204A	GS057	11/15/2019 13:08	1390	1000	1479	No
44-10	PR375273	304730	10204A	GS057	11/15/2019 13:10	1103	1000	1479	No
44-10	PR375273	304730	10204A	GS058	11/15/2019 13:12	1253	1000	1479	No
44-10	PR375273	304730	10204A	GS058	11/15/2019 13:14	1365	1000	1479	No
44-10	PR375273	304730	10204A	GS059	11/15/2019 13:16	1354	1000	1479	No
44-10	PR375273	304730	10204A	GS059	11/15/2019 13:18	1179	1000	1479	No
44-10	PR375273	304730	10204A	GS060	11/15/2019 13:20	1203	1000	1479	No
44-10	PR375273	304730	10204A	GS060	11/15/2019 13:22	1430	1000	1479	No
44-10	PR363311	304718	10204A	GS061	11/15/2019 9:54	1766	1632	2243	No
44-10	PR363311	304718	10204A	GS062	11/15/2019 9:56	1767	1632	2243	No
44-10	PR363311	304718	10204A	GS063	11/15/2019 9:58	1733	1632	2243	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	PR363311	304718	10204A	GS064	11/15/2019 10:00	1769	1632	2243	No
44-10	PR363311	304718	10204A	GS065	11/15/2019 10:02	1913	1632	2243	No
44-10	PR363311	304718	10204A	GS066	11/15/2019 10:04	1753	1632	2243	No
44-10	PR363311	304718	10204A	GS067	11/15/2019 10:06	1824	1632	2243	No
44-10	PR363311	304718	10204A	GS068	11/15/2019 10:08	1682	1632	2243	No
44-10	PR363311	304718	10204A	GS069	11/15/2019 10:10	1835	1632	2243	No
44-10	PR363311	304718	10204A	GS070	11/15/2019 10:12	1790	1632	2243	No
44-10	PR363311	304718	10204A	GS071	11/15/2019 10:16	1867	1632	2243	No
44-10	PR363311	304718	10204A	GS072	11/15/2019 10:18	2179	1632	2243	No
44-10	PR363311	304718	10204A	GS073	11/15/2019 10:20	2071	1632	2243	No
44-10	PR363311	304718	10204A	GS074	11/15/2019 10:22	2156	1632	2243	No
44-10	PR363311	304718	10204A	GS075	11/15/2019 10:28	2165	1632	2243	No
44-10	PR363311	304718	10204A	GS061	11/15/2019 12:56	1654	1208	1734	No
44-10	PR363311	304718	10204A	GS061	11/15/2019 13:01	1407	1208	1734	No
44-10	PR363311	304718	10204A	GS062	11/15/2019 13:05	1384	1208	1734	No
44-10	PR363311	304718	10204A	GS062	11/15/2019 13:07	1293	1208	1734	No
44-10	PR363311	304718	10204A	GS063	11/15/2019 13:09	1468	1208	1734	No
44-10	PR363311	304718	10204A	GS063	11/15/2019 13:11	1579	1208	1734	No
44-10	PR363311	304718	10204A	GS064	11/15/2019 13:14	1379	1208	1734	No
44-10	PR363311	304718	10204A	GS064	11/15/2019 13:16	1365	1208	1734	No
44-10	PR363311	304718	10204A	GS065	11/15/2019 13:18	1290	1208	1734	No
44-10	PR363311	304718	10204A	GS065	11/15/2019 13:20	1230	1208	1734	No
44-10	PR363311	304718	10204A	GS066	11/15/2019 13:22	1342	1208	1734	No
44-10	PR363311	304718	10204A	GS066	11/15/2019 13:24	1374	1208	1734	No
44-10	PR363311	304718	10204A	GS067	11/15/2019 13:26	1309	1208	1734	No
44-10	PR363311	304718	10204A	GS067	11/15/2019 13:28	1357	1208	1734	No
44-10	PR363311	304718	10204A	GS068	11/15/2019 13:30	1463	1208	1734	No
44-10	PR363311	304718	10204A	GS068	11/15/2019 13:32	1590	1208	1734	No
44-10	PR363311	304718	10204A	GS069	11/15/2019 13:34	1596	1208	1734	No
44-10	PR363311	304718	10204A	GS069	11/15/2019 13:36	1495	1208	1734	No
44-10	PR363311	304718	10204A	GS070	11/15/2019 13:38	1421	1208	1734	No
44-10	PR363311	304718	10204A	GS070	11/15/2019 13:40	1615	1208	1734	No
44-10	PR363311	304718	10204A	GS071	11/15/2019 13:42	1520	1208	1734	No
44-10	PR363311	304718	10204A	GS071	11/15/2019 13:44	1673	1208	1734	No
44-10	PR363311	304718	10204A	GS072	11/15/2019 13:46	1666	1208	1734	No
44-10	PR363311	304718	10204A	GS072	11/15/2019 13:48	1550	1208	1734	No
44-10	PR363311	304718	10204A	GS073	11/15/2019 13:50	1616	1208	1734	No
44-10	PR363311	304718	10204A	GS073	11/15/2019 13:52	1604	1208	1734	No
44-10	PR363311	304718	10204A	GS074	11/15/2019 13:54	1637	1208	1734	No
44-10	PR363311	304718	10204A	GS074	11/15/2019 13:56	1558	1208	1734	No
44-10	PR363311	304718	10204A	GS075	11/15/2019 13:58	1649	1208	1734	No
44-10	PR363311	304718	10204A	GS075	11/15/2019 14:00	1559	1208	1734	No
44-10	PR321892	304708	10204A	GS076	11/15/2019 10:10	3692	3041	3875	No
44-10	PR321892	304708	10204A	GS077	11/15/2019 10:14	3655	3041	3875	No
44-10	PR321892	304708	10204A	GS078	11/15/2019 10:16	3649	3041	3875	No
44-10	PR321892	304708	10204A	GS079	11/15/2019 10:19	3536	3041	3875	No
44-10	PR321892	304708	10204A	GS080	11/15/2019 10:23	3752	3041	3875	No
44-10	PR321892	304708	10204A	GS081	11/15/2019 10:26	3617	3041	3875	No
44-10	PR321892	304708	10204A	GS082	11/15/2019 10:30	3687	3041	3875	No
44-10	PR321892	304708	10204A	GS083	11/15/2019 12:49	1889	1554	2150	No
44-10	PR321892	304708	10204A	GS083	11/15/2019 12:52	1773	1554	2150	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	PR321892	304708	10204A	GS083	11/15/2019 12:54	1697	1554	2150	No
44-10	PR321892	304708	10204A	GS084	11/15/2019 12:56	1689	1554	2150	No
44-10	PR321892	304708	10204A	GS084	11/15/2019 12:58	1805	1554	2150	No
44-10	PR321892	304708	10204A	GS084	11/15/2019 13:00	1740	1554	2150	No
44-10	PR321892	304708	10204A	GS085	11/15/2019 13:04	1839	1554	2150	No
44-10	PR321892	304708	10204A	GS085	11/15/2019 13:06	1684	1554	2150	No
44-10	PR321892	304708	10204A	GS085	11/15/2019 13:09	1695	1554	2150	No
44-10	PR321892	304708	10204A	GS086	11/15/2019 13:15	1625	1554	2150	No
44-10	PR321892	304708	10204A	GS086	11/15/2019 13:19	1966	1554	2150	No
44-10	PR321892	304708	10204A	GS086	11/15/2019 13:22	1920	1554	2150	No
44-10	PR321892	304708	10204A	GS087	11/15/2019 13:24	1917	1554	2150	No
44-10	PR321892	304708	10204A	GS087	11/15/2019 13:26	1786	1554	2150	No
44-10	PR321892	304708	10204A	GS087	11/15/2019 13:28	1668	1554	2150	No
44-10	PR321892	304708	10204A	GS088	11/15/2019 13:31	1721	1554	2150	No
44-10	PR321892	304708	10204A	GS088	11/15/2019 13:33	1692	1554	2150	No
44-10	PR321892	304708	10204A	GS088	11/15/2019 13:35	1687	1554	2150	No
44-10	PR321892	304708	10204A	GS089	11/15/2019 13:40	1865	1554	2150	No
44-10	PR321892	304708	10204A	GS089	11/15/2019 13:42	1564	1554	2150	No
44-10	PR321892	304708	10204A	GS089	11/15/2019 13:47	1586	1554	2150	No
44-10	PR321892	304708	10204A	GS082	11/15/2019 13:51	1613	1554	2150	No
44-10	PR321892	304708	10204A	GS082	11/15/2019 13:55	1906	1554	2150	No
44-10	PR321892	304708	10204A	GS081	11/15/2019 14:00	1597	1554	2150	No
44-10	PR321892	304708	10204A	GS081	11/15/2019 14:02	1621	1554	2150	No
44-10	PR321892	304708	10204A	GS080	11/15/2019 14:04	1601	1554	2150	No
44-10	PR321892	304708	10204A	GS080	11/15/2019 14:06	1657	1554	2150	No
44-10	PR321892	304708	10204A	GS079	11/15/2019 14:08	1637	1554	2150	No
44-10	PR321892	304708	10204A	GS079	11/15/2019 14:10	1688	1554	2150	No
44-10	PR321892	304708	10204A	GS078	11/15/2019 14:12	1624	1554	2150	No
44-10	PR321892	304708	10204A	GS078	11/15/2019 14:14	1665	1554	2150	No
44-10	PR321892	304708	10204A	GS077	11/15/2019 14:16	1656	1554	2150	No
44-10	PR321892	304708	10204A	GS077	11/15/2019 14:18	1654	1554	2150	No
44-10	PR321892	304708	10204A	GS076	11/15/2019 14:20	1572	1554	2150	No
44-10	PR321892	304708	10204A	GS076	11/15/2019 14:22	1599	1554	2150	No
44-10	PR375273	304730	10204A	GS055	11/16/2019 8:50	1422	1354	1911	No

ATTACHMENT 3

CONSULTATION TRIGGERS FOR RESIDENTIAL AND COMMERCIAL/INDUSTRIAL SOIL CONTAMINATION

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

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

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

ATTACHMENT 4
SIGN TEST

Survey Area: No. 10200 **Description:** Radiological Restricted Area Grounds
Survey Unit: No. 10204A **Description:** North Gate Area
Classification: 1 **Type I (α) Error:** 0.05 **Number of Samples:** 19

#	Fraction of the Release Criterion						Weighted Sum (W_s)	1-W_s	Sign
	Radionuclides of Concern								
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	OpSOF			
1	2.09E-02	2.95E-02	1.11E-02	4.50E-03	2.61E-05	SOF	0.066	0.934	+
2	1.04E-02	8.25E-03	4.60E-03	2.25E-03	1.08E-05	SOF	0.026	0.974	+
3	0.00E+00	1.60E-02	8.10E-03	0.00E+00	1.90E-05	SOF	0.024	0.976	+
4	2.92E-02	0.00E+00	9.39E-03	6.29E-03	2.20E-05	SOF	0.045	0.955	+
5	1.07E-02	1.28E-02	2.12E-03	2.31E-03	4.98E-06	SOF	0.028	0.972	+
6	1.34E-02	1.70E-02	8.76E-03	2.88E-03	2.05E-05	SOF	0.042	0.958	+
7	1.37E-02	0.00E+00	4.08E-03	2.96E-03	9.56E-06	SOF	0.021	0.979	+
8	1.18E-02	1.31E-02	1.95E-03	2.55E-03	4.58E-06	SOF	0.029	0.971	+
9	1.87E-02	1.02E-02	2.98E-03	4.03E-03	6.98E-06	SOF	0.036	0.964	+
10	3.18E-02	1.85E-02	1.05E-02	6.85E-03	2.46E-05	SOF	0.068	0.932	+
11	3.70E-02	1.66E-02	1.52E-02	7.97E-03	3.56E-05	SOF	0.077	0.923	+
12	4.64E-03	5.18E-03	4.05E-03	9.98E-04	9.50E-06	SOF	0.015	0.985	+
13	3.83E-02	1.08E-02	1.70E-02	8.25E-03	3.99E-05	SOF	0.074	0.926	+
14	2.06E-02	4.84E-03	3.80E-03	4.44E-03	8.92E-06	SOF	0.034	0.966	+
15	1.80E-02	8.60E-03	1.39E-02	3.87E-03	3.27E-05	SOF	0.044	0.956	+
16	1.28E-02	7.44E-03	5.67E-05	2.76E-03	1.33E-07	SOF	0.023	0.977	+
17	2.37E-02	2.05E-02	1.06E-02	5.11E-03	2.47E-05	SOF	0.060	0.940	+
18	9.26E-04	3.65E-03	1.04E-02	1.99E-04	2.44E-05	SOF	0.015	0.985	+
19	5.11E-02	2.33E-02	0.00E+00	1.10E-02	0.00E+00	SOF	0.085	0.915	+

Critical Value (Table I.3 of MARSSIM) = **13** Number of Positive Differences (S+) = **19**

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

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #:	10200	Survey Unit #:	10204A	Survey Unit Name:	North Gate Area
Sample Plan#:	L1-10204A-F				

Sample Description: Comparison of split samples collected from surface soil sample locations #9 and #19 and analyzed using gamma spectroscopy by on-site HPGe system. The standard/comparison samples were L1-10204A-FSGS-009-SS/L1-10204A-FQGS-009-SS and L1-10204A-FSGS-019-SS/L1-10204A-FQGS-019-SS.

	STANDARD				COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
L1-10204A-FSGS-009-SS/L1-10204A-FQGS-009-SS								
K-40	2.97E+00	3.17E-01	9.37	0.6 - 1.66	3.50E+00	3.46E-01	0.85	Y
L1-10204A-FSGS-019-SS/L1-10204A-FQGS-019-SS								
K-40	5.72E+00	4.66E-01	12.27	0.6 - 1.66	5.20E+00	4.56E-01	1.1	Y

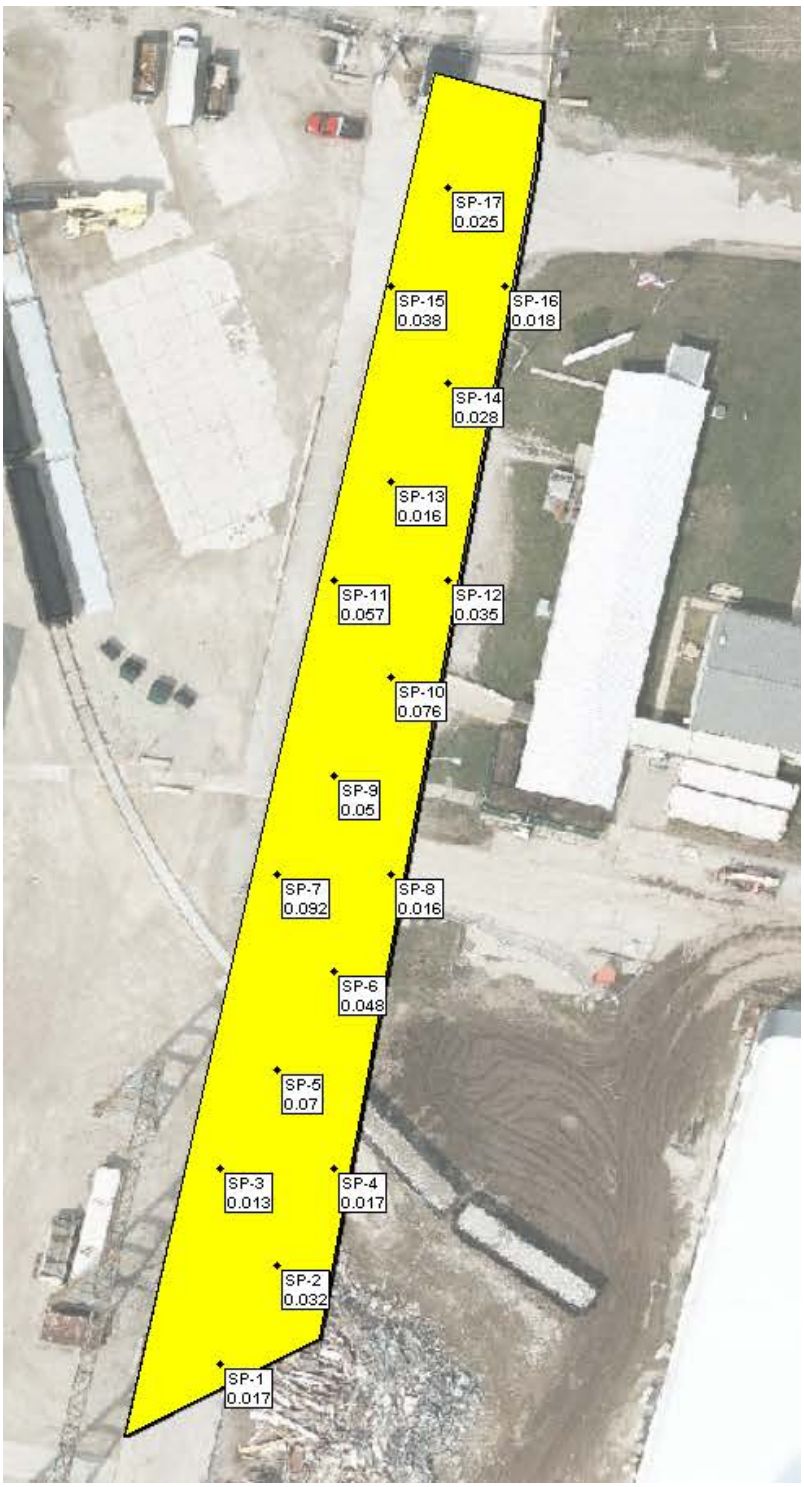
Comments/Corrective Actions:
For both sample pairs, the standard sample and QC sample did not both have a positive result for a gamma emitting ROC, therefore K-40 was used in the QC comparison. There was acceptable agreement when using K-40. No further action is necessary.

Table 4-1 from ZS-LT-01 is reproduced below to show acceptance criteria used to assess split samples.

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

ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot

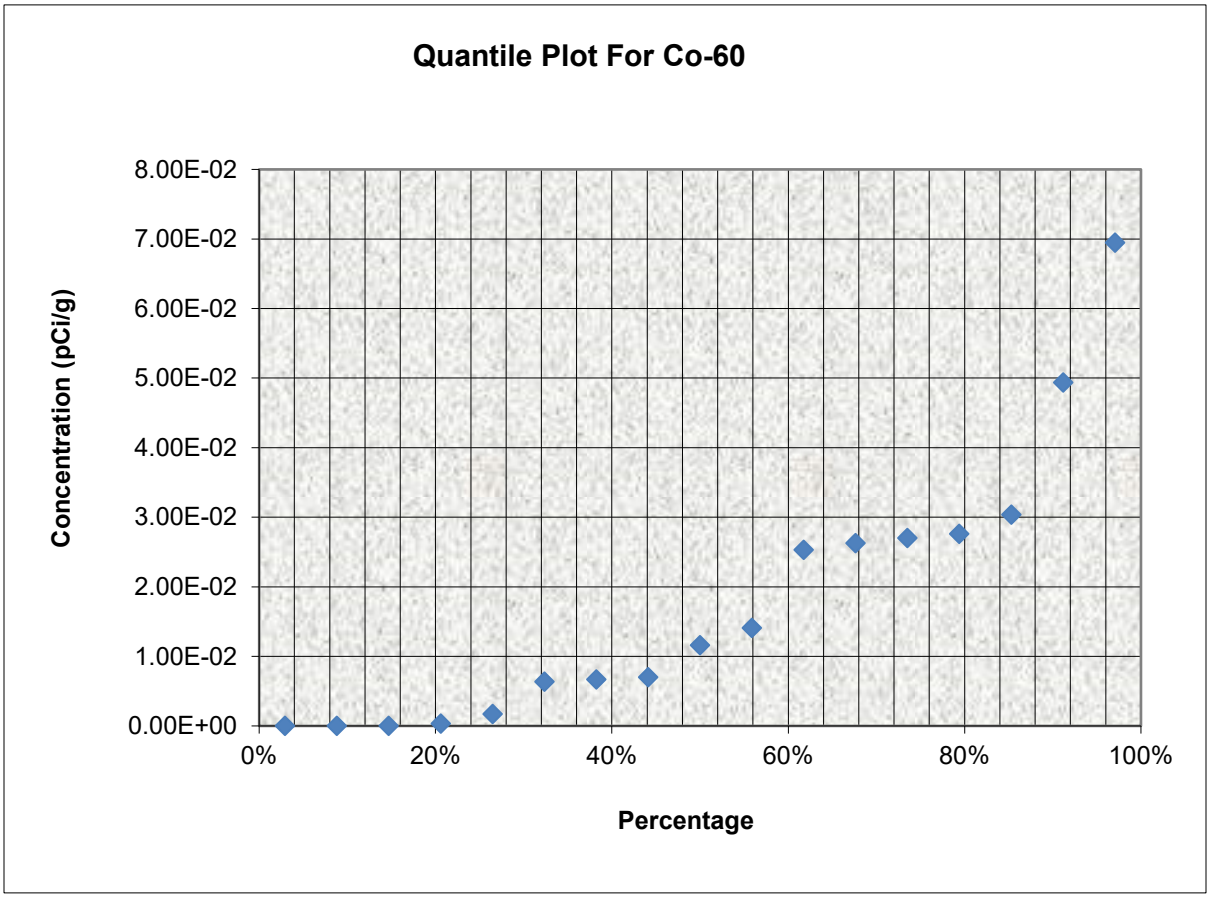


QUANTILE PLOT FOR Co-60

Survey Unit: 10204A

Survey Unit Name: North Gate Area

Mean: 1.78E-02 pCi/g

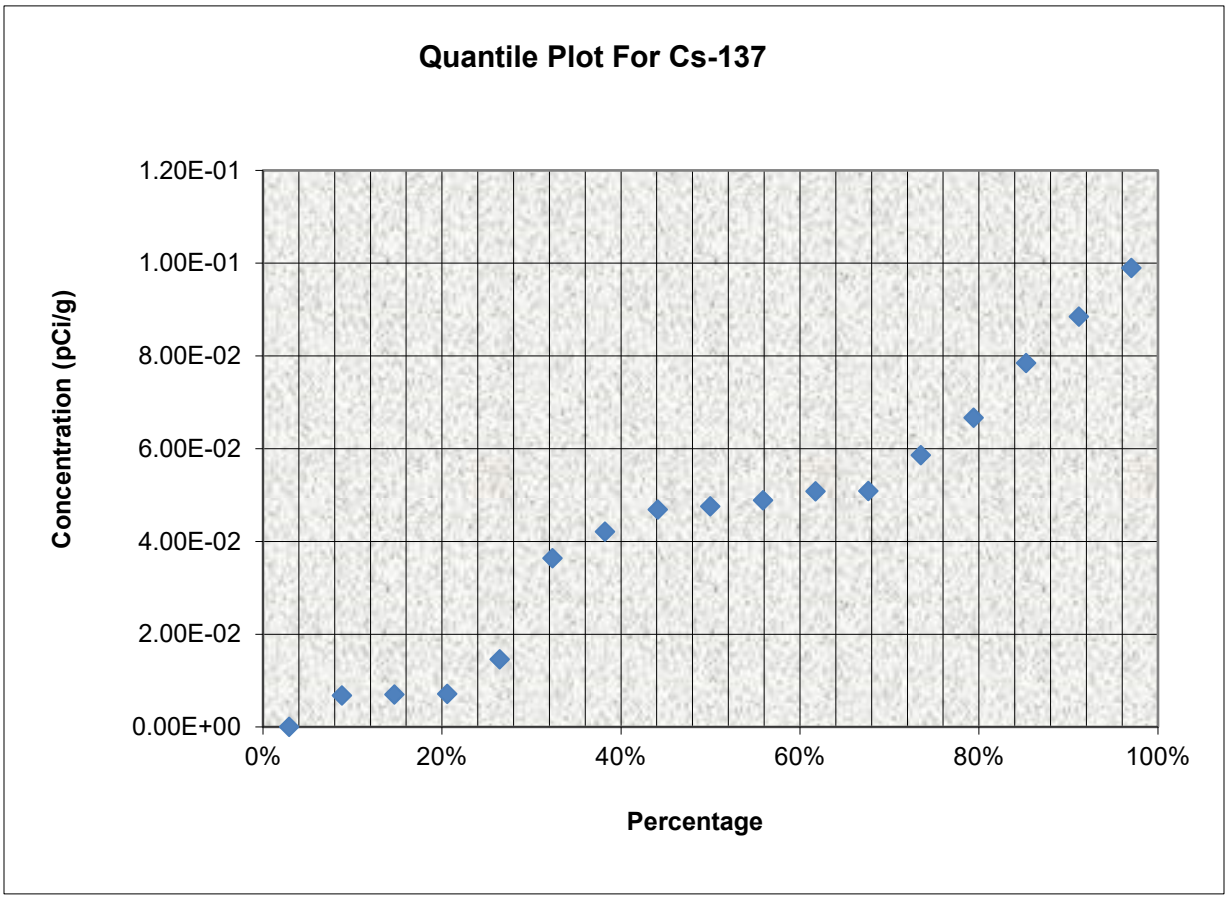


QUANTILE PLOT FOR Cs-137

Survey Unit: 10204A

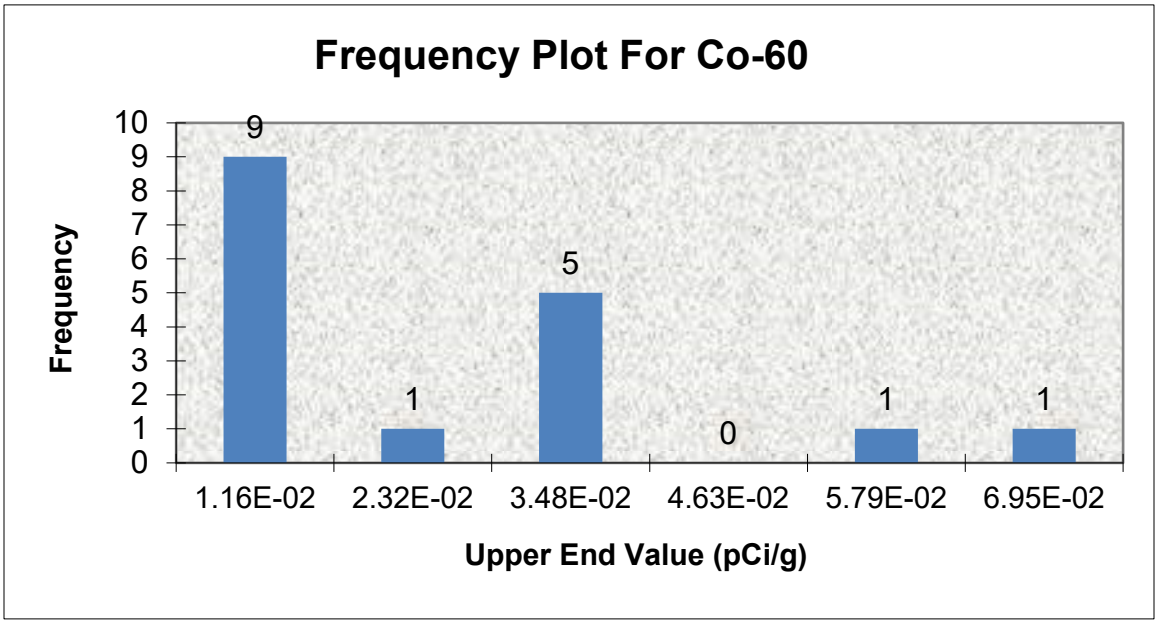
Survey Unit Name: North Gate Area

Mean: 4.41E-02 pCi/g



HISTOGRAM FOR Co-60

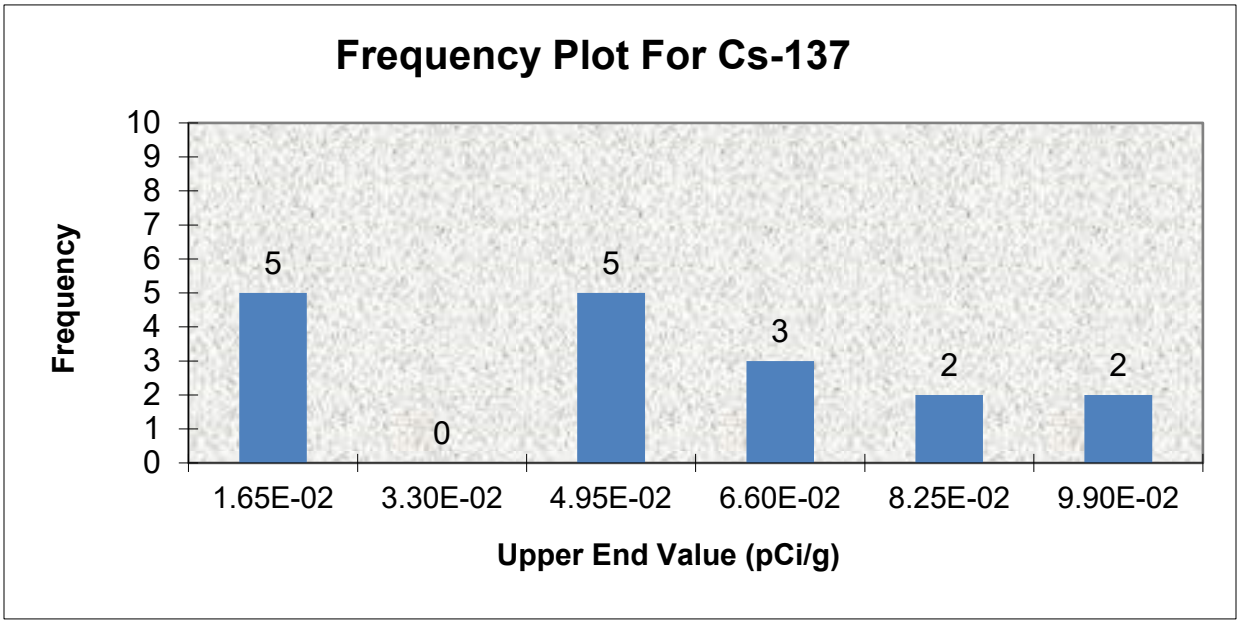
Survey Unit:	10204A	
Survey Unit Name:	North Gate Area	
Mean:	1.78E-02	pCi/g
Median:	1.16E-02	pCi/g
ST DEV:	0.019	
Skew:	1.368	



Upper Value	Observation Frequency	Observation %
1.16E-02	9	53%
2.32E-02	1	6%
3.48E-02	5	29%
4.63E-02	0	0%
5.79E-02	1	6%
6.95E-02	1	6%
TOTAL	17	100%

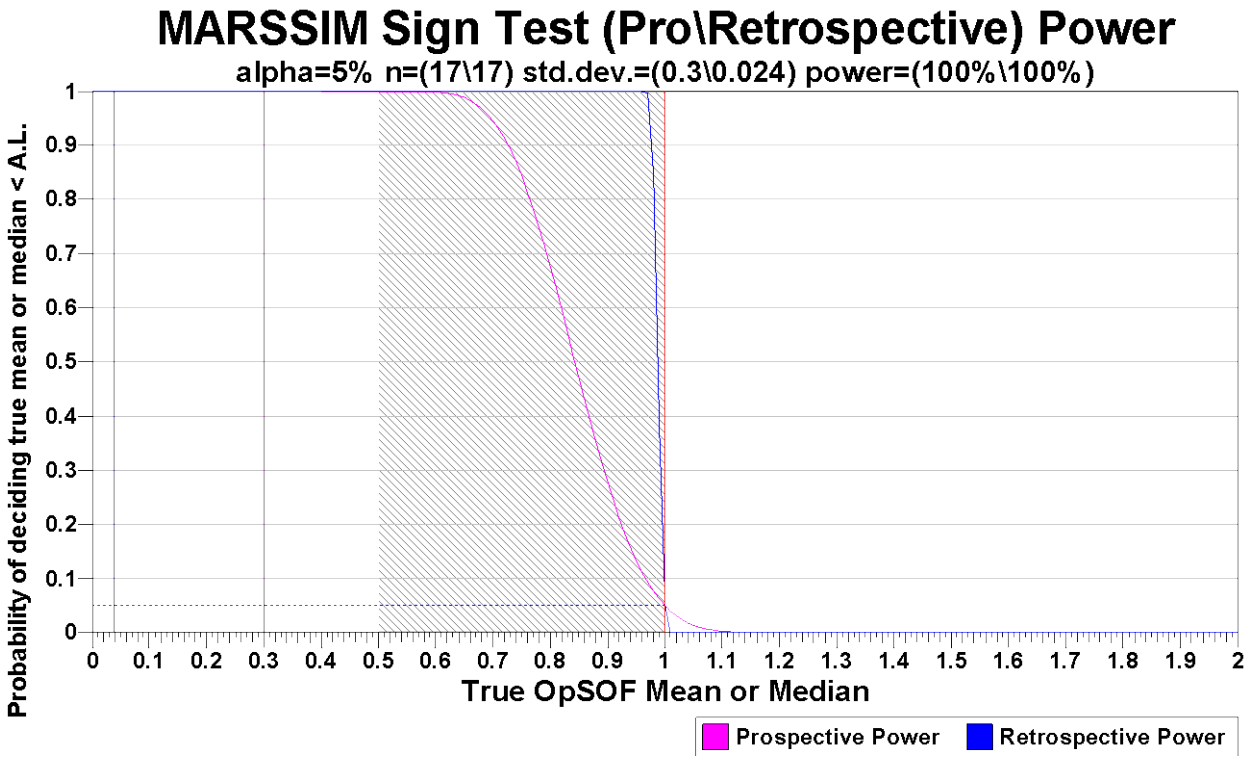
HISTOGRAM FOR Cs-137

Survey Unit:	10204A	
Survey Unit Name:	North Gate Area	
Mean:	4.41E-02	pCi/g
Median:	4.76E-02	pCi/g
ST DEV:	0.030	
Skew:	0.115	



Upper Value	Observation Frequency	Observation %
1.65E-02	5	29%
3.30E-02	0	0%
4.95E-02	5	29%
6.60E-02	3	18%
8.25E-02	2	12%
9.90E-02	2	12%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Unit 10204A



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 18-Nov-19-10014

L1-10204A-FSGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10014
Sample Description	: L1-10204A-FSGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.615E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:30:00PM
Acquisition Started	: 11/18/2019 10:03:29AM
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	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81351
Fill Height	: 1614.79 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 10:18:34AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500
JGraham

Analysis Report for 18-Nov-19-10014

L1-10204A-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	950 -	959	954.56	1.38E+02	14.81	3.61E+01	1.01
2	352.02	1401 -	1414	1407.82	7.70E+01	12.42	2.80E+01	0.92
3	583.31	2325 -	2338	2332.46	4.74E+01	8.92	1.16E+01	1.15
4	609.32	2431 -	2444	2436.45	5.99E+01	9.19	9.14E+00	1.16
5	911.20	3637 -	3649	3643.74	3.15E+01	7.87	1.15E+01	0.37
6	1460.85	5833 -	5854	5843.22	3.04E+02	17.71	2.55E+00	1.86

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	7.48E+00	5.43E-01
Tl-208	0.99	583.19	*	85.00	7.81E-02	1.54E-02
Bi-211	0.86	351.07	*	13.02	5.83E-01	1.05E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.44E-01	3.28E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.90E-01	3.13E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 18-Nov-19-10014

L1-10204A-FSGS-001SS

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		
		351.93	*	35.60	2.13E-01	3.84E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.32E-01	5.87E-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 18-Nov-19-10014

L1-10204A-FSGS-001SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	7.48E+00	5.43E-01	
	Tl-208	0.997	7.81E-02	1.54E-02	
?	Bi-211	0.865	5.83E-01	1.05E-01	
	Pb-212	1.000	2.44E-01	3.28E-02	
	Bi-214	1.000	1.90E-01	3.13E-02	
?	Pb-214	0.999	2.13E-01	3.84E-02	
	Ac-228	1.000	2.32E-01	5.87E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10014

L1-10204A-FSGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 10:18:34AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

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	3.79E-02	5.97E-02	5.97E-02
	BE-7	477.60		10.44	-2.15E-01	4.03E-01	4.03E-01
+	K-40	1460.82	*	10.66	7.48E+00	3.22E-01	3.22E-01
	Mn-54	834.85		99.98	1.14E-02	4.99E-02	4.99E-02
	Co-60	1173.23		99.85	-9.12E-03	5.24E-02	6.15E-02
		1332.49		99.98	2.28E-02		5.24E-02
	Nb-94	702.65		99.81	-2.15E-02	4.43E-02	4.43E-02
		871.09		99.89	3.08E-02		5.19E-02
	Ag-108m	79.13		6.60	1.60E+00	4.43E-02	1.96E+00
		433.94		90.50	-3.89E-03		4.43E-02
		614.28		89.80	-3.63E-02		5.84E-02
		722.94		90.80	6.86E-04		4.88E-02
	Sb-125	176.31		6.84	2.26E-02	1.27E-01	5.62E-01
		380.45		1.52	-1.90E-01		2.65E+00
		427.87		29.60	-8.31E-02		1.27E-01
		463.36		10.49	-5.40E-02		3.79E-01
		600.60		17.65	5.67E-02		2.44E-01
		606.71		4.98	1.98E+00		1.39E+00
		635.95		11.22	-2.89E-01		3.69E-01

Analysis Report for 18-Nov-19-10014

L1-10204A-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.12E+00	1.27E-01	2.52E+00
Ba-133	79.61	2.65	1.37E-01	8.30E-02	4.56E+00
	81.00	32.90	-2.74E-01		3.06E-01
	276.40	7.16	-6.94E-02		5.54E-01
	302.85	18.34	9.51E-02		2.24E-01
	356.01	62.05	-5.57E-03		8.30E-02
	383.85	8.94	-5.36E-02		4.48E-01
Cs-134	475.36	1.48	-1.45E-01	6.39E-02	2.81E+00
	563.25	8.34	-1.81E-02		5.27E-01
	569.33	15.37	-1.77E-01		2.54E-01
	604.72	97.62	-4.27E-02		6.39E-02
	795.86	85.46	5.11E-02		6.81E-02
	801.95	8.69	-3.25E-01		5.38E-01
	1038.61	0.99	3.31E+00		5.21E+00
	1167.97	1.79	1.06E+00		3.81E+00
	1365.19	3.02	-2.52E-01		1.49E+00
Cs-137	661.66	85.10	4.04E-02	6.10E-02	6.10E-02
Eu-152	121.78	28.67	-8.35E-03	1.46E-01	1.55E-01
	244.70	7.61	3.77E-01		5.80E-01
	295.94	0.45	9.38E+00		1.06E+01
	344.28	26.60	2.14E-02		1.46E-01
	367.79	0.86	1.55E+00		4.26E+00
	411.12	2.24	-6.35E-02		1.58E+00
	443.96	2.83	-3.51E-01		1.21E+00
	488.68	0.42	3.18E+00		9.47E+00
	563.99	0.49	6.21E+00		9.16E+00
	586.26	0.46	-4.12E+00		1.43E+01
	678.62	0.47	-7.78E+00		8.84E+00
	688.67	0.86	2.26E+00		5.40E+00
	719.35	0.28	-4.49E+00		1.50E+01
	778.90	12.96	9.38E-02		3.40E-01
	810.45	0.32	9.49E+00		1.41E+01
	867.37	4.26	-7.82E-01		1.09E+00
	919.33	0.43	4.99E+00		1.36E+01
	964.08	14.65	1.54E-02		4.76E-01
	1085.87	10.24	1.05E-01		5.79E-01
	1089.74	1.73	-1.87E+00		2.94E+00
	1112.07	13.69	3.22E-01		4.68E-01
	1212.95	1.43	-2.57E+00		4.89E+00
	1249.94	0.19	-1.65E+01		4.06E+01
	1299.14	1.63	-1.19E-01		2.98E+00
	1408.01	21.07	-1.11E-01		2.27E-01
	1457.64	0.50	1.37E+02		4.58E+01
	1528.10	0.28	4.81E+00		1.31E+01
Eu-154	123.07	40.40	-5.66E-02	1.09E-01	1.09E-01
	247.93	6.89	-2.28E-02		5.04E-01
	591.76	4.95	-8.05E-01		8.46E-01
	692.42	1.78	-1.52E-01		2.73E+00
	723.30	20.06	4.29E-02		2.21E-01
	756.80	4.52	1.14E-01		8.59E-01
	873.18	12.08	2.60E-01		4.30E-01

Analysis Report for 18-Nov-19-10014

L1-10204A-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.58E-01	1.09E-01	4.78E-01
	1004.76	18.01	-3.79E-02		3.33E-01
	1274.43	34.80	-3.41E-03		1.83E-01
	1596.48	1.80	7.81E-01		2.12E+00
Eu-155	45.30	1.31	3.96E-01	2.65E-01	3.07E+01
	60.01	1.22	3.56E+00		3.19E+01
	86.55	30.70	-1.08E-01		2.65E-01
	105.31	21.10	-5.59E-02		2.81E-01
Ra-226	186.21	3.64	9.61E-01	1.24E+00	1.24E+00
Pa-231	27.36	10.30	1.58E+00	1.65E+00	3.39E+00
	283.69	1.70	-4.43E-01		2.19E+00
	300.07	2.47	-2.75E+00		1.65E+00
	302.65	2.20	-7.65E-02		1.83E+00
	330.06	1.40	-3.72E-01		2.95E+00
U-235	143.76	10.96	-2.28E-01	7.79E-02	3.59E-01
	163.33	5.08	1.81E-01		7.79E-01
	185.71	57.20	3.08E-02		7.79E-02
	202.11	1.08	-5.41E-01		3.50E+00
	205.31	5.01	-5.14E-01		7.69E-01
Am-241	59.54	35.90	-4.02E-02	1.13E+00	1.13E+00

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

Apex-Gamma

Analysis Report for 18-Nov-19-10015

L1-10204A-FSGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10015
Sample Description	: L1-10204A-FSGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.774E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:32:00PM
Acquisition Started	: 11/18/2019 10:23:39AM
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	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81354
Fill Height	: 1774.16 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 10:38:42AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 11/18/19 - 1500

JGraham

Analysis Report for 18-Nov-19-10015

L1-10204A-FSGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.66	473 -	481	477.50	1.08E+02	19.02	1.12E+02	1.16
2	295.25	587 -	595	590.56	3.26E+01	12.33	5.54E+01	0.94
3	351.80	699 -	708	703.54	6.25E+01	12.13	3.75E+01	1.31
4	582.98	1162 -	1170	1165.57	3.44E+01	8.68	1.86E+01	1.05
5	609.15	1213 -	1223	1217.88	5.73E+01	9.97	1.77E+01	1.35
6	1460.35	2914 -	2928	2920.76	2.37E+02	15.59	2.02E+00	1.55

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.82	*	10.66	4.29E+00	3.38E-01
Tl-208	0.99	583.19	*	85.00	4.31E-02	1.12E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.48E-01	2.87E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.38E-01	2.54E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 18-Nov-19-10015

L1-10204A-FSGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.19E-01	4.61E-02
		351.93	*	35.60	1.33E-01	2.80E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.965	4.29E+00	3.38E-01	
	Tl-208	0.993	4.31E-02	1.12E-02	
X	Bi-211	0.919			
	Pb-212	1.000	1.48E-01	2.87E-02	
	Bi-214	0.998	1.38E-01	2.54E-02	
	Pb-214	0.998	1.30E-01	2.39E-02	

Analysis Report for 18-Nov-19-10015

L1-10204A-FSGS-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 18-Nov-19-10015

L1-10204A-FSGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 10:38:42AM
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	5.66E-02	5.00E-02	5.00E-02
	BE-7	477.60		10.44	6.52E-02	3.41E-01	3.41E-01
+	K-40	1460.82	*	10.66	4.29E+00	2.04E-01	2.04E-01
	Mn-54	834.85		99.98	9.45E-03	3.81E-02	3.81E-02
	Co-60	1173.23		99.85	4.17E-04	3.26E-02	4.79E-02
		1332.49		99.98	1.14E-02		3.26E-02
	Nb-94	702.65		99.81	-6.92E-03	3.17E-02	3.17E-02
		871.09		99.89	1.28E-02		3.64E-02
	Ag-108m	79.13		6.60	3.90E-01	2.78E-02	1.01E+00
		433.94		90.50	-1.62E-02		2.78E-02
		614.28		89.80	-4.60E-04		4.34E-02
		722.94		90.80	8.50E-03		3.98E-02
	Sb-125	176.31		6.84	-4.45E-02	9.87E-02	4.52E-01
		380.45		1.52	2.62E-01		1.78E+00
		427.87		29.60	2.33E-02		9.87E-02
		463.36		10.49	2.78E-02		3.03E-01
		600.60		17.65	4.86E-02		2.00E-01
		606.71		4.98	-1.01E-01		1.05E+00
		635.95		11.22	1.56E-02		3.06E-01

Analysis Report for 18-Nov-19-10015

L1-10204A-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-4.52E-01	9.87E-02	1.87E+00
Ba-133	79.61	2.65	-3.86E-01	5.98E-02	2.30E+00
	81.00	32.90	-2.02E-01		1.54E-01
	276.40	7.16	3.89E-02		4.10E-01
	302.85	18.34	1.35E-01		1.87E-01
	356.01	62.05	-1.06E-02		5.98E-02
	383.85	8.94	-1.17E-01		2.71E-01
Cs-134	475.36	1.48	1.18E+00	4.71E-02	2.43E+00
	563.25	8.34	5.11E-02		4.25E-01
	569.33	15.37	1.20E-01		2.40E-01
	604.72	97.62	-1.46E-02		4.78E-02
	795.86	85.46	1.43E-02		4.71E-02
	801.95	8.69	-1.02E-01		3.75E-01
	1038.61	0.99	-6.56E-01		3.72E+00
	1167.97	1.79	-2.13E+00		2.54E+00
	1365.19	3.02	-6.26E-01		8.93E-01
Cs-137	661.66	85.10	1.67E-02	4.56E-02	4.56E-02
Eu-152	121.78	28.67	-5.66E-03	1.05E-01	1.05E-01
	244.70	7.61	4.81E-02		4.66E-01
	295.94	0.45	2.37E+00		8.04E+00
	344.28	26.60	-2.24E-02		1.20E-01
	367.79	0.86	-5.17E-01		3.44E+00
	411.12	2.24	9.38E-01		1.54E+00
	443.96	2.83	-1.72E-01		1.04E+00
	488.68	0.42	-1.26E+00		6.68E+00
	563.99	0.49	3.94E+00		7.59E+00
	586.26	0.46	7.99E-01		1.05E+01
	678.62	0.47	3.48E+00		7.57E+00
	688.67	0.86	6.90E-02		3.96E+00
	719.35	0.28	1.58E+00		1.17E+01
	778.90	12.96	-6.88E-02		2.84E-01
	810.45	0.32	-3.32E+00		9.98E+00
	867.37	4.26	-3.96E-01		7.68E-01
	919.33	0.43	-8.72E+00		6.96E+00
	964.08	14.65	6.86E-02		3.38E-01
	1085.87	10.24	1.47E-01		3.85E-01
	1089.74	1.73	-1.98E+00		1.85E+00
	1112.07	13.69	-1.38E-01		2.93E-01
	1212.95	1.43	-1.20E+00		3.20E+00
	1249.94	0.19	-8.64E+00		2.13E+01
	1299.14	1.63	-3.60E-02		2.78E+00
	1408.01	21.07	-4.35E-02		1.61E-01
	1457.64	0.50	9.59E-02		2.98E+01
	1528.10	0.28	0.00E+00		2.04E+00
Eu-154	123.07	40.40	7.73E-03	7.54E-02	7.54E-02
	247.93	6.89	-1.54E-02		4.34E-01
	591.76	4.95	-5.14E-01		6.87E-01
	692.42	1.78	-1.22E-01		1.92E+00
	723.30	20.06	5.53E-02		1.88E-01
	756.80	4.52	1.42E-02		7.49E-01
	873.18	12.08	-3.95E-02		2.96E-01

Analysis Report for 18-Nov-19-10015

L1-10204A-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	5.78E-03	7.54E-02	3.34E-01
	1004.76	18.01	3.96E-02		2.09E-01
	1274.43	34.80	6.28E-02		1.43E-01
	1596.48	1.80	-3.73E-01		1.56E+00
Eu-155	45.30	1.31	-5.75E-01	1.53E-01	9.54E+00
	60.01	1.22	1.45E+00		1.07E+01
	86.55	30.70	-4.40E-03		1.53E-01
	105.31	21.10	-1.70E-02		1.69E-01
Ra-226	186.21	3.64	4.09E-01	8.85E-01	8.85E-01
Pa-231	27.36	10.30	7.64E-01	1.09E+00	1.09E+00
	283.69	1.70	-2.20E-01		1.56E+00
	300.07	2.47	5.44E-01		1.35E+00
	302.65	2.20	1.12E+00		1.56E+00
	330.06	1.40	-1.03E+00		2.11E+00
U-235	143.76	10.96	8.33E-02	5.66E-02	2.79E-01
	163.33	5.08	2.07E-02		5.99E-01
	185.71	57.20	2.91E-02		5.66E-02
	202.11	1.08	-9.30E-01		2.89E+00
	205.31	5.01	-4.49E-01		6.01E-01
Am-241	59.54	35.90	-1.02E-01	3.64E-01	3.64E-01

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

Apex-Gamma

Analysis Report for 18-Nov-19-10016

L1-10204A-FSGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10016
Sample Description	: L1-10204A-FSGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.646E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:34:00PM
Acquisition Started	: 11/18/2019 10:03:44AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81353
Fill Height	: 1646.00 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 10:18:47AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

JBrokam

Analysis Report for 18-Nov-19-10016

L1-10204A-FSGS-003SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	238.70	949 -	975	955.27	1.52E+02	12.78	3.41E+01	1.11
m	2	241.85	949 -	975	967.84	4.96E+01	7.78	2.88E+01	1.11
	3	295.20	1173 -	1187	1181.03	7.08E+01	12.09	2.63E+01	0.83
	4	351.90	1402 -	1416	1407.60	9.70E+01	13.62	3.00E+01	1.40
	5	510.99	2039 -	2048	2043.43	2.82E+01	8.67	2.08E+01	0.41
	6	583.26	2326 -	2338	2332.37	4.43E+01	9.13	1.47E+01	0.46
	7	609.31	2427 -	2445	2436.51	9.60E+01	11.95	1.40E+01	0.73
	8	727.51	2902 -	2916	2909.14	2.84E+01	6.67	5.56E+00	0.84
	9	911.35	3638 -	3651	3644.44	2.88E+01	6.35	4.23E+00	1.31
	10	1120.39	4475 -	4486	4480.83	2.42E+01	7.73	1.38E+01	0.75
	11	1460.67	5829 -	5854	5843.03	3.28E+02	18.51	3.39E+00	1.59

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	1.00	511.00	*	100.00	3.22E-02	1.01E-02
K-40	0.99	1460.82	*	10.66	6.73E+00	4.79E-01
Tl-208	0.99	583.19	*	85.00	6.24E-02	1.34E-02
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	5.90E-01	1.43E-01
		785.37		1.10		

Analysis Report for 18-Nov-19-10016

L1-10204A-FSGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-212	0.99	1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.35E-01	2.74E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.60E-01	3.59E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.98E-01	9.57E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	4.64E-01	8.18E-02
		295.22	*	18.42	2.91E-01	5.49E-02
		351.93	*	35.60	2.33E-01	3.76E-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	1.79E-01	4.02E-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 18-Nov-19-10016

L1-10204A-FSGS-003SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	1.000	3.22E-02	1.01E-02	
	K-40	0.996	6.73E+00	4.79E-01	
	Tl-208	0.999	6.24E-02	1.34E-02	
X	Bi-211	0.896			
	Bi-212	0.997	5.90E-01	1.43E-01	
	Pb-212	0.999	2.35E-01	2.74E-02	
	Bi-214	1.000	2.65E-01	3.36E-02	
	Pb-214	0.999	2.78E-01	2.90E-02	
	Ac-228	0.999	1.79E-01	4.02E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10016

L1-10204A-FSGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 10:18:47AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	3.22E-02	2.98E-02	2.98E-02
	BE-7	477.60		10.44	-1.41E-01	4.02E-01	4.02E-01
+	K-40	1460.82	*	10.66	6.73E+00	3.28E-01	3.28E-01
	Mn-54	834.85		99.98	1.03E-02	5.17E-02	5.17E-02
	Co-60	1173.23		99.85	-3.80E-03	4.64E-02	6.27E-02
		1332.49		99.98	-1.20E-02		4.64E-02
	Nb-94	702.65		99.81	-1.38E-02	4.24E-02	4.24E-02
		871.09		99.89	-8.82E-03		5.11E-02
	Ag-108m	79.13		6.60	-1.30E-02	3.54E-02	1.56E+00
		433.94		90.50	1.01E-02		3.54E-02
		614.28		89.80	1.09E-02		7.76E-02
		722.94		90.80	2.12E-02		6.12E-02
	Sb-125	176.31		6.84	3.70E-02	1.21E-01	4.95E-01
		380.45		1.52	-6.57E-01		2.05E+00
		427.87		29.60	-1.92E-03		1.21E-01
		463.36		10.49	3.25E-02		3.85E-01
		600.60		17.65	2.24E-02		2.55E-01
		606.71		4.98	1.69E+00		1.46E+00
		635.95		11.22	4.55E-02		3.40E-01

Analysis Report for 18-Nov-19-10016

L1-10204A-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.35E+00	1.21E-01	2.33E+00
Ba-133	79.61	2.65	2.95E+00	8.17E-02	3.78E+00
	81.00	32.90	-3.27E-01		2.49E-01
	276.40	7.16	-1.54E-01		4.86E-01
	302.85	18.34	1.57E-01		1.96E-01
	356.01	62.05	1.74E-03		8.17E-02
	383.85	8.94	1.78E-01		3.74E-01
Cs-134	475.36	1.48	3.96E-01	5.78E-02	2.76E+00
	563.25	8.34	-2.26E-01		4.17E-01
	569.33	15.37	-3.72E-02		2.17E-01
	604.72	97.62	-1.72E-02		7.03E-02
	795.86	85.46	2.78E-02		5.78E-02
	801.95	8.69	-2.11E-01		5.24E-01
	1038.61	0.99	-3.22E+00		5.38E+00
	1167.97	1.79	3.26E+00		3.69E+00
	1365.19	3.02	6.70E-01		1.57E+00
Cs-137	661.66	85.10	2.94E-02	6.35E-02	6.35E-02
Eu-152	121.78	28.67	3.64E-02	1.33E-01	1.44E-01
	244.70	7.61	-1.80E-02		5.23E-01
	295.94	0.45	1.18E+01		9.92E+00
	344.28	26.60	-7.64E-02		1.33E-01
	367.79	0.86	-4.52E+00		3.76E+00
	411.12	2.24	1.62E-01		1.68E+00
	443.96	2.83	7.47E-01		1.44E+00
	488.68	0.42	-1.87E+00		7.74E+00
	563.99	0.49	-1.76E+00		7.46E+00
	586.26	0.46	1.38E+01		1.24E+01
	678.62	0.47	-4.17E+00		8.29E+00
	688.67	0.86	2.90E+00		4.92E+00
	719.35	0.28	1.02E+01		1.60E+01
	778.90	12.96	-6.52E-02		3.15E-01
	810.45	0.32	3.70E+00		1.29E+01
	867.37	4.26	8.87E-02		1.22E+00
	919.33	0.43	3.47E-02		8.97E+00
	964.08	14.65	2.92E-01		4.68E-01
	1085.87	10.24	8.02E-02		4.71E-01
	1089.74	1.73	2.28E+00		2.99E+00
	1112.07	13.69	-4.75E-01		3.31E-01
	1212.95	1.43	4.45E+00		4.88E+00
	1249.94	0.19	-8.67E+00		3.20E+01
	1299.14	1.63	-3.14E+00		3.39E+00
	1408.01	21.07	-1.72E-01		2.35E-01
	1457.64	0.50	1.44E+02		3.95E+01
	1528.10	0.28	7.23E+00		1.39E+01
Eu-154	123.07	40.40	1.75E-03	1.01E-01	1.01E-01
	247.93	6.89	-2.64E-02		4.89E-01
	591.76	4.95	2.70E-01		8.30E-01
	692.42	1.78	-1.08E+00		2.23E+00
	723.30	20.06	6.42E-02		2.79E-01
	756.80	4.52	1.96E-01		1.06E+00
	873.18	12.08	2.74E-01		4.18E-01

Analysis Report for 18-Nov-19-10016

L1-10204A-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	6.49E-02	1.01E-01	4.28E-01
	1004.76	18.01	-1.09E-01		2.59E-01
	1274.43	34.80	-1.12E-01		1.51E-01
	1596.48	1.80	9.77E-01		2.87E+00
Eu-155	45.30	1.31	-1.64E+01	2.08E-01	1.74E+01
	60.01	1.22	-7.13E+00		2.05E+01
	86.55	30.70	-6.37E-02		2.18E-01
	105.31	21.10	-1.13E-01		2.08E-01
Ra-226	186.21	3.64	1.34E+00	1.10E+00	1.10E+00
Pa-231	27.36	10.30	1.94E+00	1.49E+00	2.39E+00
	283.69	1.70	-9.58E-01		1.98E+00
	300.07	2.47	-2.08E-01		1.49E+00
	302.65	2.20	6.54E-01		1.61E+00
	330.06	1.40	1.06E+00		2.44E+00
U-235	143.76	10.96	-7.49E-02	6.96E-02	3.51E-01
	163.33	5.08	-4.39E-01		6.08E-01
	185.71	57.20	7.21E-02		6.96E-02
	202.11	1.08	-9.33E-01		3.30E+00
	205.31	5.01	-2.00E-01		7.25E-01
Am-241	59.54	35.90	-4.50E-01	7.24E-01	7.24E-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 18-Nov-19-10017

L1-10204A-FSGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10017
Sample Description	: L1-10204A-FSGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.440E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:36:00PM
Acquisition Started	: 11/18/2019 10:23:48AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.2 seconds
Dead Time	: 0.13 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81355
Fill Height	: 1440.44 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 10:38:52AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

Analysis Report for 18-Nov-19-10017

L1-10204A-FSGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.78	951 -	960	955.21	7.57E+01	14.09	5.43E+01	1.05
2	295.14	1176 -	1186	1180.47	2.96E+01	9.14	2.24E+01	0.66
3	352.11	1402 -	1412	1408.19	2.81E+01	9.36	2.49E+01	0.91
4	583.24	2325 -	2338	2332.17	4.18E+01	8.69	1.23E+01	1.29
5	609.28	2429 -	2441	2436.27	3.03E+01	7.47	9.75E+00	1.21
6	1460.86	5832 -	5854	5843.27	2.20E+02	15.19	2.77E+00	1.34

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	5.59E+00	4.56E-01
Tl-208	1.00	583.19	*	85.00	7.08E-02	1.53E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.37E-01	2.78E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	9.87E-02	2.51E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 18-Nov-19-10017

L1-10204A-FSGS-004SS

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	1.43E-01	4.56E-02
		351.93	*	35.60	7.99E-02	2.73E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	1.000	5.59E+00	4.56E-01	
Tl-208	1.000	7.08E-02	1.53E-02	
Pb-212	0.997	1.37E-01	2.78E-02	
Bi-214	1.000	9.87E-02	2.51E-02	
Pb-214	0.997	9.66E-02	2.34E-02	

Analysis Report for 18-Nov-19-10017

L1-10204A-FSGS-004SS

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10017

L1-10204A-FSGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 10:38:52AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.90E-02	6.21E-02	6.21E-02
	BE-7	477.60		10.44	9.49E-02	4.24E-01	4.24E-01
+	K-40	1460.82	*	10.66	5.59E+00	3.52E-01	3.52E-01
	Mn-54	834.85		99.98	-3.90E-03	4.40E-02	4.40E-02
	Co-60	1173.23		99.85	3.19E-02	5.26E-02	6.35E-02
		1332.49		99.98	-2.90E-02		5.26E-02
	Nb-94	702.65		99.81	-1.05E-02	4.40E-02	4.41E-02
		871.09		99.89	-2.28E-02		4.40E-02
	Ag-108m	79.13		6.60	-1.03E-01	3.94E-02	1.73E+00
		433.94		90.50	1.46E-02		3.94E-02
		614.28		89.80	-5.21E-02		5.52E-02
		722.94		90.80	-5.64E-02		5.11E-02
	Sb-125	176.31		6.84	-3.14E-02	1.23E-01	5.14E-01
		380.45		1.52	4.39E-01		2.35E+00
		427.87		29.60	1.98E-02		1.23E-01
		463.36		10.49	-1.17E-02		3.62E-01
		600.60		17.65	-9.52E-02		2.12E-01
		606.71		4.98	6.43E-01		1.14E+00
		635.95		11.22	-1.50E-01		3.86E-01

Analysis Report for 18-Nov-19-10017

L1-10204A-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	7.71E-01	1.23E-01	2.70E+00
Ba-133	79.61	2.65	-8.54E-01	7.11E-02	4.14E+00
	81.00	32.90	-2.51E-01		2.87E-01
	276.40	7.16	3.00E-01		5.22E-01
	302.85	18.34	2.84E-03		2.13E-01
	356.01	62.05	-5.01E-02		7.11E-02
	383.85	8.94	4.76E-02		4.05E-01
Cs-134	475.36	1.48	1.72E-01	5.51E-02	2.88E+00
	563.25	8.34	8.88E-02		5.15E-01
	569.33	15.37	-1.11E-01		2.48E-01
	604.72	97.62	-1.42E-03		5.58E-02
	795.86	85.46	-4.69E-02		5.51E-02
	801.95	8.69	-1.63E-01		5.13E-01
	1038.61	0.99	4.13E-01		5.15E+00
	1167.97	1.79	-1.26E+00		3.60E+00
	1365.19	3.02	-1.11E+00		1.25E+00
Cs-137	661.66	85.10	3.41E-02	6.61E-02	6.61E-02
Eu-152	121.78	28.67	-4.57E-02	1.43E-01	1.55E-01
	244.70	7.61	4.32E-01		5.22E-01
	295.94	0.45	3.15E+00		9.58E+00
	344.28	26.60	-1.23E-01		1.43E-01
	367.79	0.86	5.91E-01		3.53E+00
	411.12	2.24	-2.01E-01		1.62E+00
	443.96	2.83	7.02E-04		1.23E+00
	488.68	0.42	3.04E-01		9.61E+00
	563.99	0.49	3.86E+00		8.73E+00
	586.26	0.46	-2.44E+00		1.34E+01
	678.62	0.47	-7.24E-01		1.03E+01
	688.67	0.86	-3.45E+00		4.77E+00
	719.35	0.28	1.49E+01		1.60E+01
	778.90	12.96	-3.77E-01		2.99E-01
	810.45	0.32	6.19E+00		1.24E+01
	867.37	4.26	-1.99E-01		1.03E+00
	919.33	0.43	-3.41E+00		1.09E+01
	964.08	14.65	4.55E-02		4.39E-01
	1085.87	10.24	-5.38E-01		4.87E-01
	1089.74	1.73	2.81E+00		3.24E+00
	1112.07	13.69	2.92E-01		4.31E-01
	1212.95	1.43	-5.12E+00		5.06E+00
	1249.94	0.19	-2.08E+01		2.75E+01
	1299.14	1.63	-1.06E-01		3.63E+00
	1408.01	21.07	3.96E-02		2.68E-01
	1457.64	0.50	1.20E+02		4.03E+01
	1528.10	0.28	4.98E+00		1.35E+01
Eu-154	123.07	40.40	-5.17E-03	1.10E-01	1.10E-01
	247.93	6.89	-5.10E-02		4.97E-01
	591.76	4.95	-3.75E-01		7.47E-01
	692.42	1.78	-2.03E-01		2.36E+00
	723.30	20.06	2.08E-03		2.46E-01
	756.80	4.52	4.18E-01		1.04E+00
	873.18	12.08	4.59E-02		3.82E-01

Analysis Report for 18-Nov-19-10017

L1-10204A-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	9.94E-02	1.10E-01	5.52E-01
	1004.76	18.01	2.17E-01		2.95E-01
	1274.43	34.80	4.25E-02		1.60E-01
	1596.48	1.80	-2.83E-01		2.02E+00
Eu-155	45.30	1.31	-8.38E+00	2.32E-01	2.71E+01
	60.01	1.22	-2.55E+01		2.73E+01
	86.55	30.70	-2.13E-01		2.37E-01
	105.31	21.10	-8.88E-02		2.32E-01
Ra-226	186.21	3.64	8.70E-01	1.11E+00	1.11E+00
Pa-231	27.36	10.30	2.94E+00	1.52E+00	3.36E+00
	283.69	1.70	1.49E-02		2.08E+00
	300.07	2.47	2.46E-01		1.52E+00
	302.65	2.20	3.67E-01		1.78E+00
	330.06	1.40	7.18E-01		2.84E+00
U-235	143.76	10.96	-8.58E-02	7.10E-02	3.91E-01
	163.33	5.08	-1.02E-01		7.33E-01
	185.71	57.20	6.60E-02		7.10E-02
	202.11	1.08	-5.45E-01		3.44E+00
	205.31	5.01	-2.20E-01		7.26E-01
Am-241	59.54	35.90	1.74E-01	1.02E+00	1.02E+00

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

Apex-Gamma

Analysis Report for 18-Nov-19-10018

L1-10204A-FSGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10018
Sample Description	: L1-10204A-FSGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.316E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:38:00PM
Acquisition Started	: 11/18/2019 10:23:54AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81356
Fill Height	: 1316.00 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 10:39:05AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

JBroham

Analysis Report for 18-Nov-19-10018

L1-10204A-FSGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.68	949 -	962	954.28	7.36E+01	16.44	6.44E+01	1.12
2	352.20	1400 -	1415	1407.81	6.65E+01	9.74	9.53E+00	1.24
3	582.82	2323 -	2339	2329.40	4.63E+01	8.36	7.69E+00	0.83
4	609.11	2428 -	2440	2434.46	3.38E+01	6.50	3.25E+00	0.49
5	1459.99	5827 -	5849	5837.88	1.95E+02	15.16	8.77E+00	1.48

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.89	1460.82	*	10.66	4.60E+00	4.09E-01
Tl-208	0.97	583.19	*	85.00	7.26E-02	1.38E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.21E-01	2.87E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.02E-01	2.06E-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 18-Nov-19-10018

L1-10204A-FSGS-005SS

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	1.74E-01	2.90E-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	0.894	4.60E+00	4.09E-01	
Tl-208	0.979	7.26E-02	1.38E-02	
Pb-212	1.000	1.21E-01	2.87E-02	
Bi-214	0.997	1.02E-01	2.06E-02	
Pb-214	0.994	1.74E-01	2.90E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10018

L1-10204A-FSGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 10:39:05AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.10E-02	4.89E-02	4.89E-02
	BE-7	477.60		10.44	-1.31E-01	3.46E-01	3.46E-01
+	K-40	1460.82	*	10.66	4.60E+00	5.38E-01	5.38E-01
	Mn-54	834.85		99.98	2.58E-03	4.36E-02	4.36E-02
	Co-60	1173.23		99.85	-1.23E-02	4.40E-02	4.76E-02
		1332.49		99.98	1.17E-02		4.40E-02
	Nb-94	702.65		99.81	-1.09E-02	3.78E-02	3.78E-02
		871.09		99.89	-4.35E-03		4.37E-02
	Ag-108m	79.13		6.60	4.66E-01	3.21E-02	1.08E+00
		433.94		90.50	-3.32E-02		3.21E-02
		614.28		89.80	-1.83E-02		4.28E-02
		722.94		90.80	-7.67E-03		3.76E-02
	Sb-125	176.31		6.84	-4.90E-02	1.04E-01	3.96E-01
		380.45		1.52	-6.24E-01		1.87E+00
		427.87		29.60	5.65E-02		1.04E-01
		463.36		10.49	-3.58E-02		3.43E-01
		600.60		17.65	1.73E-01		2.29E-01
		606.71		4.98	5.99E-01		1.01E+00
		635.95		11.22	4.15E-02		2.18E-01

Analysis Report for 18-Nov-19-10018

L1-10204A-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-8.14E-02	1.04E-01	2.13E+00
Ba-133	79.61	2.65	1.08E+00	5.72E-02	2.61E+00
	81.00	32.90	-3.51E-01		1.65E-01
	276.40	7.16	4.21E-02		3.71E-01
	302.85	18.34	3.18E-02		1.56E-01
	356.01	62.05	-1.48E-02		5.72E-02
	383.85	8.94	2.28E-01		3.56E-01
Cs-134	475.36	1.48	7.65E-01	4.92E-02	2.48E+00
	563.25	8.34	-1.03E-01		4.96E-01
	569.33	15.37	-4.28E-03		1.99E-01
	604.72	97.62	-2.43E-02		5.02E-02
	795.86	85.46	2.21E-02		4.92E-02
	801.95	8.69	-9.58E-03		4.66E-01
	1038.61	0.99	-2.58E-01		4.31E+00
	1167.97	1.79	1.23E+00		3.05E+00
	1365.19	3.02	-2.97E-01		1.37E+00
Cs-137	661.66	85.10	7.70E-03	4.51E-02	4.51E-02
Eu-152	121.78	28.67	2.46E-02	1.02E-01	1.02E-01
	244.70	7.61	9.09E-02		4.17E-01
	295.94	0.45	6.71E+00		8.11E+00
	344.28	26.60	-3.80E-02		1.17E-01
	367.79	0.86	-9.98E-01		3.20E+00
	411.12	2.24	2.91E-01		1.38E+00
	443.96	2.83	-3.23E-01		1.17E+00
	488.68	0.42	4.95E+00		8.30E+00
	563.99	0.49	-5.51E+00		7.62E+00
	586.26	0.46	-5.82E-01		1.17E+01
	678.62	0.47	-1.02E+00		8.58E+00
	688.67	0.86	1.12E+00		3.95E+00
	719.35	0.28	-1.04E-01		1.22E+01
	778.90	12.96	4.58E-02		2.99E-01
	810.45	0.32	6.12E+00		1.32E+01
	867.37	4.26	-3.60E-02		9.55E-01
	919.33	0.43	-1.39E+00		7.02E+00
	964.08	14.65	-1.80E-01		4.03E-01
	1085.87	10.24	1.12E-01		3.75E-01
	1089.74	1.73	-2.07E-01		2.14E+00
	1112.07	13.69	3.05E-01		4.15E-01
	1212.95	1.43	-3.65E+00		3.40E+00
	1249.94	0.19	1.62E+01		2.82E+01
	1299.14	1.63	2.41E+00		3.21E+00
	1408.01	21.07	9.02E-03		2.00E-01
	1457.64	0.50	1.05E+02		3.65E+01
	1528.10	0.28	5.54E+00		1.35E+01
Eu-154	123.07	40.40	-4.64E-02	7.11E-02	7.11E-02
	247.93	6.89	1.52E-02		4.00E-01
	591.76	4.95	-3.28E-01		6.01E-01
	692.42	1.78	9.52E-01		2.10E+00
	723.30	20.06	-2.70E-02		1.75E-01
	756.80	4.52	3.09E-01		8.40E-01
	873.18	12.08	-2.46E-01		4.05E-01

Analysis Report for 18-Nov-19-10018

L1-10204A-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.56E-01	7.11E-02	5.21E-01
	1004.76	18.01	-1.16E-01		2.79E-01
	1274.43	34.80	4.67E-03		1.36E-01
	1596.48	1.80	-1.28E-01		2.04E+00
Eu-155	45.30	1.31	4.70E+00	1.65E-01	1.07E+01
	60.01	1.22	-8.84E+00		9.89E+00
	86.55	30.70	3.94E-02		1.68E-01
	105.31	21.10	-2.79E-02		1.65E-01
Ra-226	186.21	3.64	8.23E-01	8.92E-01	8.92E-01
Pa-231	27.36	10.30	1.17E+00	1.23E+00	1.27E+00
	283.69	1.70	1.08E+00		1.88E+00
	300.07	2.47	-1.45E+00		1.23E+00
	302.65	2.20	6.11E-01		1.34E+00
	330.06	1.40	4.79E-01		2.30E+00
U-235	143.76	10.96	1.48E-01	5.51E-02	2.64E-01
	163.33	5.08	1.27E-01		5.31E-01
	185.71	57.20	1.44E-02		5.51E-02
	202.11	1.08	-9.43E-01		2.48E+00
	205.31	5.01	-6.89E-01		5.15E-01
Am-241	59.54	35.90	-3.57E-02	3.57E-01	3.57E-01

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

Apex-Gamma

Analysis Report for 18-Nov-19-10019

L1-10204A-FSGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10019
Sample Description	: L1-10204A-FSGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.731E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:40:00PM
Acquisition Started	: 11/18/2019 10:24:01AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81357
Fill Height	: 1731.17 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 10:39:04AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

T Graham

Analysis Report for 18-Nov-19-10019

L1-10204A-FSGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.28	306 -	317	310.42	2.33E+01	12.24	4.97E+01	0.74
2	238.66	950 -	960	955.12	8.23E+01	13.30	3.97E+01	1.25
3	295.17	1176 -	1187	1180.89	3.24E+01	10.82	3.36E+01	0.97
4	351.76	1401 -	1415	1407.03	7.53E+01	11.42	1.88E+01	0.97
5	583.14	2326 -	2339	2331.88	4.85E+01	8.82	1.05E+01	1.21
6	609.15	2429 -	2444	2435.88	6.84E+01	10.72	1.46E+01	0.79
7	661.87	2641 -	2652	2646.66	2.10E+01	5.34	3.00E+00	1.17
8	727.05	2902 -	2913	2907.28	1.45E+01	5.20	4.50E+00	0.66
9	1460.71	5831 -	5854	5843.20	2.90E+02	17.70	5.84E+00	1.90

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	5.89E+00	4.41E-01
Cs-137	0.99	661.66	*	85.10	3.18E-02	8.30E-03
Tl-208	1.00	583.19	*	85.00	6.77E-02	1.30E-02
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	2.98E-01	1.08E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	1.00	115.18		0.60		

Analysis Report for 18-Nov-19-10019

L1-10204A-FSGS-006SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	1.00	238.63	*	43.60	1.26E-01	2.29E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.13E-01	1.14E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.84E-01	3.08E-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	1.32E-01	4.54E-02
		351.93	*	35.60	1.79E-01	3.08E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	3.76E-01	2.02E-01
		87.35		2.24		
		89.78		0.82		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 18-Nov-19-10019

L1-10204A-FSGS-006SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	5.89E+00	4.41E-01	
	Cs-137	0.993	3.18E-02	8.30E-03	
	Tl-208	1.000	6.77E-02	1.30E-02	
X	Bi-211	0.927			
	Bi-212	0.992	2.98E-01	1.08E-01	
	Pb-212	1.000	1.26E-01	2.29E-02	
?	Pb212-XR	0.998	2.13E-01	1.14E-01	
	Bi-214	0.998	1.84E-01	3.08E-02	
	Pb-214	0.997	1.64E-01	2.55E-02	
?	Pb214-XR	0.998	3.76E-01	2.02E-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 18-Nov-19-10019

L1-10204A-FSGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 10:39:04AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.76E-02	4.86E-02	4.86E-02
	BE-7	477.60		10.44	1.60E-01	4.36E-01	4.36E-01
+	K-40	1460.82	*	10.66	5.89E+00	3.89E-01	3.89E-01
	Mn-54	834.85		99.98	-1.27E-02	3.90E-02	3.90E-02
	Co-60	1173.23		99.85	-4.31E-02	5.14E-02	6.06E-02
		1332.49		99.98	1.46E-02		5.14E-02
	Nb-94	702.65		99.81	-7.24E-03	3.85E-02	3.85E-02
		871.09		99.89	-1.78E-02		3.98E-02
	Ag-108m	79.13		6.60	-2.19E-01	3.46E-02	1.26E+00
		433.94		90.50	-1.45E-02		3.46E-02
		614.28		89.80	-3.31E-04		7.08E-02
		722.94		90.80	2.93E-02		5.32E-02
	Sb-125	176.31		6.84	5.15E-02	1.02E-01	4.65E-01
		380.45		1.52	9.31E-03		2.25E+00
		427.87		29.60	-6.52E-02		1.02E-01
		463.36		10.49	1.70E-01		3.45E-01
		600.60		17.65	-1.06E-01		2.03E-01
		606.71		4.98	1.74E+00		1.25E+00
		635.95		11.22	1.35E-01		3.22E-01

Analysis Report for 18-Nov-19-10019

L1-10204A-FSGS-006SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-3.45E-01	1.02E-01	2.09E+00
	Ba-133	79.61		2.65	1.92E-01	6.88E-02	3.16E+00
		81.00		32.90	8.95E-02		2.25E-01
		276.40		7.16	-4.36E-02		4.59E-01
		302.85		18.34	1.66E-01		1.89E-01
		356.01		62.05	-8.04E-04		6.88E-02
		383.85		8.94	-2.57E-01		3.50E-01
	Cs-134	475.36		1.48	2.49E+00	4.89E-02	2.99E+00
		563.25		8.34	2.16E-01		4.41E-01
		569.33		15.37	-1.54E-01		2.25E-01
		604.72		97.62	-2.24E-02		5.75E-02
		795.86		85.46	2.94E-02		4.89E-02
		801.95		8.69	-4.39E-01		4.83E-01
		1038.61		0.99	9.93E-01		4.16E+00
		1167.97		1.79	-2.19E+00		3.21E+00
		1365.19		3.02	-6.14E-01		1.33E+00
+	Cs-137	661.66	*	85.10	3.18E-02	1.84E-02	1.84E-02
	Eu-152	121.78		28.67	1.19E-02	1.20E-01	1.36E-01
		244.70		7.61	4.11E-01		4.83E-01
		295.94		0.45	4.65E+00		9.39E+00
		344.28		26.60	-3.15E-02		1.20E-01
		367.79		0.86	8.68E-01		3.67E+00
		411.12		2.24	-1.82E+00		1.54E+00
		443.96		2.83	-3.42E-01		1.24E+00
		488.68		0.42	1.57E+00		8.06E+00
		563.99		0.49	2.39E+00		7.39E+00
		586.26		0.46	1.02E+01		1.14E+01
		678.62		0.47	-4.73E+00		8.09E+00
		688.67		0.86	3.81E+00		4.87E+00
		719.35		0.28	8.81E+00		1.52E+01
		778.90		12.96	-9.33E-02		3.07E-01
		810.45		0.32	1.28E+01		1.41E+01
		867.37		4.26	1.68E-02		9.32E-01
		919.33		0.43	-2.34E+01		9.47E+00
		964.08		14.65	3.01E-01		3.98E-01
		1085.87		10.24	-1.31E-01		5.20E-01
		1089.74		1.73	3.73E+00		3.53E+00
		1112.07		13.69	3.14E-02		3.89E-01
		1212.95		1.43	1.86E+00		4.12E+00
		1249.94		0.19	-1.01E+01		2.61E+01
		1299.14		1.63	-9.36E-01		2.70E+00
		1408.01		21.07	1.30E-01		2.02E-01
		1457.64		0.50	1.28E+02		3.70E+01
		1528.10		0.28	-9.92E-01		1.30E+01
	Eu-154	123.07		40.40	5.17E-03	9.77E-02	9.77E-02
		247.93		6.89	-4.37E-01		4.65E-01
		591.76		4.95	-5.52E-02		7.57E-01
		692.42		1.78	-1.12E+00		2.27E+00
		723.30		20.06	2.37E-01		2.41E-01
		756.80		4.52	-3.39E-01		7.23E-01
		873.18		12.08	-1.91E-02		3.30E-01

Analysis Report for 18-Nov-19-10019

L1-10204A-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.30E-01	9.77E-02	4.46E-01
	1004.76	18.01	-8.30E-02		2.48E-01
	1274.43	34.80	1.64E-01		1.62E-01
	1596.48	1.80	-1.69E+00		1.60E+00
Eu-155	45.30	1.31	-3.50E+00	1.99E-01	1.90E+01
	60.01	1.22	-1.06E+01		2.09E+01
	86.55	30.70	5.56E-02		2.07E-01
	105.31	21.10	6.73E-02		1.99E-01
Ra-226	186.21	3.64	-4.24E-01	9.85E-01	9.85E-01
Pa-231	27.36	10.30	1.92E+00	1.42E+00	2.02E+00
	283.69	1.70	1.13E+00		2.02E+00
	300.07	2.47	4.28E-01		1.42E+00
	302.65	2.20	4.59E-01		1.53E+00
	330.06	1.40	4.87E-01		2.28E+00
U-235	143.76	10.96	-1.53E-01	6.41E-02	3.24E-01
	163.33	5.08	-1.11E-01		6.50E-01
	185.71	57.20	2.92E-02		6.41E-02
	202.11	1.08	4.81E-01		3.25E+00
	205.31	5.01	4.19E-01		6.69E-01
Am-241	59.54	35.90	-2.49E-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 18-Nov-19-10020

L1-10204A-FSGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10020
Sample Description	: L1-10204A-FSGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.348E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:42:00PM
Acquisition Started	: 11/18/2019 10:43:03AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81358
Fill Height	: 1348.20 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 10:58:05AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 11/18/19 - 1500

J Graham

Analysis Report for 18-Nov-19-10020

L1-10204A-FSGS-007SS

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	1.21E+02	19.10	1.06E+02	1.32
2	351.80	698 -	708	703.55	7.12E+01	12.62	3.68E+01	1.41
3	583.26	1161 -	1171	1166.13	5.20E+01	10.23	2.20E+01	1.19
4	609.22	1214 -	1223	1218.02	6.75E+01	10.66	1.95E+01	1.53
5	911.11	1816 -	1826	1821.67	3.36E+01	7.94	1.24E+01	1.53
6	1460.47	2914 -	2928	2921.00	2.23E+02	15.54	6.08E+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	0.98	1460.82	*	10.66	4.36E+00	3.58E-01
Tl-208	0.99	583.19	*	85.00	6.93E-02	1.42E-02
Bi-211	0.91	351.07	*	13.02	4.39E-01	8.54E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.74E-01	3.09E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.73E-01	2.92E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 18-Nov-19-10020

L1-10204A-FSGS-007SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.61E-01	3.12E-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	1.98E-01	4.76E-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 18-Nov-19-10020

L1-10204A-FSGS-007SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.980	4.36E+00	3.58E-01	
	Tl-208	0.999	6.93E-02	1.42E-02	
?	Bi-211	0.918	4.39E-01	8.54E-02	
	Pb-212	1.000	1.74E-01	3.09E-02	
	Bi-214	0.999	1.73E-01	2.92E-02	
?	Pb-214	0.998	1.61E-01	3.12E-02	
	Ac-228	1.000	1.98E-01	4.76E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10020

L1-10204A-FSGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 10:58:05AM
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	6.10E-02	5.06E-02	5.06E-02
	BE-7	477.60		10.44	-4.92E-03	3.15E-01	3.15E-01
+	K-40	1460.82	*	10.66	4.36E+00	3.42E-01	3.42E-01
	Mn-54	834.85		99.98	-5.05E-03	3.88E-02	3.88E-02
	Co-60	1173.23		99.85	1.50E-02	3.93E-02	4.37E-02
		1332.49		99.98	1.31E-02		3.93E-02
	Nb-94	702.65		99.81	5.64E-03	2.98E-02	3.57E-02
		871.09		99.89	-9.56E-03		2.98E-02
	Ag-108m	79.13		6.60	1.90E-01	3.20E-02	1.05E+00
		433.94		90.50	-8.60E-03		3.20E-02
		614.28		89.80	1.28E-03		5.02E-02
		722.94		90.80	1.20E-02		4.55E-02
	Sb-125	176.31		6.84	-1.05E-02	1.15E-01	4.47E-01
		380.45		1.52	-5.02E-01		1.66E+00
		427.87		29.60	5.95E-02		1.15E-01
		463.36		10.49	2.34E-02		2.74E-01
		600.60		17.65	2.29E-02		1.97E-01
		606.71		4.98	-9.22E-01		1.19E+00
		635.95		11.22	-6.51E-02		2.88E-01

Analysis Report for 18-Nov-19-10020

L1-10204A-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.80E-02	1.15E-01	1.80E+00
Ba-133	79.61	2.65	-7.80E-02	6.04E-02	2.43E+00
	81.00	32.90	-1.88E-01		1.65E-01
	276.40	7.16	-5.26E-02		4.11E-01
	302.85	18.34	1.54E-02		1.69E-01
	356.01	62.05	-2.41E-02		6.04E-02
	383.85	8.94	-1.68E-01		2.74E-01
Cs-134	475.36	1.48	1.05E+00	3.60E-02	2.22E+00
	563.25	8.34	6.12E-02		3.51E-01
	569.33	15.37	3.82E-02		2.09E-01
	604.72	97.62	-5.72E-02		5.42E-02
	795.86	85.46	-3.40E-02		3.60E-02
	801.95	8.69	-8.86E-02		3.83E-01
	1038.61	0.99	4.96E-01		3.80E+00
	1167.97	1.79	-9.13E-01		2.38E+00
	1365.19	3.02	-1.48E-01		8.21E-01
Cs-137	661.66	85.10	1.48E-02	4.46E-02	4.46E-02
Eu-152	121.78	28.67	3.60E-03	1.07E-01	1.07E-01
	244.70	7.61	-9.55E-02		4.34E-01
	295.94	0.45	3.77E+00		8.13E+00
	344.28	26.60	-1.42E-01		1.14E-01
	367.79	0.86	8.95E-01		3.63E+00
	411.12	2.24	6.80E-01		1.43E+00
	443.96	2.83	-3.47E-01		1.01E+00
	488.68	0.42	-1.78E+00		7.38E+00
	563.99	0.49	-1.11E+00		5.72E+00
	586.26	0.46	-6.41E-01		1.16E+01
	678.62	0.47	-1.48E+00		6.45E+00
	688.67	0.86	-7.36E-01		3.33E+00
	719.35	0.28	7.48E-01		1.34E+01
	778.90	12.96	1.84E-01		3.22E-01
	810.45	0.32	-6.50E+00		9.67E+00
	867.37	4.26	6.04E-02		7.62E-01
	919.33	0.43	2.79E+00		9.26E+00
	964.08	14.65	2.53E-01		3.66E-01
	1085.87	10.24	3.33E-02		4.47E-01
	1089.74	1.73	1.48E+00		2.75E+00
	1112.07	13.69	-6.34E-02		2.71E-01
	1212.95	1.43	-1.72E-01		3.85E+00
	1249.94	0.19	2.10E+01		2.75E+01
	1299.14	1.63	-5.87E-01		2.38E+00
	1408.01	21.07	3.95E-02		2.00E-01
	1457.64	0.50	-3.83E+00		3.13E+01
	1528.10	0.28	1.37E+00		1.44E+01
Eu-154	123.07	40.40	-9.10E-04	7.51E-02	7.51E-02
	247.93	6.89	-2.26E-01		3.99E-01
	591.76	4.95	2.77E-02		7.03E-01
	692.42	1.78	1.82E-01		1.74E+00
	723.30	20.06	1.45E-01		2.19E-01
	756.80	4.52	-2.84E-01		6.91E-01
	873.18	12.08	1.56E-01		2.62E-01

Analysis Report for 18-Nov-19-10020

L1-10204A-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.08E-01	7.51E-02	4.35E-01
	1004.76	18.01	4.90E-04		2.33E-01
	1274.43	34.80	3.51E-03		1.23E-01
	1596.48	1.80	-3.78E-01		2.24E+00
Eu-155	45.30	1.31	-1.36E+00	1.58E-01	1.01E+01
	60.01	1.22	-2.03E+00		1.08E+01
	86.55	30.70	2.41E-02		1.58E-01
	105.31	21.10	-6.71E-02		1.66E-01
Ra-226	186.21	3.64	5.42E-01	9.19E-01	9.19E-01
Pa-231	27.36	10.30	6.49E-01	1.03E+00	1.03E+00
	283.69	1.70	-1.98E-01		1.72E+00
	300.07	2.47	-7.93E-01		1.25E+00
	302.65	2.20	1.28E-01		1.41E+00
	330.06	1.40	4.39E-01		2.20E+00
U-235	143.76	10.96	-1.47E-01	5.92E-02	2.64E-01
	163.33	5.08	1.85E-01		6.68E-01
	185.71	57.20	4.51E-02		5.92E-02
	202.11	1.08	-9.45E-01		2.62E+00
	205.31	5.01	-2.38E-01		5.91E-01
Am-241	59.54	35.90	-1.70E-01	3.72E-01	3.72E-01

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

Apex-Gamma

Analysis Report for 18-Nov-19-10021

L1-10204A-FSGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10021
Sample Description	: L1-10204A-FSGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.654E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:44:00PM
Acquisition Started	: 11/18/2019 10:43:10AM
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	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81359
Fill Height	: 1654.08 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 10:58:14AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

J Graham

Analysis Report for 18-Nov-19-10021

L1-10204A-FSGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.69	950 -	961	954.87	1.45E+02	17.00	5.65E+01	0.89
2	338.38	1346 -	1357	1353.29	3.11E+01	9.29	2.19E+01	0.44
3	351.84	1401 -	1413	1407.08	4.76E+01	10.42	2.24E+01	1.09
4	583.27	2325 -	2340	2332.29	6.00E+01	9.81	1.20E+01	0.93
5	609.31	2430 -	2444	2436.42	4.18E+01	7.87	6.25E+00	1.32
6	1460.77	5833 -	5853	5842.92	2.54E+02	17.08	1.05E+01	1.83

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	6.18E+00	4.96E-01
Tl-208	0.99	583.19	*	85.00	9.84E-02	1.71E-02
Bi-211	0.91	351.07	*	13.02	3.58E-01	8.36E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.55E-01	3.64E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.32E-01	2.61E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 18-Nov-19-10021

L1-10204A-FSGS-008SS

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		
		351.93	*	35.60	1.31E-01	3.06E-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	2.63E-01	8.15E-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		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 18-Nov-19-10021

L1-10204A-FSGS-008SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	6.18E+00	4.96E-01	
	Tl-208	0.999	9.84E-02	1.71E-02	
?	Bi-211	0.910	3.58E-01	8.36E-02	
	Pb-212	0.999	2.55E-01	3.64E-02	
	Bi-214	1.000	1.32E-01	2.61E-02	
?	Pb-214	0.999	1.31E-01	3.06E-02	
	Ac-228	1.000	2.63E-01	8.15E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10021

L1-10204A-FSGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 10:58:14AM
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	6.44E-02	5.87E-02	5.87E-02
	BE-7	477.60		10.44	9.64E-02	4.32E-01	4.32E-01
+	K-40	1460.82	*	10.66	6.18E+00	5.81E-01	5.81E-01
	Mn-54	834.85		99.98	1.12E-02	4.97E-02	4.97E-02
	Co-60	1173.23		99.85	1.16E-02	6.28E-02	6.61E-02
		1332.49		99.98	1.29E-02		6.28E-02
	Nb-94	702.65		99.81	3.49E-02	4.82E-02	4.82E-02
		871.09		99.89	-1.29E-02		5.00E-02
	Ag-108m	79.13		6.60	8.29E-01	4.62E-02	1.80E+00
		433.94		90.50	0.00E+00		4.62E-02
		614.28		89.80	-6.43E-03		5.92E-02
		722.94		90.80	-5.18E-02		5.40E-02
	Sb-125	176.31		6.84	-2.37E-01	1.39E-01	5.54E-01
		380.45		1.52	6.27E-01		2.33E+00
		427.87		29.60	-9.88E-03		1.39E-01
		463.36		10.49	3.77E-01		4.55E-01
		600.60		17.65	4.44E-02		2.17E-01
		606.71		4.98	1.11E+00		1.14E+00
		635.95		11.22	2.33E-02		2.91E-01

Analysis Report for 18-Nov-19-10021

L1-10204A-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-8.94E-02	1.39E-01	2.26E+00
Ba-133	79.61	2.65	1.61E+00	6.29E-02	4.34E+00
	81.00	32.90	-2.22E-01		3.06E-01
	276.40	7.16	6.69E-02		5.09E-01
	302.85	18.34	7.54E-02		1.96E-01
	356.01	62.05	-1.66E-02		6.29E-02
	383.85	8.94	-2.60E-01		3.70E-01
Cs-134	475.36	1.48	-1.90E-01	5.09E-02	2.88E+00
	563.25	8.34	1.58E-01		5.56E-01
	569.33	15.37	7.02E-02		2.97E-01
	604.72	97.62	-3.49E-02		5.09E-02
	795.86	85.46	2.27E-02		5.97E-02
	801.95	8.69	1.88E-01		5.35E-01
	1038.61	0.99	2.34E+00		5.39E+00
	1167.97	1.79	-6.15E-01		3.74E+00
	1365.19	3.02	3.36E-01		1.54E+00
Cs-137	661.66	85.10	7.09E-03	6.13E-02	6.13E-02
Eu-152	121.78	28.67	-5.54E-02	1.47E-01	1.57E-01
	244.70	7.61	-3.31E-02		5.29E-01
	295.94	0.45	-1.55E-01		9.97E+00
	344.28	26.60	5.11E-02		1.47E-01
	367.79	0.86	-3.94E+00		4.08E+00
	411.12	2.24	-8.65E-01		1.70E+00
	443.96	2.83	-4.49E-01		1.45E+00
	488.68	0.42	-1.19E-02		8.70E+00
	563.99	0.49	7.36E+00		9.73E+00
	586.26	0.46	-6.52E-02		1.50E+01
	678.62	0.47	-1.62E+00		9.11E+00
	688.67	0.86	2.93E+00		5.61E+00
	719.35	0.28	1.89E+01		1.98E+01
	778.90	12.96	-2.61E-01		3.51E-01
	810.45	0.32	-2.26E-01		1.51E+01
	867.37	4.26	-8.10E-01		1.15E+00
	919.33	0.43	-9.00E+00		1.03E+01
	964.08	14.65	7.05E-02		4.74E-01
	1085.87	10.24	-4.60E-01		4.92E-01
	1089.74	1.73	-1.92E+00		3.05E+00
	1112.07	13.69	-5.31E-02		4.30E-01
	1212.95	1.43	1.86E-02		4.66E+00
	1249.94	0.19	1.06E+01		3.69E+01
	1299.14	1.63	-1.36E+00		3.33E+00
	1408.01	21.07	-1.85E-02		1.76E-01
	1457.64	0.50	1.41E+02		4.24E+01
	1528.10	0.28	-1.90E+01		1.65E+01
Eu-154	123.07	40.40	-8.57E-03	1.13E-01	1.13E-01
	247.93	6.89	2.78E-01		5.42E-01
	591.76	4.95	2.13E-02		8.30E-01
	692.42	1.78	-5.95E-01		2.33E+00
	723.30	20.06	7.59E-02		2.58E-01
	756.80	4.52	2.66E-01		9.52E-01
	873.18	12.08	-8.05E-02		3.99E-01

Analysis Report for 18-Nov-19-10021

L1-10204A-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.28E-01	1.13E-01	3.86E-01
	1004.76	18.01	-7.63E-02		3.11E-01
	1274.43	34.80	-3.38E-03		1.82E-01
	1596.48	1.80	-1.20E+00		2.55E+00
Eu-155	45.30	1.31	-1.35E+01	2.69E-01	3.27E+01
	60.01	1.22	-1.56E+01		2.97E+01
	86.55	30.70	8.91E-03		2.77E-01
	105.31	21.10	6.78E-02		2.69E-01
Ra-226	186.21	3.64	9.41E-01	1.07E+00	1.07E+00
Pa-231	27.36	10.30	2.76E+00	1.53E+00	3.51E+00
	283.69	1.70	-2.14E-01		2.03E+00
	300.07	2.47	-1.35E+00		1.53E+00
	302.65	2.20	-4.71E-01		1.60E+00
	330.06	1.40	-5.71E-01		2.71E+00
U-235	143.76	10.96	1.75E-01	6.71E-02	3.84E-01
	163.33	5.08	1.15E-02		8.05E-01
	185.71	57.20	5.23E-02		6.71E-02
	202.11	1.08	-5.60E-01		3.42E+00
	205.31	5.01	-3.94E-01		7.56E-01
Am-241	59.54	35.90	-7.25E-01	1.05E+00	1.05E+00

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

Apex-Gamma

Analysis Report for 18-Nov-19-10022

L1-10204A-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10022
Sample Description	: L1-10204A-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.465E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:46:00PM
Acquisition Started	: 11/18/2019 10:43:18AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81360
Fill Height	: 1464.60 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 10:58:28AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

JGraham

Analysis Report for 18-Nov-19-10022

L1-10204A-FSGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.70	947 -	959	954.39	6.94E+01	12.01	2.86E+01	0.76
2	351.73	1400 -	1412	1405.92	4.57E+01	8.68	1.13E+01	0.85
3	1460.22	5827 -	5848	5838.83	1.31E+02	12.71	8.23E+00	1.31

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.94	1460.82	*	10.66	2.97E+00	3.17E-01
Bi-211	0.93	351.07	*	13.02	3.18E-01	6.55E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.11E-01	2.12E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.16E-01	2.39E-02
		785.96		1.06		

Analysis Report for 18-Nov-19-10022

L1-10204A-FSGS-009SS

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.944	2.97E+00	3.17E-01	
?	Bi-211	0.934	3.18E-01	6.55E-02	
	Pb-212	0.999	1.11E-01	2.12E-02	
?	Pb-214	0.996	1.16E-01	2.39E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10022

L1-10204A-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 10:58:28AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.89E-02	5.05E-02	5.05E-02
	BE-7	477.60		10.44	-1.66E-01	3.21E-01	3.21E-01
+	K-40	1460.82	*	10.66	2.97E+00	4.94E-01	4.94E-01
	Mn-54	834.85		99.98	-1.58E-02	3.12E-02	3.12E-02
	Co-60	1173.23		99.85	-1.40E-02	3.91E-02	4.71E-02
		1332.49		99.98	2.04E-02		3.91E-02
	Nb-94	702.65		99.81	-9.88E-04	3.43E-02	3.50E-02
		871.09		99.89	4.68E-03		3.43E-02
	Ag-108m	79.13		6.60	-8.68E-02	3.34E-02	8.90E-01
		433.94		90.50	3.20E-03		3.34E-02
		614.28		89.80	-9.18E-03		4.90E-02
		722.94		90.80	1.88E-02		4.51E-02
	Sb-125	176.31		6.84	1.51E-01	1.07E-01	3.92E-01
		380.45		1.52	-6.94E-01		1.79E+00
		427.87		29.60	4.45E-02		1.07E-01
		463.36		10.49	1.14E-01		3.37E-01
		600.60		17.65	-6.41E-02		1.61E-01
		606.71		4.98	6.46E-01		9.57E-01
		635.95		11.22	-4.29E-02		2.71E-01

Analysis Report for 18-Nov-19-10022

L1-10204A-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	7.37E-01	1.07E-01	1.90E+00
Ba-133	79.61	2.65	-5.69E-01	5.26E-02	2.17E+00
	81.00	32.90	-2.03E-01		1.52E-01
	276.40	7.16	4.62E-02		3.61E-01
	302.85	18.34	6.66E-02		1.52E-01
	356.01	62.05	-1.10E-02		5.26E-02
	383.85	8.94	-2.46E-01		2.95E-01
Cs-134	475.36	1.48	-2.09E-02	4.02E-02	2.22E+00
	563.25	8.34	-4.15E-01		3.53E-01
	569.33	15.37	1.40E-01		2.06E-01
	604.72	97.62	-6.39E-02		4.09E-02
	795.86	85.46	1.76E-02		4.02E-02
	801.95	8.69	3.52E-01		4.41E-01
	1038.61	0.99	-1.93E+00		3.50E+00
	1167.97	1.79	1.09E+00		2.82E+00
	1365.19	3.02	-1.01E+00		1.04E+00
Cs-137	661.66	85.10	1.08E-02	4.53E-02	4.53E-02
Eu-152	121.78	28.67	-3.54E-02	8.78E-02	8.78E-02
	244.70	7.61	9.64E-02		4.09E-01
	295.94	0.45	1.74E-01		7.21E+00
	344.28	26.60	4.37E-03		1.09E-01
	367.79	0.86	-2.58E+00		2.70E+00
	411.12	2.24	1.21E+00		1.34E+00
	443.96	2.83	1.09E-01		1.01E+00
	488.68	0.42	2.77E+00		8.05E+00
	563.99	0.49	-4.52E+00		5.36E+00
	586.26	0.46	1.01E+01		9.59E+00
	678.62	0.47	1.07E+00		6.71E+00
	688.67	0.86	-1.29E+00		3.17E+00
	719.35	0.28	-5.02E+00		1.21E+01
	778.90	12.96	2.62E-02		2.00E-01
	810.45	0.32	9.04E+00		1.31E+01
	867.37	4.26	-4.57E-01		6.87E-01
	919.33	0.43	-2.27E+00		9.35E+00
	964.08	14.65	2.56E-01		3.52E-01
	1085.87	10.24	1.17E-01		3.89E-01
	1089.74	1.73	1.17E+00		2.45E+00
	1112.07	13.69	-6.35E-02		3.32E-01
	1212.95	1.43	-1.30E+00		3.37E+00
	1249.94	0.19	-2.09E+01		2.31E+01
	1299.14	1.63	-8.28E-01		2.76E+00
	1408.01	21.07	-6.43E-02		1.74E-01
	1457.64	0.50	6.79E+01		2.92E+01
	1528.10	0.28	-1.71E+00		1.30E+01
Eu-154	123.07	40.40	-4.80E-03	6.35E-02	6.35E-02
	247.93	6.89	1.30E-01		3.90E-01
	591.76	4.95	2.10E-01		6.70E-01
	692.42	1.78	9.16E-02		1.86E+00
	723.30	20.06	1.74E-01		2.11E-01
	756.80	4.52	5.47E-01		7.55E-01
	873.18	12.08	-1.06E-01		3.02E-01

Analysis Report for 18-Nov-19-10022

L1-10204A-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.29E-01	6.35E-02	4.23E-01
	1004.76	18.01	3.16E-02		2.17E-01
	1274.43	34.80	-4.27E-02		1.50E-01
	1596.48	1.80	8.68E-01		2.12E+00
Eu-155	45.30	1.31	1.67E+00	1.44E-01	8.66E+00
	60.01	1.22	2.87E+00		9.98E+00
	86.55	30.70	-3.07E-02		1.54E-01
	105.31	21.10	3.21E-02		1.44E-01
Ra-226	186.21	3.64	4.03E-01	7.29E-01	7.29E-01
Pa-231	27.36	10.30	4.68E-01	1.06E+00	1.06E+00
	283.69	1.70	6.94E-02		1.62E+00
	300.07	2.47	-9.48E-01		1.09E+00
	302.65	2.20	8.18E-01		1.26E+00
	330.06	1.40	8.28E-01		2.17E+00
U-235	143.76	10.96	7.40E-02	4.69E-02	2.70E-01
	163.33	5.08	3.35E-01		4.84E-01
	185.71	57.20	4.47E-02		4.69E-02
	202.11	1.08	-6.54E-01		2.37E+00
	205.31	5.01	-4.36E-02		5.23E-01
Am-241	59.54	35.90	-4.53E-03	3.37E-01	3.37E-01

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

Apex-Gamma

Analysis Report for 18-Nov-19-10023

L1-10204A-FQGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10023
Sample Description	: L1-10204A-FQGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.454E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:46:00PM
Acquisition Started	: 11/18/2019 11:17:38AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81362
Fill Height	: 1454.00 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 11:32:41AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

JBroham

Analysis Report for 18-Nov-19-10023

L1-10204A-FQGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.74	947 -	960	954.55	7.05E+01	14.82	5.35E+01	0.95
2	351.92	1402 -	1413	1406.70	5.83E+01	9.66	1.37E+01	0.59
3	609.16	2429 -	2442	2434.66	4.64E+01	9.17	1.36E+01	1.24
4	910.81	3634 -	3645	3640.68	2.17E+01	6.37	7.34E+00	0.58
5	1459.91	5827 -	5849	5837.56	1.53E+02	13.65	8.50E+00	0.94

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	0.87	1460.82	*	10.66	3.50E+00	3.46E-01
Bi-211	0.89	351.07	*	13.02	4.06E-01	7.48E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.13E-01	2.55E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.36E-01	2.81E-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 18-Nov-19-10023

L1-10204A-FQGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.48E-01	2.73E-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	1.48E-01	4.39E-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 18-Nov-19-10023

L1-10204A-FQGS-009SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.874	3.50E+00	3.46E-01	
?	Bi-211	0.890	4.06E-01	7.48E-02	
	Pb-212	0.998	1.13E-01	2.55E-02	
	Bi-214	0.998	1.36E-01	2.81E-02	
?	Pb-214	1.000	1.48E-01	2.73E-02	
	Ac-228	0.992	1.48E-01	4.39E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10023

L1-10204A-FQGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 11:32:41AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.09E-02	5.45E-02	5.45E-02
	BE-7	477.60		10.44	1.51E-01	3.68E-01	3.68E-01
+	K-40	1460.82	*	10.66	3.50E+00	5.07E-01	5.07E-01
	Mn-54	834.85		99.98	-2.82E-03	3.77E-02	3.77E-02
	Co-60	1173.23		99.85	-8.63E-03	5.00E-02	5.60E-02
		1332.49		99.98	-5.06E-03		5.00E-02
	Nb-94	702.65		99.81	7.74E-03	3.16E-02	3.16E-02
		871.09		99.89	-2.39E-02		3.55E-02
	Ag-108m	79.13		6.60	4.60E-01	3.18E-02	9.80E-01
		433.94		90.50	2.24E-05		3.18E-02
		614.28		89.80	-2.31E-02		5.60E-02
		722.94		90.80	2.44E-02		4.44E-02
	Sb-125	176.31		6.84	5.69E-03	1.12E-01	3.39E-01
		380.45		1.52	-9.67E-01		1.85E+00
		427.87		29.60	7.95E-03		1.12E-01
		463.36		10.49	-1.95E-01		3.07E-01
		600.60		17.65	3.40E-02		2.09E-01
		606.71		4.98	1.44E+00		1.23E+00
		635.95		11.22	1.33E-01		2.92E-01

Analysis Report for 18-Nov-19-10023

L1-10204A-FQGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.99E-02	1.12E-01	1.90E+00
Ba-133	79.61	2.65	9.44E-01	5.57E-02	2.36E+00
	81.00	32.90	-1.71E-01		1.43E-01
	276.40	7.16	-1.96E-01		3.41E-01
	302.85	18.34	-9.49E-02		1.55E-01
	356.01	62.05	-3.63E-02		5.57E-02
	383.85	8.94	-2.39E-02		3.38E-01
Cs-134	475.36	1.48	4.96E-01	3.91E-02	2.47E+00
	563.25	8.34	-6.23E-01		3.62E-01
	569.33	15.37	6.41E-02		1.88E-01
	604.72	97.62	-1.13E-02		5.29E-02
	795.86	85.46	-1.05E-02		3.91E-02
	801.95	8.69	6.97E-02		3.87E-01
	1038.61	0.99	-4.86E-01		4.73E+00
	1167.97	1.79	5.23E-01		3.28E+00
	1365.19	3.02	-8.43E-01		8.57E-01
Cs-137	661.66	85.10	1.79E-02	5.52E-02	5.52E-02
Eu-152	121.78	28.67	-4.20E-02	9.00E-02	9.00E-02
	244.70	7.61	-3.25E-02		4.50E-01
	295.94	0.45	8.38E+00		8.72E+00
	344.28	26.60	2.26E-02		1.18E-01
	367.79	0.86	-1.13E+00		3.26E+00
	411.12	2.24	1.19E+00		1.54E+00
	443.96	2.83	1.32E-01		9.41E-01
	488.68	0.42	2.02E+00		6.64E+00
	563.99	0.49	-4.67E+00		5.84E+00
	586.26	0.46	1.44E+01		1.19E+01
	678.62	0.47	1.01E+00		7.89E+00
	688.67	0.86	-2.42E+00		3.63E+00
	719.35	0.28	-1.30E+01		1.22E+01
	778.90	12.96	1.52E-01		3.39E-01
	810.45	0.32	3.99E+00		1.20E+01
	867.37	4.26	3.89E-01		9.70E-01
	919.33	0.43	2.59E+00		8.06E+00
	964.08	14.65	-2.28E-02		3.35E-01
	1085.87	10.24	-2.75E-01		3.90E-01
	1089.74	1.73	1.60E+00		2.39E+00
	1112.07	13.69	4.77E-02		3.15E-01
	1212.95	1.43	1.28E+00		4.22E+00
	1249.94	0.19	1.25E+01		3.25E+01
	1299.14	1.63	1.51E+00		2.57E+00
	1408.01	21.07	1.23E-01		2.11E-01
	1457.64	0.50	7.81E+01		3.12E+01
	1528.10	0.28	4.46E+00		1.21E+01
Eu-154	123.07	40.40	5.83E-02	6.89E-02	6.89E-02
	247.93	6.89	-6.79E-03		4.45E-01
	591.76	4.95	-3.44E-01		6.98E-01
	692.42	1.78	1.36E+00		2.08E+00
	723.30	20.06	1.10E-01		2.01E-01
	756.80	4.52	1.60E-01		8.70E-01
	873.18	12.08	2.47E-02		2.85E-01

Analysis Report for 18-Nov-19-10023

L1-10204A-FQGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	7.41E-02	6.89E-02	3.60E-01
	1004.76	18.01	-1.08E-01		1.96E-01
	1274.43	34.80	-1.85E-01		1.09E-01
	1596.48	1.80	2.90E-01		1.40E+00
Eu-155	45.30	1.31	2.06E+00	1.46E-01	9.84E+00
	60.01	1.22	1.76E+00		1.05E+01
	86.55	30.70	7.62E-02		1.46E-01
	105.31	21.10	-1.80E-02		1.56E-01
Ra-226	186.21	3.64	-5.29E-02	8.57E-01	8.57E-01
Pa-231	27.36	10.30	1.08E+00	1.13E+00	1.26E+00
	283.69	1.70	4.83E-01		1.65E+00
	300.07	2.47	-1.85E+00		1.13E+00
	302.65	2.20	-1.93E-01		1.32E+00
	330.06	1.40	1.08E+00		2.48E+00
U-235	143.76	10.96	1.93E-02	5.37E-02	2.53E-01
	163.33	5.08	-3.88E-01		5.13E-01
	185.71	57.20	-2.27E-02		5.37E-02
	202.11	1.08	-1.59E+00		2.46E+00
	205.31	5.01	-2.76E-01		5.43E-01
Am-241	59.54	35.90	-1.47E-01	3.60E-01	3.60E-01

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

Apex-Gamma

Analysis Report for 18-Nov-19-10024

L1-10204A-FSGS-010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10024
Sample Description	: L1-10204A-FSGS-010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.395E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:48:00PM
Acquisition Started	: 11/18/2019 10:43:25AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81361
Fill Height	: 1395.10 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 10:58:29AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

JBrokam

Analysis Report for 18-Nov-19-10024

L1-10204A-FSGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.18	306 -	314	310.04	2.19E+01	10.60	4.11E+01	0.32
2	238.66	947 -	961	955.11	1.21E+02	16.31	5.00E+01	0.95
3	295.33	1176 -	1187	1181.56	4.00E+01	9.65	2.10E+01	0.93
4	351.89	1400 -	1413	1407.56	5.06E+01	10.50	2.04E+01	1.81
5	583.15	2325 -	2339	2331.91	3.95E+01	7.82	7.50E+00	1.04
6	609.41	2430 -	2445	2436.89	3.50E+01	8.45	1.20E+01	0.79
7	1460.68	5831 -	5854	5843.09	2.23E+02	14.93	0.00E+00	1.82

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	4.80E+00	3.83E-01
Tl-208	1.00	583.19	*	85.00	5.78E-02	1.20E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.93E-01	3.03E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	2.06E-01	1.02E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	9.85E-02	2.45E-02

Analysis Report for 18-Nov-19-10024

L1-10204A-FSGS-010SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	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	1.70E-01	4.31E-02
		351.93	*	35.60	1.26E-01	2.79E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	3.63E-01	1.80E-01
		87.35		2.24		
		89.78		0.82		

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

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.997	4.80E+00	3.83E-01	
Tl-208	1.000	5.78E-02	1.20E-02	

Analysis Report for 18-Nov-19-10024

L1-10204A-FSGS-010SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
X	Bi-211	0.898			
	Pb-212	1.000	1.93E-01	3.03E-02	
?	Pb212-XR	1.000	2.06E-01	1.02E-01	
	Bi-214	1.000	9.85E-02	2.45E-02	
	Pb-214	0.999	1.39E-01	2.34E-02	
?	Pb214-XR	1.000	3.63E-01	1.80E-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 18-Nov-19-10024

L1-10204A-FSGS-010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 10:58:29AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.97E-02	5.11E-02	5.11E-02
	BE-7	477.60		10.44	-6.76E-02	3.79E-01	3.79E-01
+	K-40	1460.82	*	10.66	4.80E+00	6.19E-02	6.19E-02
	Mn-54	834.85		99.98	2.73E-02	4.55E-02	4.55E-02
	Co-60	1173.23		99.85	3.47E-02	4.98E-02	5.21E-02
		1332.49		99.98	8.04E-03		4.98E-02
	Nb-94	702.65		99.81	1.80E-02	3.72E-02	3.72E-02
		871.09		99.89	-4.05E-03		4.11E-02
	Ag-108m	79.13		6.60	-4.24E-01	3.48E-02	1.25E+00
		433.94		90.50	-1.03E-02		3.48E-02
		614.28		89.80	4.39E-03		5.82E-02
		722.94		90.80	1.44E-02		5.06E-02
	Sb-125	176.31		6.84	-2.08E-01	1.03E-01	4.39E-01
		380.45		1.52	-3.49E+00		1.85E+00
		427.87		29.60	6.22E-02		1.03E-01
		463.36		10.49	7.64E-03		2.97E-01
		600.60		17.65	6.61E-02		2.16E-01
		606.71		4.98	1.12E+00		1.07E+00
		635.95		11.22	-1.40E-01		2.98E-01

Analysis Report for 18-Nov-19-10024

L1-10204A-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.00E+00	1.03E-01	2.05E+00
Ba-133	79.61	2.65	-1.48E+00	6.84E-02	3.03E+00
	81.00	32.90	-1.35E-01		2.08E-01
	276.40	7.16	6.16E-02		4.47E-01
	302.85	18.34	6.30E-03		1.76E-01
	356.01	62.05	-3.39E-02		6.84E-02
	383.85	8.94	-9.51E-02		3.65E-01
Cs-134	475.36	1.48	3.21E-01	4.72E-02	2.53E+00
	563.25	8.34	6.50E-02		3.92E-01
	569.33	15.37	-3.46E-01		2.18E-01
	604.72	97.62	-6.41E-03		4.90E-02
	795.86	85.46	3.21E-02		4.72E-02
	801.95	8.69	-3.23E-01		4.01E-01
	1038.61	0.99	-4.63E-01		4.58E+00
	1167.97	1.79	4.11E-01		2.95E+00
	1365.19	3.02	3.79E-01		1.31E+00
Cs-137	661.66	85.10	3.81E-02	4.19E-02	4.19E-02
Eu-152	121.78	28.67	8.94E-04	1.17E-01	1.20E-01
	244.70	7.61	1.03E-01		4.60E-01
	295.94	0.45	5.38E+00		8.75E+00
	344.28	26.60	-6.46E-02		1.17E-01
	367.79	0.86	4.47E-01		3.67E+00
	411.12	2.24	2.95E-01		1.53E+00
	443.96	2.83	-2.79E-01		1.08E+00
	488.68	0.42	-4.06E+00		7.67E+00
	563.99	0.49	8.84E-01		6.65E+00
	586.26	0.46	7.10E+00		1.12E+01
	678.62	0.47	1.66E+00		8.75E+00
	688.67	0.86	2.06E+00		4.26E+00
	719.35	0.28	-4.29E+00		1.33E+01
	778.90	12.96	1.26E-01		3.63E-01
	810.45	0.32	3.74E+00		1.17E+01
	867.37	4.26	-3.16E-01		9.81E-01
	919.33	0.43	-1.43E+01		9.13E+00
	964.08	14.65	3.82E-01		3.80E-01
	1085.87	10.24	-2.73E-01		3.81E-01
	1089.74	1.73	1.08E+00		2.76E+00
	1112.07	13.69	-2.22E-01		3.15E-01
	1212.95	1.43	-2.53E+00		3.72E+00
	1249.94	0.19	2.61E+01		2.87E+01
	1299.14	1.63	2.07E+00		2.86E+00
	1408.01	21.07	-2.26E-01		2.21E-01
	1457.64	0.50	9.93E+01		3.43E+01
	1528.10	0.28	5.05E+00		1.23E+01
Eu-154	123.07	40.40	-6.71E-02	8.17E-02	8.17E-02
	247.93	6.89	3.18E-02		4.52E-01
	591.76	4.95	4.58E-03		8.04E-01
	692.42	1.78	7.47E-01		2.18E+00
	723.30	20.06	-4.01E-02		2.23E-01
	756.80	4.52	-5.40E-01		7.21E-01
	873.18	12.08	-4.99E-02		3.34E-01

Analysis Report for 18-Nov-19-10024

L1-10204A-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.42E-02	8.17E-02	4.86E-01
	1004.76	18.01	1.41E-01		2.75E-01
	1274.43	34.80	-1.05E-02		1.17E-01
	1596.48	1.80	-1.37E+00		1.53E+00
Eu-155	45.30	1.31	1.78E+00	1.78E-01	1.69E+01
	60.01	1.22	-1.32E+01		1.67E+01
	86.55	30.70	-7.56E-02		1.89E-01
	105.31	21.10	-7.21E-03		1.78E-01
Ra-226	186.21	3.64	6.65E-01	9.23E-01	9.23E-01
Pa-231	27.36	10.30	1.19E+00	1.39E+00	1.89E+00
	283.69	1.70	5.07E-01		1.89E+00
	300.07	2.47	-4.00E-01		1.39E+00
	302.65	2.20	3.79E-01		1.48E+00
	330.06	1.40	1.38E+00		2.28E+00
U-235	143.76	10.96	-8.25E-02	5.84E-02	2.91E-01
	163.33	5.08	-1.21E-01		5.94E-01
	185.71	57.20	4.25E-02		5.84E-02
	202.11	1.08	-1.45E+00		2.98E+00
	205.31	5.01	-1.31E-01		6.80E-01
Am-241	59.54	35.90	-5.11E-01	5.99E-01	5.99E-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 18-Nov-19-10025

L1-10204A-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10025
Sample Description	: L1-10204A-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.449E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:50:00PM
Acquisition Started	: 11/18/2019 11:17:48AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81363
Fill Height	: 1448.83 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 11:32:51AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 11/18/19 - 1500

J Graham

Analysis Report for 18-Nov-19-10025

L1-10204A-FSGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.57	475 -	481	477.33	1.25E+02	17.54	9.19E+01	0.90
2	295.57	586 -	595	591.20	2.52E+01	11.84	5.08E+01	0.71
3	338.18	674 -	681	676.33	3.15E+01	10.00	3.25E+01	1.30
4	351.74	698 -	708	703.42	6.14E+01	12.02	3.46E+01	1.23
5	583.18	1161 -	1171	1165.96	6.39E+01	11.22	2.61E+01	0.93
6	609.18	1212 -	1222	1217.93	4.89E+01	8.69	1.11E+01	1.66
7	910.74	1816 -	1827	1820.92	3.65E+01	9.39	2.05E+01	1.32
8	1460.35	2915 -	2927	2920.76	3.14E+02	18.07	4.72E+00	2.15

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.82	*	10.66	6.00E+00	4.32E-01
Tl-208	1.00	583.19	*	85.00	8.34E-02	1.55E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.77E-01	2.87E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.23E-01	2.30E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 18-Nov-19-10025

L1-10204A-FSGS-011SS

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	9.53E-02	4.55E-02
		351.93	*	35.60	1.36E-01	2.88E-02
		785.96		1.06		
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.14E-01	7.03E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.11E-01	5.50E-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 18-Nov-19-10025

L1-10204A-FSGS-011SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.966	6.00E+00	4.32E-01	
	Tl-208	1.000	8.34E-02	1.55E-02	
X	Bi-211	0.931			
	Pb-212	1.000	1.77E-01	2.87E-02	
	Bi-214	0.999	1.23E-01	2.30E-02	
	Pb-214	0.991	1.24E-01	2.43E-02	
	Ac-228	0.989	2.12E-01	4.33E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10025

L1-10204A-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 11:32:51AM
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	7.65E-02	5.73E-02	5.73E-02
	BE-7	477.60		10.44	-1.02E-01	2.77E-01	2.77E-01
+	K-40	1460.82	*	10.66	6.00E+00	2.81E-01	2.81E-01
	Mn-54	834.85		99.98	-3.37E-04	3.51E-02	3.51E-02
	Co-60	1173.23		99.85	1.94E-02	5.29E-02	5.34E-02
		1332.49		99.98	4.04E-02		5.29E-02
	Nb-94	702.65		99.81	1.39E-03	3.98E-02	3.98E-02
		871.09		99.89	1.45E-02		4.15E-02
	Ag-108m	79.13		6.60	4.82E-01	3.34E-02	1.07E+00
		433.94		90.50	6.29E-03		3.34E-02
		614.28		89.80	-4.08E-02		4.25E-02
		722.94		90.80	1.27E-02		4.28E-02
	Sb-125	176.31		6.84	6.20E-02	1.05E-01	4.92E-01
		380.45		1.52	-3.19E-01		2.12E+00
		427.87		29.60	-3.50E-02		1.05E-01
		463.36		10.49	-1.57E-01		2.98E-01
		600.60		17.65	1.11E-01		2.25E-01
		606.71		4.98	2.21E-02		1.01E+00
		635.95		11.22	2.18E-01		3.28E-01

Analysis Report for 18-Nov-19-10025

L1-10204A-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.75E+00	1.05E-01	1.66E+00
Ba-133	79.61	2.65	-3.41E-01	5.97E-02	2.40E+00
	81.00	32.90	-2.78E-01		1.56E-01
	276.40	7.16	1.23E-01		4.37E-01
	302.85	18.34	1.81E-02		1.50E-01
	356.01	62.05	-1.70E-02		5.97E-02
	383.85	8.94	-7.98E-02		3.22E-01
Cs-134	475.36	1.48	-6.57E-02	4.44E-02	1.89E+00
	563.25	8.34	9.38E-02		4.52E-01
	569.33	15.37	-4.25E-02		2.14E-01
	604.72	97.62	2.92E-04		4.89E-02
	795.86	85.46	2.87E-02		4.44E-02
	801.95	8.69	-3.32E-01		3.58E-01
	1038.61	0.99	2.49E+00		4.78E+00
	1167.97	1.79	-1.43E+00		2.33E+00
	1365.19	3.02	3.06E-01		1.30E+00
Cs-137	661.66	85.10	5.51E-02	5.59E-02	5.59E-02
Eu-152	121.78	28.67	-3.09E-02	1.04E-01	1.04E-01
	244.70	7.61	-1.20E-02		4.54E-01
	295.94	0.45	2.00E+00		7.50E+00
	344.28	26.60	7.20E-02		1.17E-01
	367.79	0.86	-2.04E-01		3.57E+00
	411.12	2.24	-9.25E-01		1.30E+00
	443.96	2.83	5.82E-02		1.12E+00
	488.68	0.42	-5.51E+00		6.95E+00
	563.99	0.49	3.27E+00		7.91E+00
	586.26	0.46	-2.56E+00		1.25E+01
	678.62	0.47	3.64E-01		6.98E+00
	688.67	0.86	4.69E-01		4.27E+00
	719.35	0.28	3.12E+00		1.29E+01
	778.90	12.96	-1.76E-01		2.29E-01
	810.45	0.32	1.77E+00		1.36E+01
	867.37	4.26	-1.19E-01		8.58E-01
	919.33	0.43	-4.48E+00		8.33E+00
	964.08	14.65	1.35E-01		3.99E-01
	1085.87	10.24	-2.51E-01		4.13E-01
	1089.74	1.73	7.73E-01		2.86E+00
	1112.07	13.69	-3.05E-01		3.14E-01
	1212.95	1.43	3.93E-01		3.66E+00
	1249.94	0.19	1.30E+01		2.59E+01
	1299.14	1.63	8.91E-01		2.98E+00
	1408.01	21.07	5.17E-02		1.62E-01
	1457.64	0.50	-1.10E+01		3.60E+01
	1528.10	0.28	5.98E+00		1.23E+01
Eu-154	123.07	40.40	-2.92E-02	7.11E-02	7.11E-02
	247.93	6.89	-9.78E-02		4.55E-01
	591.76	4.95	-1.98E-01		6.99E-01
	692.42	1.78	7.17E-01		2.16E+00
	723.30	20.06	9.73E-02		1.91E-01
	756.80	4.52	5.34E-01		9.11E-01
	873.18	12.08	1.48E-01		3.38E-01

Analysis Report for 18-Nov-19-10025

L1-10204A-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.14E-01	7.11E-02	3.58E-01
	1004.76	18.01	6.39E-02		2.28E-01
	1274.43	34.80	-3.14E-02		1.32E-01
	1596.48	1.80	-4.34E-01		1.77E+00
Eu-155	45.30	1.31	-8.54E-01	1.59E-01	1.06E+01
	60.01	1.22	-2.06E+00		1.19E+01
	86.55	30.70	-1.62E-02		1.59E-01
	105.31	21.10	-9.66E-02		1.65E-01
Ra-226	186.21	3.64	6.83E-01	9.67E-01	9.67E-01
Pa-231	27.36	10.30	8.44E-01	1.09E+00	1.09E+00
	283.69	1.70	3.21E-01		1.69E+00
	300.07	2.47	1.82E-01		1.16E+00
	302.65	2.20	1.51E-01		1.25E+00
	330.06	1.40	2.91E-01		2.47E+00
U-235	143.76	10.96	2.75E-02	6.00E-02	2.70E-01
	163.33	5.08	-3.01E-01		6.93E-01
	185.71	57.20	1.71E-02		6.00E-02
	202.11	1.08	-1.69E+00		2.92E+00
	205.31	5.01	-1.14E-01		6.50E-01
Am-241	59.54	35.90	1.78E-01	4.35E-01	4.35E-01

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

Apex-Gamma

Analysis Report for 18-Nov-19-10026

L1-10204A-FSGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10026
Sample Description	: L1-10204A-FSGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.845E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:52:00PM
Acquisition Started	: 11/18/2019 11:17:55AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.0 seconds
Dead Time	: 0.11 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81364
Fill Height	: 1844.99 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 11:33:15AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

J Graham

Analysis Report for 18-Nov-19-10026

L1-10204A-FSGS-012SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	951 -	959	954.67	4.88E+01	11.90	4.32E+01	0.77
2	351.97	1401 -	1414	1407.61	4.85E+01	9.81	1.65E+01	0.85
3	609.10	2430 -	2441	2435.57	3.30E+01	7.45	9.00E+00	0.85
4	1460.95	5833 -	5853	5843.62	1.19E+02	11.72	5.11E+00	1.24

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	2.83E+00	3.04E-01
Bi-211	0.87	351.07	*	13.02	3.59E-01	7.83E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	8.49E-02	2.18E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.02E-01	2.38E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		

Analysis Report for 18-Nov-19-10026

L1-10204A-FSGS-012SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	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	1.31E-01	2.86E-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	0.998	2.83E+00	3.04E-01	
?	Bi-211	0.879	3.59E-01	7.83E-02	
	Pb-212	1.000	8.49E-02	2.18E-02	
	Bi-214	0.997	1.02E-01	2.38E-02	
?	Pb-214	1.000	1.31E-01	2.86E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10026

L1-10204A-FSGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 11:33:15AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.25E-02	5.50E-02	5.50E-02
	BE-7	477.60		10.44	2.62E-01	4.32E-01	4.32E-01
+	K-40	1460.82	*	10.66	2.83E+00	4.14E-01	4.14E-01
	Mn-54	834.85		99.98	-9.00E-03	4.34E-02	4.34E-02
	Co-60	1173.23		99.85	-2.50E-02	4.09E-02	4.94E-02
		1332.49		99.98	5.06E-03		4.09E-02
	Nb-94	702.65		99.81	8.67E-04	3.51E-02	3.51E-02
		871.09		99.89	1.61E-02		3.72E-02
	Ag-108m	79.13		6.60	2.54E-01	3.26E-02	1.59E+00
		433.94		90.50	3.22E-02		4.54E-02
		614.28		89.80	-3.39E-02		4.73E-02
		722.94		90.80	8.53E-03		3.26E-02
	Sb-125	176.31		6.84	-2.18E-01	1.26E-01	4.65E-01
		380.45		1.52	2.58E-01		2.26E+00
		427.87		29.60	-1.19E-02		1.26E-01
		463.36		10.49	3.30E-01		4.03E-01
		600.60		17.65	2.17E-01		2.41E-01
		606.71		4.98	1.01E+00		1.17E+00
		635.95		11.22	5.56E-02		3.28E-01

Analysis Report for 18-Nov-19-10026

L1-10204A-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	6.82E-01	1.26E-01	2.13E+00
Ba-133	79.61	2.65	-1.02E+00	6.03E-02	3.70E+00
	81.00	32.90	-1.11E-01		2.51E-01
	276.40	7.16	-1.68E-01		4.57E-01
	302.85	18.34	-3.36E-02		1.78E-01
	356.01	62.05	-3.13E-02		6.03E-02
	383.85	8.94	8.61E-03		3.90E-01
Cs-134	475.36	1.48	1.35E+00	4.69E-02	2.86E+00
	563.25	8.34	-1.56E-01		3.73E-01
	569.33	15.37	-1.86E-01		2.52E-01
	604.72	97.62	-2.56E-02		5.67E-02
	795.86	85.46	8.98E-03		4.69E-02
	801.95	8.69	3.11E-01		4.95E-01
	1038.61	0.99	1.68E+00		4.24E+00
	1167.97	1.79	6.99E-01		2.82E+00
	1365.19	3.02	5.60E-01		1.25E+00
Cs-137	661.66	85.10	1.47E-02	4.94E-02	4.94E-02
Eu-152	121.78	28.67	-1.19E-01	1.12E-01	1.29E-01
	244.70	7.61	9.65E-02		5.02E-01
	295.94	0.45	2.75E+00		8.91E+00
	344.28	26.60	-2.06E-01		1.12E-01
	367.79	0.86	-1.58E+00		3.52E+00
	411.12	2.24	4.21E-01		1.52E+00
	443.96	2.83	1.42E-01		1.17E+00
	488.68	0.42	-3.93E+00		8.53E+00
	563.99	0.49	3.31E+00		6.76E+00
	586.26	0.46	9.08E+00		1.06E+01
	678.62	0.47	-4.05E+00		6.02E+00
	688.67	0.86	1.34E+00		4.03E+00
	719.35	0.28	-2.81E+00		1.06E+01
	778.90	12.96	-1.44E-01		2.40E-01
	810.45	0.32	-9.77E+00		1.17E+01
	867.37	4.26	-1.57E-01		8.70E-01
	919.33	0.43	1.19E+00		9.02E+00
	964.08	14.65	3.01E-01		3.92E-01
	1085.87	10.24	5.85E-02		4.21E-01
	1089.74	1.73	-5.38E-01		2.57E+00
	1112.07	13.69	1.26E-01		3.20E-01
	1212.95	1.43	-6.94E-01		3.35E+00
	1249.94	0.19	-1.69E+00		2.72E+01
	1299.14	1.63	1.70E-01		2.35E+00
	1408.01	21.07	7.02E-02		1.71E-01
	1457.64	0.50	6.49E+01		2.89E+01
	1528.10	0.28	1.02E+01		1.75E+01
Eu-154	123.07	40.40	5.46E-02	9.65E-02	9.65E-02
	247.93	6.89	-3.18E-01		4.72E-01
	591.76	4.95	-2.84E-01		6.48E-01
	692.42	1.78	-1.74E+00		1.85E+00
	723.30	20.06	-3.80E-02		1.36E-01
	756.80	4.52	-7.88E-02		1.03E+00
	873.18	12.08	-1.85E-01		2.67E-01

Analysis Report for 18-Nov-19-10026

L1-10204A-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.93E-02	9.65E-02	4.12E-01
	1004.76	18.01	1.97E-01		2.54E-01
	1274.43	34.80	2.15E-02		1.46E-01
	1596.48	1.80	4.53E-01		1.69E+00
Eu-155	45.30	1.31	4.30E+00	2.39E-01	2.74E+01
	60.01	1.22	-1.69E+01		2.60E+01
	86.55	30.70	9.46E-02		2.39E-01
	105.31	21.10	3.50E-02		2.49E-01
Ra-226	186.21	3.64	5.94E-02	9.07E-01	9.07E-01
Pa-231	27.36	10.30	1.10E+00	1.34E+00	3.00E+00
	283.69	1.70	1.08E+00		1.96E+00
	300.07	2.47	-7.80E-01		1.34E+00
	302.65	2.20	-3.03E-02		1.50E+00
	330.06	1.40	-1.41E-02		2.52E+00
U-235	143.76	10.96	1.68E-02	5.76E-02	3.74E-01
	163.33	5.08	2.63E-01		7.04E-01
	185.71	57.20	3.24E-03		5.76E-02
	202.11	1.08	-5.26E-01		3.23E+00
	205.31	5.01	6.53E-02		7.39E-01
Am-241	59.54	35.90	-1.27E-01	9.58E-01	9.58E-01

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

Apex-Gamma

Analysis Report for 18-Nov-19-10027
L1-10204A-FSGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10027
Sample Description	: L1-10204A-FSGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.729E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:54:00PM
Acquisition Started	: 11/18/2019 11:18:03AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81365
Fill Height	: 1729.06 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 11:33:10AM

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

DATA VALIDATED 11/18/19 - 1500
JBroham

Analysis Report for 18-Nov-19-10027

L1-10204A-FSGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.59	949 -	960	954.84	7.92E+01	14.50	4.98E+01	0.98
2	295.31	1175 -	1188	1181.45	4.35E+01	9.29	1.55E+01	0.72
3	351.89	1401 -	1413	1407.57	5.37E+01	10.22	1.93E+01	0.42
4	477.66	1905 -	1916	1910.22	2.26E+01	6.98	1.04E+01	0.49
5	583.24	2327 -	2337	2332.28	3.00E+01	8.01	1.40E+01	0.31
6	609.30	2430 -	2444	2436.45	4.81E+01	9.23	1.29E+01	0.71
7	969.16	3870 -	3881	3875.73	1.61E+01	5.15	3.86E+00	0.33
8	1460.60	5831 -	5853	5842.77	2.22E+02	15.26	2.78E+00	1.72

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	2.34E-01	7.43E-02
K-40	0.99	1460.82	*	10.66	4.51E+00	3.66E-01
Tl-208	1.00	583.19	*	85.00	4.19E-02	1.15E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.22E-01	2.44E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.29E-01	2.60E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 18-Nov-19-10027

L1-10204A-FSGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.78E-01	4.05E-02
		351.93	*	35.60	1.28E-01	2.64E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97	*	15.80	1.69E-01	5.43E-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 18-Nov-19-10027

L1-10204A-FSGS-013SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.999	2.34E-01	7.43E-02	
	K-40	0.992	4.51E+00	3.66E-01	
	Tl-208	1.000	4.19E-02	1.15E-02	
X	Bi-211	0.897			
	Pb-212	1.000	1.22E-01	2.44E-02	
	Bi-214	1.000	1.29E-01	2.60E-02	
	Pb-214	1.000	1.43E-01	2.21E-02	
	Ac-228	0.999	1.69E-01	5.43E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10027

L1-10204A-FSGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 11:33:10AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.48E-02	5.00E-02	5.00E-02
+	BE-7	477.60	*	10.44	2.34E-01	2.10E-01	2.10E-01
+	K-40	1460.82	*	10.66	4.51E+00	2.82E-01	2.82E-01
	Mn-54	834.85		99.98	-2.81E-03	4.33E-02	4.33E-02
	Co-60	1173.23		99.85	4.18E-02	4.93E-02	6.41E-02
		1332.49		99.98	1.16E-02		4.93E-02
	Nb-94	702.65		99.81	-6.47E-04	3.79E-02	3.79E-02
		871.09		99.89	1.35E-02		3.83E-02
	Ag-108m	79.13		6.60	-3.33E-01	3.75E-02	1.40E+00
		433.94		90.50	-1.06E-02		3.75E-02
		614.28		89.80	-1.49E-02		6.11E-02
		722.94		90.80	-1.17E-02		4.38E-02
	Sb-125	176.31		6.84	1.89E-01	1.20E-01	4.65E-01
		380.45		1.52	-1.14E+00		1.64E+00
		427.87		29.60	-1.81E-03		1.20E-01
		463.36		10.49	2.24E-01		3.46E-01
		600.60		17.65	4.12E-02		2.46E-01
		606.71		4.98	1.04E+00		1.19E+00
		635.95		11.22	-1.35E-01		2.96E-01

Analysis Report for 18-Nov-19-10027

L1-10204A-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	7.55E-01	1.20E-01	2.02E+00
Ba-133	79.61	2.65	1.53E+00	6.50E-02	3.42E+00
	81.00	32.90	-1.64E-01		2.44E-01
	276.40	7.16	5.63E-02		4.77E-01
	302.85	18.34	1.24E-01		1.92E-01
	356.01	62.05	-3.19E-02		6.50E-02
	383.85	8.94	6.30E-02		3.11E-01
Cs-134	475.36	1.48	1.01E+00	4.96E-02	2.81E+00
	563.25	8.34	8.64E-02		4.19E-01
	569.33	15.37	-9.15E-02		2.15E-01
	604.72	97.62	-9.59E-03		5.65E-02
	795.86	85.46	1.88E-02		4.96E-02
	801.95	8.69	-1.64E-01		4.52E-01
	1038.61	0.99	-2.49E+00		4.61E+00
	1167.97	1.79	-1.35E+00		3.50E+00
	1365.19	3.02	3.26E-01		1.38E+00
Cs-137	661.66	85.10	6.17E-02	5.67E-02	5.67E-02
Eu-152	121.78	28.67	4.50E-02	1.20E-01	1.20E-01
	244.70	7.61	-7.34E-02		4.65E-01
	295.94	0.45	-3.42E+00		8.26E+00
	344.28	26.60	-1.45E-02		1.24E-01
	367.79	0.86	3.26E-01		3.84E+00
	411.12	2.24	-1.73E-01		1.60E+00
	443.96	2.83	9.23E-01		1.18E+00
	488.68	0.42	1.76E+00		8.09E+00
	563.99	0.49	-2.62E+00		7.00E+00
	586.26	0.46	9.65E+00		1.10E+01
	678.62	0.47	-3.26E+00		7.05E+00
	688.67	0.86	1.70E+00		4.35E+00
	719.35	0.28	-7.08E+00		1.19E+01
	778.90	12.96	1.13E-01		2.80E-01
	810.45	0.32	-1.02E+01		1.14E+01
	867.37	4.26	-8.22E-01		9.14E-01
	919.33	0.43	-6.22E+00		9.66E+00
	964.08	14.65	1.55E-02		3.94E-01
	1085.87	10.24	-2.73E-01		4.40E-01
	1089.74	1.73	-1.54E-01		2.76E+00
	1112.07	13.69	-1.72E-01		3.84E-01
	1212.95	1.43	1.21E+00		3.83E+00
	1249.94	0.19	-4.74E+00		2.33E+01
	1299.14	1.63	-2.16E-02		2.78E+00
	1408.01	21.07	6.33E-02		2.02E-01
	1457.64	0.50	9.84E+01		3.24E+01
	1528.10	0.28	-1.82E+00		1.16E+01
Eu-154	123.07	40.40	-4.48E-02	8.34E-02	8.34E-02
	247.93	6.89	1.12E-01		4.44E-01
	591.76	4.95	-2.85E-01		7.47E-01
	692.42	1.78	-4.91E-02		2.08E+00
	723.30	20.06	-2.37E-02		2.01E-01
	756.80	4.52	4.68E-01		8.65E-01
	873.18	12.08	-7.02E-02		3.04E-01

Analysis Report for 18-Nov-19-10027

L1-10204A-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.55E-01	8.34E-02	3.64E-01
	1004.76	18.01	9.63E-02		2.43E-01
	1274.43	34.80	-5.18E-02		1.28E-01
	1596.48	1.80	1.56E+00		3.06E+00
Eu-155	45.30	1.31	3.57E+00	2.03E-01	1.80E+01
	60.01	1.22	-5.37E-01		2.02E+01
	86.55	30.70	7.73E-02		2.14E-01
	105.31	21.10	-4.36E-02		2.03E-01
Ra-226	186.21	3.64	-7.48E-02	9.91E-01	9.91E-01
Pa-231	27.36	10.30	2.05E+00	1.39E+00	2.22E+00
	283.69	1.70	-1.64E+00		1.82E+00
	300.07	2.47	1.70E-01		1.39E+00
	302.65	2.20	8.78E-01		1.58E+00
	330.06	1.40	-6.38E-01		2.30E+00
U-235	143.76	10.96	-3.05E-02	6.36E-02	2.97E-01
	163.33	5.08	-1.16E-01		5.98E-01
	185.71	57.20	3.03E-02		6.36E-02
	202.11	1.08	-6.49E-02		2.76E+00
	205.31	5.01	-2.95E-01		6.25E-01
Am-241	59.54	35.90	-1.66E-01	7.16E-01	7.16E-01

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

Apex-Gamma

Analysis Report for 18-Nov-19-10028

L1-10204A-FSGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10028
Sample Description	: L1-10204A-FSGS-014SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.779E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:56:00PM
Acquisition Started	: 11/18/2019 11:44:43AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81366
Fill Height	: 1778.97 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 11:59:46AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 11/18/19 - 1500

J Graham

Analysis Report for 18-Nov-19-10028

L1-10204A-FSGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.51	472 -	481	477.20	1.12E+02	20.39	1.29E+02	1.05
2	295.24	585 -	595	590.53	5.85E+01	13.85	5.55E+01	1.04
3	351.95	698 -	708	703.84	1.06E+02	14.84	4.82E+01	1.85
4	477.69	952 -	958	955.11	1.73E+01	7.90	2.27E+01	0.91
5	583.28	1161 -	1171	1166.16	3.98E+01	9.54	2.12E+01	1.32
6	609.16	1213 -	1222	1217.91	6.99E+01	10.67	1.91E+01	1.35
7	911.08	1816 -	1826	1821.61	4.58E+01	8.12	8.21E+00	1.07
8	968.81	1934 -	1941	1937.08	1.65E+01	6.47	1.25E+01	0.81
9	1460.56	2913 -	2927	2921.18	3.47E+02	19.16	7.24E+00	1.90

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	1.61E-01	7.44E-02
K-40	0.98	1460.82	*	10.66	6.28E+00	4.41E-01
Tl-208	0.99	583.19	*	85.00	4.98E-02	1.23E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.54E-01	3.06E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.68E-01	2.76E-02
		768.36		4.89		

Analysis Report for 18-Nov-19-10028

L1-10204A-FSGS-014SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.14E-01	5.34E-02
		351.93	*	35.60	2.26E-01	3.65E-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	2.52E-01	4.60E-02
		964.77		4.99		
		968.97	*	15.80	1.54E-01	6.09E-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 18-Nov-19-10028

L1-10204A-FSGS-014SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.999	1.61E-01	7.44E-02	
	K-40	0.989	6.28E+00	4.41E-01	
	Tl-208	0.999	4.98E-02	1.23E-02	
X	Bi-211	0.884			
	Pb-212	0.998	1.54E-01	3.06E-02	
	Bi-214	0.998	1.68E-01	2.76E-02	
	Pb-214	1.000	2.22E-01	3.01E-02	
	Ac-228	0.998	2.17E-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 18-Nov-19-10028

L1-10204A-FSGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 11:59:46AM
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	5.52E-02	5.09E-02	5.09E-02
+	BE-7	477.60	*	10.44	1.61E-01	2.39E-01	2.39E-01
+	K-40	1460.82	*	10.66	6.28E+00	3.30E-01	3.30E-01
	Mn-54	834.85		99.98	-5.20E-03	3.62E-02	3.62E-02
	Co-60	1173.23		99.85	-1.91E-02	4.58E-02	4.79E-02
		1332.49		99.98	2.25E-02		4.58E-02
	Nb-94	702.65		99.81	5.64E-03	3.56E-02	3.56E-02
		871.09		99.89	1.32E-02		3.77E-02
	Ag-108m	79.13		6.60	1.54E-01	3.73E-02	1.03E+00
		433.94		90.50	1.05E-02		3.73E-02
		614.28		89.80	-4.02E-02		4.59E-02
		722.94		90.80	1.48E-02		4.67E-02
	Sb-125	176.31		6.84	-1.96E-03	1.12E-01	4.81E-01
		380.45		1.52	5.55E-01		2.04E+00
		427.87		29.60	-7.30E-03		1.12E-01
		463.36		10.49	4.52E-02		2.87E-01
		600.60		17.65	-1.64E-02		1.71E-01
		606.71		4.98	-3.19E-01		1.12E+00
		635.95		11.22	9.33E-02		3.06E-01

Analysis Report for 18-Nov-19-10028

L1-10204A-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.34E-01	1.12E-01	1.90E+00
Ba-133	79.61	2.65	1.06E+00	7.22E-02	2.49E+00
	81.00	32.90	-1.65E-01		1.63E-01
	276.40	7.16	-7.73E-02		4.15E-01
	302.85	18.34	3.17E-03		1.53E-01
	356.01	62.05	-4.67E-02		7.22E-02
	383.85	8.94	-2.14E-01		3.35E-01
Cs-134	475.36	1.48	-1.23E+00	4.83E-02	2.61E+00
	563.25	8.34	2.42E-02		3.75E-01
	569.33	15.37	-1.12E-01		1.87E-01
	604.72	97.62	-1.98E-02		5.15E-02
	795.86	85.46	8.39E-03		4.83E-02
	801.95	8.69	-3.28E-01		3.90E-01
	1038.61	0.99	-1.78E+00		4.27E+00
	1167.97	1.79	-2.17E-01		2.75E+00
	1365.19	3.02	-4.15E-01		1.10E+00
Cs-137	661.66	85.10	1.38E-02	4.19E-02	4.19E-02
Eu-152	121.78	28.67	4.85E-02	1.13E-01	1.13E-01
	244.70	7.61	7.20E-02		4.69E-01
	295.94	0.45	-4.01E-01		8.44E+00
	344.28	26.60	-8.57E-02		1.15E-01
	367.79	0.86	7.63E-01		3.35E+00
	411.12	2.24	-1.90E-01		1.30E+00
	443.96	2.83	-3.54E-01		1.10E+00
	488.68	0.42	8.08E-01		8.24E+00
	563.99	0.49	1.57E+00		6.46E+00
	586.26	0.46	-3.13E+00		9.65E+00
	678.62	0.47	-6.73E-01		7.57E+00
	688.67	0.86	-2.06E+00		3.57E+00
	719.35	0.28	2.91E+00		1.43E+01
	778.90	12.96	-1.58E-01		2.51E-01
	810.45	0.32	2.97E+00		1.21E+01
	867.37	4.26	6.87E-02		8.02E-01
	919.33	0.43	-3.50E+00		6.74E+00
	964.08	14.65	-1.75E-01		3.70E-01
	1085.87	10.24	1.37E-01		4.31E-01
	1089.74	1.73	-7.97E-01		2.38E+00
	1112.07	13.69	-2.33E-01		3.58E-01
	1212.95	1.43	-5.08E-01		3.63E+00
	1249.94	0.19	-1.32E+00		2.55E+01
	1299.14	1.63	2.39E-01		2.88E+00
	1408.01	21.07	8.39E-02		1.80E-01
	1457.64	0.50	-2.49E+00		3.58E+01
	1528.10	0.28	1.77E-01		8.83E+00
Eu-154	123.07	40.40	-2.47E-02	7.51E-02	7.51E-02
	247.93	6.89	-1.55E-01		4.22E-01
	591.76	4.95	2.60E-01		6.42E-01
	692.42	1.78	2.19E-01		1.80E+00
	723.30	20.06	8.47E-02		2.14E-01
	756.80	4.52	-6.14E-02		7.87E-01
	873.18	12.08	-1.37E-01		2.84E-01

Analysis Report for 18-Nov-19-10028

L1-10204A-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.36E-01	7.51E-02	4.66E-01
	1004.76	18.01	-2.03E-02		2.26E-01
	1274.43	34.80	2.80E-02		1.40E-01
	1596.48	1.80	3.53E-01		1.79E+00
Eu-155	45.30	1.31	-4.81E+00	1.75E-01	1.04E+01
	60.01	1.22	-3.32E+00		1.18E+01
	86.55	30.70	9.03E-02		1.75E-01
	105.31	21.10	-3.98E-02		1.82E-01
Ra-226	186.21	3.64	3.27E-01	9.84E-01	9.84E-01
Pa-231	27.36	10.30	8.41E-01	1.14E+00	1.14E+00
	283.69	1.70	4.64E-01		1.79E+00
	300.07	2.47	-5.85E-02		1.15E+00
	302.65	2.20	2.64E-02		1.27E+00
	330.06	1.40	2.99E-01		2.11E+00
U-235	143.76	10.96	-7.79E-02	6.32E-02	2.47E-01
	163.33	5.08	1.04E-01		6.64E-01
	185.71	57.20	2.80E-02		6.32E-02
	202.11	1.08	-2.80E-02		3.09E+00
	205.31	5.01	-6.72E-02		6.78E-01
Am-241	59.54	35.90	-8.97E-02	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 18-Nov-19-10029

L1-10204A-FSGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10029
Sample Description	: L1-10204A-FSGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.797E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 1:58:00PM
Acquisition Started	: 11/18/2019 11:44:52AM
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	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81367
Fill Height	: 1796.64 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 11:59:56AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

JGraham

Analysis Report for 18-Nov-19-10029

L1-10204A-FSGS-015SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	950 -	959	954.71	1.00E+02	14.05	4.28E+01	1.09
2	351.94	1402 -	1413	1407.51	8.76E+01	11.67	1.94E+01	0.92
3	583.14	2325 -	2338	2331.76	3.47E+01	8.28	1.23E+01	1.03
4	609.47	2429 -	2443	2437.05	5.50E+01	9.63	1.30E+01	0.85
5	911.03	3635 -	3648	3643.09	3.15E+01	6.99	6.46E+00	0.72
6	1460.87	5833 -	5853	5843.31	2.58E+02	16.38	2.70E+00	1.54

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	6.18E+00	4.75E-01
Tl-208	1.00	583.19	*	85.00	5.61E-02	1.38E-02
Bi-211	0.88	351.07	*	13.02	6.52E-01	1.01E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.75E-01	2.83E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.71E-01	3.16E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 18-Nov-19-10029

L1-10204A-FSGS-015SS

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	2.38E-01	3.70E-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	2.26E-01	5.11E-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 18-Nov-19-10029

L1-10204A-FSGS-015SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	6.18E+00	4.75E-01	
	Tl-208	1.000	5.61E-02	1.38E-02	
?	Bi-211	0.885	6.52E-01	1.01E-01	
	Pb-212	1.000	1.75E-01	2.83E-02	
	Bi-214	0.999	1.71E-01	3.16E-02	
?	Pb-214	1.000	2.38E-01	3.70E-02	
	Ac-228	0.999	2.26E-01	5.11E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10029

L1-10204A-FSGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 11:59:56AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	1.40E-02	5.68E-02	5.68E-02
	BE-7	477.60		10.44	1.70E-01	4.69E-01	4.69E-01
+	K-40	1460.82	*	10.66	6.18E+00	3.25E-01	3.25E-01
	Mn-54	834.85		99.98	-1.71E-02	4.36E-02	4.36E-02
	Co-60	1173.23		99.85	-3.52E-03	5.92E-02	6.30E-02
		1332.49		99.98	1.96E-02		5.92E-02
	Nb-94	702.65		99.81	-3.78E-02	4.27E-02	4.33E-02
		871.09		99.89	-2.65E-02		4.27E-02
	Ag-108m	79.13		6.60	9.37E-01	4.64E-02	1.86E+00
		433.94		90.50	2.64E-03		4.64E-02
		614.28		89.80	-3.20E-02		6.48E-02
		722.94		90.80	4.98E-02		5.99E-02
	Sb-125	176.31		6.84	-1.98E-01	1.36E-01	5.63E-01
		380.45		1.52	-1.60E+00		2.69E+00
		427.87		29.60	-4.98E-02		1.36E-01
		463.36		10.49	2.00E-01		3.68E-01
		600.60		17.65	-6.36E-02		2.35E-01
		606.71		4.98	1.44E+00		1.32E+00
		635.95		11.22	-1.19E-01		3.49E-01

Analysis Report for 18-Nov-19-10029

L1-10204A-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.15E+00	1.36E-01	1.91E+00
Ba-133	79.61	2.65	4.77E-01	7.82E-02	4.48E+00
	81.00	32.90	-3.98E-01		3.12E-01
	276.40	7.16	-9.48E-02		5.24E-01
	302.85	18.34	1.26E-01		2.20E-01
	356.01	62.05	-1.80E-02		7.82E-02
	383.85	8.94	7.46E-02		4.86E-01
Cs-134	475.36	1.48	2.58E+00	5.60E-02	3.17E+00
	563.25	8.34	2.98E-01		5.17E-01
	569.33	15.37	3.20E-02		2.41E-01
	604.72	97.62	-1.65E-02		5.83E-02
	795.86	85.46	1.49E-02		5.60E-02
	801.95	8.69	-3.68E-01		5.07E-01
	1038.61	0.99	2.51E+00		5.40E+00
	1167.97	1.79	1.53E+00		3.61E+00
	1365.19	3.02	-1.64E+00		1.45E+00
Cs-137	661.66	85.10	5.06E-02	6.10E-02	6.10E-02
Eu-152	121.78	28.67	-2.75E-02	1.23E-01	1.66E-01
	244.70	7.61	2.34E-01		5.71E-01
	295.94	0.45	-7.93E-01		1.02E+01
	344.28	26.60	-1.26E-02		1.23E-01
	367.79	0.86	-2.05E+00		4.50E+00
	411.12	2.24	-5.03E-01		1.66E+00
	443.96	2.83	-8.36E-01		1.27E+00
	488.68	0.42	-6.49E+00		8.94E+00
	563.99	0.49	2.56E+00		8.65E+00
	586.26	0.46	-4.49E-01		1.27E+01
	678.62	0.47	3.38E+00		9.39E+00
	688.67	0.86	-2.10E+00		4.63E+00
	719.35	0.28	-2.04E+00		1.68E+01
	778.90	12.96	1.24E-01		3.51E-01
	810.45	0.32	-3.47E+00		1.46E+01
	867.37	4.26	-4.91E-01		1.13E+00
	919.33	0.43	-1.26E+01		9.61E+00
	964.08	14.65	2.64E-01		5.09E-01
	1085.87	10.24	9.14E-02		5.74E-01
	1089.74	1.73	-2.95E+00		3.18E+00
	1112.07	13.69	1.28E-01		4.22E-01
	1212.95	1.43	2.47E+00		4.43E+00
	1249.94	0.19	8.55E+00		3.36E+01
	1299.14	1.63	-1.03E+00		3.80E+00
	1408.01	21.07	8.83E-03		1.83E-01
	1457.64	0.50	1.30E+02		4.11E+01
	1528.10	0.28	4.68E+00		1.27E+01
Eu-154	123.07	40.40	1.02E-01	1.20E-01	1.20E-01
	247.93	6.89	-1.86E-01		5.64E-01
	591.76	4.95	-1.90E-02		8.64E-01
	692.42	1.78	-1.52E-01		2.49E+00
	723.30	20.06	1.78E-01		2.72E-01
	756.80	4.52	-1.18E-01		9.89E-01
	873.18	12.08	-2.82E-01		3.70E-01

Analysis Report for 18-Nov-19-10029

L1-10204A-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	8.43E-02	1.20E-01	4.57E-01
	1004.76	18.01	1.25E-01		3.11E-01
	1274.43	34.80	3.49E-02		1.54E-01
	1596.48	1.80	-8.87E-02		2.22E+00
Eu-155	45.30	1.31	-1.60E+01	2.77E-01	2.89E+01
	60.01	1.22	-3.75E+00		2.89E+01
	86.55	30.70	-1.39E-01		2.78E-01
	105.31	21.10	3.20E-02		2.77E-01
Ra-226	186.21	3.64	6.87E-01	1.20E+00	1.20E+00
Pa-231	27.36	10.30	2.99E+00	1.65E+00	3.58E+00
	283.69	1.70	1.65E+00		2.18E+00
	300.07	2.47	-1.41E+00		1.65E+00
	302.65	2.20	1.20E+00		1.87E+00
	330.06	1.40	-1.62E-01		2.76E+00
U-235	143.76	10.96	-1.88E-01	7.78E-02	3.75E-01
	163.33	5.08	-4.24E-01		7.00E-01
	185.71	57.20	8.04E-02		7.78E-02
	202.11	1.08	-4.89E-01		3.48E+00
	205.31	5.01	-2.12E-01		7.38E-01
Am-241	59.54	35.90	-5.29E-02	1.04E+00	1.04E+00

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

Apex-Gamma

Analysis Report for 18-Nov-19-10030
L1-10204A-FSGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10030
Sample Description	: L1-10204A-FSGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.497E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 2:00:00PM
Acquisition Started	: 11/18/2019 11:44:59AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81368
Fill Height	: 1496.58 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 12:00:09PM

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

DATA VALIDATED 11/18/19 - 1500
JBroham

Analysis Report for 18-Nov-19-10030

L1-10204A-FSGS-016SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.70	947 -	959	954.38	1.46E+02	15.75	3.88E+01	1.38
2	295.15	1176 -	1185	1179.90	3.31E+01	9.27	2.29E+01	0.97
3	351.87	1400 -	1413	1406.49	7.50E+01	10.66	1.40E+01	1.18
4	582.95	2324 -	2335	2329.92	4.94E+01	8.72	1.06E+01	0.52
5	609.17	2426 -	2442	2434.73	7.28E+01	9.29	4.25E+00	1.00
6	1459.98	5826 -	5848	5837.84	2.57E+02	17.67	1.44E+01	1.54

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.89	1460.82	*	10.66	5.79E+00	4.72E-01
Tl-208	0.99	583.19	*	85.00	7.48E-02	1.39E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.33E-01	3.14E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.12E-01	2.99E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 18-Nov-19-10030

L1-10204A-FSGS-016SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.42E-01	4.14E-02
		351.93	*	35.60	1.90E-01	3.09E-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	0.892	5.79E+00	4.72E-01	
	Tl-208	0.991	7.48E-02	1.39E-02	
X	Bi-211	0.903			
	Pb-212	0.999	2.33E-01	3.14E-02	
	Bi-214	0.999	2.12E-01	2.99E-02	
	Pb-214	0.999	1.73E-01	2.48E-02	

Analysis Report for 18-Nov-19-10030

L1-10204A-FSGS-016SS

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10030

L1-10204A-FSGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 12:00:09PM
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	6.80E-02	5.41E-02	5.41E-02
	BE-7	477.60		10.44	1.40E-01	3.65E-01	3.65E-01
+	K-40	1460.82	*	10.66	5.79E+00	6.36E-01	6.36E-01
	Mn-54	834.85		99.98	-2.60E-02	3.54E-02	3.54E-02
	Co-60	1173.23		99.85	1.14E-02	5.58E-02	5.94E-02
		1332.49		99.98	1.90E-03		5.58E-02
	Nb-94	702.65		99.81	2.09E-02	4.02E-02	4.45E-02
		871.09		99.89	2.18E-02		4.02E-02
	Ag-108m	79.13		6.60	6.84E-01	3.16E-02	1.10E+00
		433.94		90.50	-1.89E-02		3.16E-02
		614.28		89.80	-7.29E-03		5.66E-02
		722.94		90.80	4.39E-02		5.26E-02
	Sb-125	176.31		6.84	3.16E-01	1.23E-01	4.48E-01
		380.45		1.52	1.40E+00		2.25E+00
		427.87		29.60	4.57E-02		1.23E-01
		463.36		10.49	-3.59E-02		3.81E-01
		600.60		17.65	6.24E-02		2.20E-01
		606.71		4.98	2.16E+00		1.34E+00
		635.95		11.22	1.65E-01		3.50E-01

Analysis Report for 18-Nov-19-10030

L1-10204A-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	4.83E-02	1.23E-01	1.75E+00
Ba-133	79.61	2.65	2.54E-01	6.00E-02	2.60E+00
	81.00	32.90	-3.80E-01		1.61E-01
	276.40	7.16	2.63E-01		4.53E-01
	302.85	18.34	-3.06E-02		1.76E-01
	356.01	62.05	-1.29E-03		6.00E-02
	383.85	8.94	-1.57E-01		3.65E-01
Cs-134	475.36	1.48	-2.10E-01	4.82E-02	2.33E+00
	563.25	8.34	-5.52E-01		4.96E-01
	569.33	15.37	-3.17E-02		2.37E-01
	604.72	97.62	1.29E-02		5.82E-02
	795.86	85.46	-5.06E-03		4.82E-02
	801.95	8.69	2.07E-02		5.04E-01
	1038.61	0.99	-3.09E-01		4.69E+00
	1167.97	1.79	9.58E-01		3.20E+00
	1365.19	3.02	5.32E-01		1.18E+00
Cs-137	661.66	85.10	2.06E-04	4.95E-02	4.95E-02
Eu-152	121.78	28.67	-3.89E-03	1.10E-01	1.10E-01
	244.70	7.61	2.67E-01		4.74E-01
	295.94	0.45	8.75E-01		8.56E+00
	344.28	26.60	6.63E-02		1.34E-01
	367.79	0.86	-1.44E+00		3.46E+00
	411.12	2.24	4.95E-01		1.56E+00
	443.96	2.83	-3.71E-01		1.22E+00
	488.68	0.42	3.39E+00		8.46E+00
	563.99	0.49	-4.79E+00		8.00E+00
	586.26	0.46	-4.93E+00		1.28E+01
	678.62	0.47	2.48E+00		7.83E+00
	688.67	0.86	4.66E-01		3.80E+00
	719.35	0.28	1.44E+00		1.50E+01
	778.90	12.96	-6.04E-03		2.94E-01
	810.45	0.32	-1.08E+01		1.14E+01
	867.37	4.26	-6.23E-01		8.48E-01
	919.33	0.43	-3.40E+00		1.20E+01
	964.08	14.65	2.04E-01		4.38E-01
	1085.87	10.24	5.59E-02		5.32E-01
	1089.74	1.73	-1.67E+00		3.21E+00
	1112.07	13.69	-2.81E-01		3.54E-01
	1212.95	1.43	1.03E+00		4.44E+00
	1249.94	0.19	-1.16E+01		2.58E+01
	1299.14	1.63	-5.58E-01		2.83E+00
	1408.01	21.07	-3.36E-01		1.83E-01
	1457.64	0.50	1.22E+02		3.97E+01
	1528.10	0.28	5.31E+00		1.29E+01
Eu-154	123.07	40.40	-3.94E-02	7.78E-02	7.78E-02
	247.93	6.89	6.68E-02		4.59E-01
	591.76	4.95	-5.62E-01		5.47E-01
	692.42	1.78	2.04E-01		2.07E+00
	723.30	20.06	1.99E-01		2.38E-01
	756.80	4.52	-6.50E-01		8.45E-01
	873.18	12.08	-9.17E-02		3.41E-01

Analysis Report for 18-Nov-19-10030

L1-10204A-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.21E-02	7.78E-02	4.11E-01
	1004.76	18.01	-2.19E-01		2.52E-01
	1274.43	34.80	-3.22E-02		1.62E-01
	1596.48	1.80	4.80E-01		2.70E+00
Eu-155	45.30	1.31	8.97E-01	1.72E-01	9.98E+00
	60.01	1.22	-2.23E+00		1.16E+01
	86.55	30.70	8.48E-02		1.76E-01
	105.31	21.10	-1.07E-01		1.72E-01
Ra-226	186.21	3.64	7.36E-01	8.95E-01	8.95E-01
Pa-231	27.36	10.30	8.78E-01	1.12E+00	1.12E+00
	283.69	1.70	-3.23E-01		1.70E+00
	300.07	2.47	-4.55E-01		1.30E+00
	302.65	2.20	8.36E-01		1.50E+00
	330.06	1.40	8.56E-01		2.44E+00
U-235	143.76	10.96	6.95E-02	5.78E-02	2.98E-01
	163.33	5.08	1.61E-01		6.02E-01
	185.71	57.20	5.68E-02		5.78E-02
	202.11	1.08	-1.49E+00		2.60E+00
	205.31	5.01	-5.42E-02		6.36E-01
Am-241	59.54	35.90	1.30E-02	4.05E-01	4.05E-01

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

Apex-Gamma

Analysis Report for 18-Nov-19-10031

L1-10204A-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10031
Sample Description	: L1-10204A-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.535E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 2:02:00PM
Acquisition Started	: 11/18/2019 11:45:05AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81369
Fill Height	: 1535.28 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 12:00:11PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

T Graham

Analysis Report for 18-Nov-19-10031

L1-10204A-FSGS-017SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.19	740 -	749	745.47	3.16E+01	11.68	4.64E+01	0.68
2	238.74	949 -	961	955.42	1.26E+02	16.86	6.02E+01	1.17
3	295.28	1173 -	1187	1181.34	6.92E+01	12.71	3.18E+01	0.39
4	338.20	1346 -	1358	1352.84	4.35E+01	9.73	1.95E+01	0.82
5	351.90	1401 -	1413	1407.57	8.25E+01	11.56	1.95E+01	0.78
6	582.95	2324 -	2338	2331.13	5.92E+01	10.73	1.88E+01	0.97
7	609.17	2428 -	2445	2435.96	9.07E+01	12.07	1.63E+01	1.03
8	661.48	2640 -	2650	2645.11	2.47E+01	6.70	8.33E+00	0.89
9	911.43	3639 -	3652	3644.76	2.37E+01	8.68	1.83E+01	0.43
10	1460.60	5830 -	5853	5842.77	2.26E+02	15.45	3.10E+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	0.99	1460.82	*	10.66	4.72E+00	3.83E-01
Cs-137	0.99	661.66	*	85.10	3.83E-02	1.06E-02
Tl-208	0.99	583.19	*	85.00	8.47E-02	1.62E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.97E-01	3.08E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.49E-01	3.64E-02

Analysis Report for 18-Nov-19-10031

L1-10204A-FSGS-017SS

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	2.88E-01	5.76E-02
		351.93	*	35.60	2.01E-01	3.24E-02
		785.96		1.06		
Ra-226	1.00	186.21	*	3.64	5.31E-01	2.01E-01
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.25E-01	7.74E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.50E-01	5.52E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.97	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.38E-02	1.28E-02
		202.11		1.08		
		205.31		5.01		

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

Analysis Report for 18-Nov-19-10031

L1-10204A-FSGS-017SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.992	4.72E+00	3.83E-01	
	Cs-137	0.995	3.83E-02	1.06E-02	
	Tl-208	0.991	8.47E-02	1.62E-02	
X	Bi-211	0.897			
	Pb-212	0.998	1.97E-01	3.08E-02	
	Bi-214	0.999	2.49E-01	3.64E-02	
	Pb-214	1.000	2.22E-01	2.82E-02	
?	Ra-226	1.000	5.31E-01	2.01E-01	
	Ac-228	0.997	2.09E-01	4.49E-02	
?	U-235	0.975	3.38E-02	1.28E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10031

L1-10204A-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 12:00:11PM
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	7.29E-02	5.71E-02	5.71E-02
	BE-7	477.60		10.44	1.85E-02	4.04E-01	4.04E-01
+	K-40	1460.82	*	10.66	4.72E+00	3.13E-01	3.13E-01
	Mn-54	834.85		99.98	-1.02E-02	4.37E-02	4.37E-02
	Co-60	1173.23		99.85	2.59E-02	5.18E-02	5.93E-02
		1332.49		99.98	-5.89E-02		5.18E-02
	Nb-94	702.65		99.81	-2.36E-02	4.19E-02	4.19E-02
		871.09		99.89	3.59E-02		4.74E-02
	Ag-108m	79.13		6.60	5.75E-01	3.71E-02	1.55E+00
		433.94		90.50	2.21E-03		3.71E-02
		614.28		89.80	1.03E-02		7.82E-02
		722.94		90.80	-7.68E-03		5.40E-02
	Sb-125	176.31		6.84	-3.66E-01	1.21E-01	4.58E-01
		380.45		1.52	-9.12E-01		2.22E+00
		427.87		29.60	1.52E-02		1.21E-01
		463.36		10.49	-1.39E-01		3.46E-01
		600.60		17.65	5.71E-02		2.08E-01
		606.71		4.98	2.39E+00		1.42E+00
		635.95		11.22	7.18E-02		3.50E-01

Analysis Report for 18-Nov-19-10031

L1-10204A-FSGS-017SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	4.81E-01	1.21E-01	2.33E+00
	Ba-133	79.61		2.65	-8.23E-01	7.32E-02	3.69E+00
		81.00		32.90	-5.57E-01		2.52E-01
		276.40		7.16	-1.31E-01		4.86E-01
		302.85		18.34	1.82E-01		2.15E-01
		356.01		62.05	-6.12E-02		7.32E-02
		383.85		8.94	8.67E-02		3.82E-01
	Cs-134	475.36		1.48	2.46E+00	5.67E-02	2.72E+00
		563.25		8.34	-1.74E-01		4.35E-01
		569.33		15.37	-7.02E-02		2.34E-01
		604.72		97.62	-2.02E-03		6.56E-02
		795.86		85.46	3.55E-02		5.67E-02
		801.95		8.69	-3.61E-01		4.96E-01
		1038.61		0.99	9.45E-01		4.91E+00
		1167.97		1.79	1.31E+00		2.93E+00
		1365.19		3.02	1.15E-01		1.51E+00
+	Cs-137	661.66	*	85.10	3.83E-02	2.81E-02	2.81E-02
	Eu-152	121.78		28.67	1.71E-01	1.33E-01	1.39E-01
		244.70		7.61	1.40E-03		5.48E-01
		295.94		0.45	3.34E+00		1.06E+01
		344.28		26.60	-6.68E-02		1.33E-01
		367.79		0.86	1.69E+00		4.05E+00
		411.12		2.24	8.85E-01		1.80E+00
		443.96		2.83	-1.52E+00		1.13E+00
		488.68		0.42	3.15E+00		8.84E+00
		563.99		0.49	5.68E-01		7.27E+00
		586.26		0.46	-6.95E+00		1.37E+01
		678.62		0.47	2.99E+00		8.66E+00
		688.67		0.86	-1.78E+00		4.16E+00
		719.35		0.28	1.66E+00		1.50E+01
		778.90		12.96	-3.19E-01		3.25E-01
		810.45		0.32	-1.52E+00		1.28E+01
		867.37		4.26	-6.47E-01		1.19E+00
		919.33		0.43	-1.66E+01		1.03E+01
		964.08		14.65	4.54E-01		4.21E-01
		1085.87		10.24	2.36E-01		4.87E-01
		1089.74		1.73	5.78E-01		2.89E+00
		1112.07		13.69	-1.86E-01		3.70E-01
		1212.95		1.43	6.42E-01		4.07E+00
		1249.94		0.19	-1.36E+01		2.99E+01
		1299.14		1.63	8.51E-01		3.13E+00
		1408.01		21.07	-8.87E-02		2.08E-01
		1457.64		0.50	9.73E+01		3.38E+01
		1528.10		0.28	6.54E+00		1.35E+01
	Eu-154	123.07		40.40	-1.01E-02	9.50E-02	9.50E-02
		247.93		6.89	8.57E-02		5.31E-01
		591.76		4.95	-6.94E-02		8.24E-01
		692.42		1.78	2.28E-01		2.02E+00
		723.30		20.06	4.96E-02		2.47E-01
		756.80		4.52	-4.82E-01		8.72E-01
		873.18		12.08	-1.89E-01		3.82E-01

Analysis Report for 18-Nov-19-10031

L1-10204A-FSGS-017SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	1.28E-01	9.50E-02	4.51E-01
		1004.76		18.01	1.79E-01		2.59E-01
		1274.43		34.80	1.30E-02		1.64E-01
		1596.48		1.80	-1.52E+00		2.49E+00
	Eu-155	45.30		1.31	1.38E-02	2.07E-01	1.81E+01
		60.01		1.22	-4.78E+00		2.29E+01
		86.55		30.70	-1.54E-01		2.47E-01
		105.31		21.10	-1.11E-01		2.07E-01
+	Ra-226	186.21	*	3.64	5.31E-01	6.31E-01	6.31E-01
	Pa-231	27.36		10.30	2.08E+00	1.62E+00	2.46E+00
		283.69		1.70	-6.18E-01		1.88E+00
		300.07		2.47	1.83E-01		1.62E+00
		302.65		2.20	1.16E+00		1.78E+00
		330.06		1.40	6.43E-01		2.74E+00
+	U-235	143.76		10.96	-4.05E-02	4.02E-02	3.48E-01
		163.33		5.08	-3.24E-01		7.38E-01
		185.71	*	57.20	3.38E-02		4.02E-02
		202.11		1.08	-3.16E+00		3.35E+00
		205.31		5.01	-1.47E-01		7.41E-01
	Am-241	59.54		35.90	-7.93E-02	7.91E-01	7.91E-01

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

Apex-Gamma

Analysis Report for 18-Nov-19-10032

L1-10204A-FSGS-018SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10032
Sample Description	: L1-10204A-FSGS-018SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.862E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 2:04:00PM
Acquisition Started	: 11/18/2019 12:25:06PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81370
Fill Height	: 1862.03 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 12:40:08PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 11/18/19 - 1500

J Graham

Analysis Report for 18-Nov-19-10032

L1-10204A-FSGS-018SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.83	368 -	375	371.97	4.04E+01	15.09	9.26E+01	0.72
2	238.53	473 -	481	477.24	8.74E+01	18.86	1.22E+02	1.20
3	351.94	699 -	708	703.83	7.80E+01	13.41	4.50E+01	0.77
4	609.27	1212 -	1223	1218.11	8.15E+01	11.41	1.95E+01	1.34
5	1120.30	2235 -	2244	2240.15	1.82E+01	6.18	8.81E+00	1.11
6	1460.55	2913 -	2927	2921.16	3.93E+02	20.28	6.02E+00	2.19

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	0.98	1460.82	*	10.66	7.05E+00	4.75E-01
Bi-211	0.88	351.07	*	13.02	4.53E-01	8.60E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.19E-01	2.75E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.95E-01	2.97E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	1.96E-01	6.70E-02
		1155.21		1.63		

Analysis Report for 18-Nov-19-10032

L1-10204A-FSGS-018SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.66E-01	3.14E-02
		785.96		1.06		
Ra-226	0.97	186.21	*	3.64	5.87E-01	2.24E-01
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.73E-02	1.43E-02
		202.11		1.08		
		205.31		5.01		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.988	7.05E+00	4.75E-01	
?	Bi-211	0.886	4.53E-01	8.60E-02	
	Pb-212	0.998	1.19E-01	2.75E-02	
	Bi-214	1.000	1.95E-01	2.71E-02	
?	Pb-214	1.000	1.66E-01	3.14E-02	

Analysis Report for 18-Nov-19-10032

L1-10204A-FSGS-018SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
?	Ra-226	0.977	5.87E-01	2.24E-01	
?	U-235	0.998	3.73E-02	1.43E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10032

L1-10204A-FSGS-018SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 12:40:08PM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.56E-02	5.14E-02	5.14E-02
	BE-7	477.60		10.44	2.49E-02	3.42E-01	3.42E-01
+	K-40	1460.82	*	10.66	7.05E+00	3.11E-01	3.11E-01
	Mn-54	834.85		99.98	2.13E-02	3.84E-02	3.84E-02
	Co-60	1173.23		99.85	6.54E-03	4.98E-02	5.55E-02
		1332.49		99.98	3.77E-02		4.98E-02
	Nb-94	702.65		99.81	-1.40E-02	3.53E-02	3.53E-02
		871.09		99.89	1.03E-02		3.61E-02
	Ag-108m	79.13		6.60	2.66E-01	3.30E-02	1.08E+00
		433.94		90.50	-1.45E-03		3.30E-02
		614.28		89.80	-8.70E-03		4.79E-02
		722.94		90.80	-5.54E-03		4.28E-02
	Sb-125	176.31		6.84	1.82E-01	9.81E-02	4.74E-01
		380.45		1.52	6.55E-01		1.92E+00
		427.87		29.60	-1.22E-02		9.81E-02
		463.36		10.49	1.15E-02		2.78E-01
		600.60		17.65	-7.41E-03		1.86E-01
		606.71		4.98	4.91E-02		1.18E+00
		635.95		11.22	8.42E-02		2.99E-01

Analysis Report for 18-Nov-19-10032

L1-10204A-FSGS-018SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-4.90E-01	9.81E-02	1.83E+00
Ba-133	79.61	2.65	-6.57E-01	6.65E-02	2.42E+00
	81.00	32.90	-2.25E-01		1.67E-01
	276.40	7.16	2.48E-02		4.29E-01
	302.85	18.34	1.17E-01		1.80E-01
	356.01	62.05	-7.47E-03		6.65E-02
	383.85	8.94	-1.47E-01		2.91E-01
Cs-134	475.36	1.48	7.84E-02	4.41E-02	2.31E+00
	563.25	8.34	1.13E-01		3.67E-01
	569.33	15.37	-4.60E-03		1.92E-01
	604.72	97.62	-1.54E-04		5.20E-02
	795.86	85.46	6.33E-03		4.41E-02
	801.95	8.69	-2.78E-02		4.16E-01
	1038.61	0.99	-4.23E-01		4.01E+00
	1167.97	1.79	1.04E+00		3.06E+00
	1365.19	3.02	-1.41E-01		1.09E+00
Cs-137	661.66	85.10	1.01E-03	4.16E-02	4.16E-02
Eu-152	121.78	28.67	5.88E-03	1.14E-01	1.15E-01
	244.70	7.61	-2.10E-01		4.49E-01
	295.94	0.45	2.83E+00		8.37E+00
	344.28	26.60	-4.76E-02		1.14E-01
	367.79	0.86	2.49E+00		3.39E+00
	411.12	2.24	8.36E-01		1.46E+00
	443.96	2.83	6.29E-01		1.09E+00
	488.68	0.42	-3.46E+00		7.44E+00
	563.99	0.49	-1.29E-01		6.04E+00
	586.26	0.46	1.12E+01		1.07E+01
	678.62	0.47	-7.54E-01		7.92E+00
	688.67	0.86	-2.06E+00		4.34E+00
	719.35	0.28	-1.84E+00		1.24E+01
	778.90	12.96	-5.36E-02		2.64E-01
	810.45	0.32	-9.15E-01		1.03E+01
	867.37	4.26	-4.77E-01		8.75E-01
	919.33	0.43	-1.28E+00		9.66E+00
	964.08	14.65	-2.78E-02		3.39E-01
	1085.87	10.24	-6.76E-02		4.06E-01
	1089.74	1.73	-5.14E-01		2.22E+00
	1112.07	13.69	4.18E-02		3.25E-01
	1212.95	1.43	1.26E+00		4.27E+00
	1249.94	0.19	-5.45E+00		2.40E+01
	1299.14	1.63	1.50E+00		3.11E+00
	1408.01	21.07	6.50E-02		1.84E-01
	1457.64	0.50	-6.51E-01		3.78E+01
	1528.10	0.28	5.61E+00		1.15E+01
Eu-154	123.07	40.40	-7.04E-03	7.93E-02	7.93E-02
	247.93	6.89	-1.20E-01		4.52E-01
	591.76	4.95	3.90E-01		7.86E-01
	692.42	1.78	-7.16E-01		2.08E+00
	723.30	20.06	7.60E-02		2.01E-01
	756.80	4.52	6.57E-02		7.29E-01
	873.18	12.08	-1.19E-01		2.93E-01

Analysis Report for 18-Nov-19-10032

L1-10204A-FSGS-018SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	2.55E-01	7.93E-02	4.21E-01
		1004.76		18.01	7.05E-02		2.39E-01
		1274.43		34.80	2.25E-02		1.39E-01
		1596.48		1.80	7.18E-01		1.87E+00
	Eu-155	45.30		1.31	-2.75E+00	1.79E-01	1.05E+01
		60.01		1.22	-7.29E+00		1.16E+01
		86.55		30.70	4.54E-02		1.79E-01
		105.31		21.10	1.30E-02		1.82E-01
+	Ra-226	186.21	*	3.64	5.87E-01	7.17E-01	7.17E-01
	Pa-231	27.36		10.30	4.27E-01	1.02E+00	1.02E+00
		283.69		1.70	3.14E-01		1.73E+00
		300.07		2.47	-1.50E+00		1.32E+00
		302.65		2.20	9.75E-01		1.50E+00
		330.06		1.40	1.86E-01		2.32E+00
+	U-235	143.76		10.96	-5.41E-02	4.56E-02	2.74E-01
		163.33		5.08	-1.28E-01		6.65E-01
		185.71	*	57.20	3.73E-02		4.56E-02
		202.11		1.08	1.72E+00		3.18E+00
		205.31		5.01	-2.53E-01		6.16E-01
	Am-241	59.54		35.90	-3.17E-02	4.16E-01	4.16E-01

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

Apex-Gamma

Analysis Report for 18-Nov-19-10033

L1-10204A-FSGS-019SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10033
Sample Description	: L1-10204A-FSGS-019SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.675E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 2:06:00PM
Acquisition Started	: 11/18/2019 12:25:12PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.15 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81371
Fill Height	: 1675.46 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 12:40:16PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

JGraham

Analysis Report for 18-Nov-19-10033

L1-10204A-FSGS-019SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.76	949 -	960	955.14	1.44E+02	17.94	7.07E+01	0.87
2	295.27	1175 -	1187	1180.98	6.81E+01	13.04	3.79E+01	0.92
3	338.25	1347 -	1358	1352.77	2.63E+01	10.27	3.07E+01	0.71
4	351.99	1402 -	1414	1407.68	9.81E+01	13.19	2.89E+01	0.77
5	477.79	1906 -	1917	1910.55	1.93E+01	7.32	1.27E+01	0.87
6	583.32	2326 -	2338	2332.48	5.12E+01	9.21	1.28E+01	0.88
7	609.38	2430 -	2443	2436.69	8.56E+01	10.36	7.41E+00	0.52
8	911.21	3637 -	3651	3643.79	3.74E+01	7.74	7.64E+00	0.92
9	1460.81	5833 -	5854	5843.08	2.35E+02	16.23	7.77E+00	1.76

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	2.34E-01	9.00E-02
K-40	1.00	1460.82	*	10.66	5.72E+00	4.66E-01
Tl-208	0.99	583.19	*	85.00	8.37E-02	1.59E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.54E-01	3.77E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.69E-01	3.64E-02
		768.36		4.89		

Analysis Report for 18-Nov-19-10033

L1-10204A-FSGS-019SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	3.19E-01	6.63E-02
		351.93	*	35.60	2.70E-01	4.22E-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	2.22E-01	8.86E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.72E-01	5.76E-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 18-Nov-19-10033

L1-10204A-FSGS-019SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.995	2.34E-01	9.00E-02	
	K-40	1.000	5.72E+00	4.66E-01	
	Tl-208	0.997	8.37E-02	1.59E-02	
X	Bi-211	0.874			
	Pb-212	0.998	2.54E-01	3.77E-02	
	Bi-214	1.000	2.69E-01	3.64E-02	
	Pb-214	1.000	2.84E-01	3.56E-02	
	Ac-228	1.000	2.57E-01	4.83E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 18-Nov-19-10033

L1-10204A-FSGS-019SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 12:40:16PM
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	7.91E-02	6.56E-02	6.56E-02
+	BE-7	477.60	*	10.44	2.34E-01	2.75E-01	2.75E-01
+	K-40	1460.82	*	10.66	5.72E+00	5.08E-01	5.08E-01
	Mn-54	834.85		99.98	1.23E-02	4.52E-02	4.52E-02
	Co-60	1173.23		99.85	2.90E-02	6.26E-02	7.14E-02
		1332.49		99.98	5.57E-02		6.26E-02
	Nb-94	702.65		99.81	2.74E-03	4.54E-02	4.54E-02
		871.09		99.89	1.30E-02		5.23E-02
	Ag-108m	79.13		6.60	7.80E-01	4.36E-02	2.01E+00
		433.94		90.50	-6.87E-03		4.36E-02
		614.28		89.80	-5.51E-02		7.21E-02
		722.94		90.80	2.42E-02		6.01E-02
	Sb-125	176.31		6.84	1.50E-01	1.36E-01	6.17E-01
		380.45		1.52	1.35E+00		2.88E+00
		427.87		29.60	9.51E-02		1.36E-01
		463.36		10.49	-1.88E-02		4.37E-01
		600.60		17.65	-7.14E-02		2.31E-01
		606.71		4.98	2.66E+00		1.52E+00
		635.95		11.22	1.36E-02		4.12E-01

Analysis Report for 18-Nov-19-10033

L1-10204A-FSGS-019SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.59E+00	1.36E-01	3.06E+00
Ba-133	79.61	2.65	3.12E+00	8.61E-02	4.86E+00
	81.00	32.90	-5.04E-01		3.13E-01
	276.40	7.16	2.29E-01		6.00E-01
	302.85	18.34	1.69E-01		2.22E-01
	356.01	62.05	-1.94E-02		8.61E-02
	383.85	8.94	-1.47E-01		4.52E-01
Cs-134	475.36	1.48	-7.75E-01	5.30E-02	3.42E+00
	563.25	8.34	0.00E+00		5.24E-01
	569.33	15.37	-4.25E-02		2.83E-01
	604.72	97.62	-1.25E-02		6.97E-02
	795.86	85.46	4.03E-02		5.30E-02
	801.95	8.69	-4.85E-01		3.43E-01
	1038.61	0.99	5.03E-01		4.94E+00
	1167.97	1.79	1.60E+00		3.62E+00
	1365.19	3.02	4.09E-02		1.81E+00
Cs-137	661.66	85.10	-1.34E-02	6.61E-02	6.61E-02
Eu-152	121.78	28.67	3.18E-02	1.30E-01	1.67E-01
	244.70	7.61	-8.24E-02		6.02E-01
	295.94	0.45	4.66E+00		1.18E+01
	344.28	26.60	-3.88E-02		1.30E-01
	367.79	0.86	-1.12E+00		4.55E+00
	411.12	2.24	3.35E-02		1.73E+00
	443.96	2.83	-1.69E-01		1.32E+00
	488.68	0.42	1.61E+00		9.30E+00
	563.99	0.49	2.56E+00		8.88E+00
	586.26	0.46	-6.98E+00		1.41E+01
	678.62	0.47	-2.61E+00		9.38E+00
	688.67	0.86	2.45E+00		5.52E+00
	719.35	0.28	8.47E+00		1.54E+01
	778.90	12.96	-2.73E-01		2.88E-01
	810.45	0.32	-8.15E+00		1.40E+01
	867.37	4.26	-1.38E+00		1.10E+00
	919.33	0.43	-7.40E+00		1.10E+01
	964.08	14.65	2.51E-01		4.72E-01
	1085.87	10.24	-1.18E-01		4.55E-01
	1089.74	1.73	-1.80E+00		2.55E+00
	1112.07	13.69	9.44E-02		4.06E-01
	1212.95	1.43	-1.64E+00		4.12E+00
	1249.94	0.19	-4.70E+00		2.92E+01
	1299.14	1.63	7.68E-01		3.05E+00
	1408.01	21.07	5.85E-02		2.25E-01
	1457.64	0.50	1.30E+02		4.07E+01
	1528.10	0.28	-8.33E+00		1.30E+01
Eu-154	123.07	40.40	2.74E-02	1.17E-01	1.17E-01
	247.93	6.89	-1.02E-01		5.79E-01
	591.76	4.95	3.26E-01		1.03E+00
	692.42	1.78	5.35E-01		2.60E+00
	723.30	20.06	1.63E-01		2.81E-01
	756.80	4.52	-2.47E-01		1.09E+00
	873.18	12.08	3.22E-01		4.60E-01

Analysis Report for 18-Nov-19-10033

L1-10204A-FSGS-019SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	6.67E-02	1.17E-01	5.21E-01
	1004.76	18.01	-1.08E-02		3.10E-01
	1274.43	34.80	-5.58E-02		2.03E-01
	1596.48	1.80	-1.28E+00		2.26E+00
Eu-155	45.30	1.31	-2.03E+00	2.78E-01	3.19E+01
	60.01	1.22	-1.49E+01		3.15E+01
	86.55	30.70	9.23E-02		2.78E-01
	105.31	21.10	-5.56E-02		2.78E-01
Ra-226	186.21	3.64	5.04E-02	1.17E+00	1.17E+00
Pa-231	27.36	10.30	3.63E+00	1.64E+00	3.83E+00
	283.69	1.70	-2.12E+00		2.09E+00
	300.07	2.47	-4.89E-01		1.64E+00
	302.65	2.20	3.92E-01		1.82E+00
	330.06	1.40	4.03E-01		3.16E+00
U-235	143.76	10.96	1.44E-01	7.62E-02	4.58E-01
	163.33	5.08	9.42E-01		8.77E-01
	185.71	57.20	4.91E-02		7.62E-02
	202.11	1.08	-1.88E+00		3.54E+00
	205.31	5.01	-1.23E-01		7.52E-01
Am-241	59.54	35.90	-1.52E-01	1.14E+00	1.14E+00

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

Apex-Gamma

Analysis Report for 18-Nov-19-10034

L1-10204A-FQGS-019SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 18-Nov-19-10034
Sample Description	: L1-10204A-FQGS-019SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.456E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 2:06:00PM
Acquisition Started	: 11/18/2019 12:48:22PM
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	: 11/4/2019
Efficiency Calibration Used Done On	: 11/18/2019
Efficiency Calibration Description	:
Sample Number	: 81372
Fill Height	: 1455.51 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/18/2019 1:03:26PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/18/19 - 1500

J Graham

Analysis Report for 18-Nov-19-10034

L1-10204A-FQGS-019SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.64	946 -	961	954.66	1.41E+02	19.37	7.78E+01	0.86
2	295.27	1175 -	1189	1180.99	8.81E+01	12.75	2.59E+01	0.68
3	338.46	1348 -	1358	1353.61	3.53E+01	9.75	2.47E+01	0.52
4	351.96	1401 -	1413	1407.57	8.40E+01	12.34	2.60E+01	0.69
5	583.09	2326 -	2338	2331.56	3.42E+01	9.68	2.18E+01	0.92
6	609.29	2429 -	2444	2436.31	7.72E+01	10.02	7.78E+00	1.22
7	911.12	3637 -	3649	3643.44	3.47E+01	8.03	1.13E+01	0.34
8	1460.83	5833 -	5854	5843.16	2.05E+02	15.63	1.06E+01	1.56

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	5.20E+00	4.56E-01
Tl-208	0.99	583.19	*	85.00	5.79E-02	1.67E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.55E-01	4.06E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.51E-01	3.59E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 18-Nov-19-10034

L1-10204A-FQGS-019SS

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	4.25E-01	7.02E-02
		351.93	*	35.60	2.38E-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	3.07E-01	8.84E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.62E-01	6.17E-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 18-Nov-19-10034

L1-10204A-FQGS-019SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	5.20E+00	4.56E-01	
	Tl-208	0.998	5.79E-02	1.67E-02	
X	Bi-211	0.881			
	Pb-212	1.000	2.55E-01	4.06E-02	
	Bi-214	1.000	2.51E-01	3.59E-02	
	Pb-214	1.000	2.83E-01	3.46E-02	
	Ac-228	0.999	2.77E-01	5.06E-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 18-Nov-19-10034

L1-10204A-FQGS-019SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/18/2019 1:03:26PM
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	6.04E-02	6.05E-02	6.05E-02
	BE-7	477.60		10.44	1.73E-01	4.70E-01	4.70E-01
+	K-40	1460.82	*	10.66	5.20E+00	6.09E-01	6.09E-01
	Mn-54	834.85		99.98	-4.72E-02	4.59E-02	4.59E-02
	Co-60	1173.23		99.85	7.18E-02	6.12E-02	6.85E-02
		1332.49		99.98	-4.45E-02		6.12E-02
	Nb-94	702.65		99.81	-1.14E-02	4.69E-02	4.77E-02
		871.09		99.89	-1.46E-02		4.69E-02
	Ag-108m	79.13		6.60	-3.60E-01	4.71E-02	1.94E+00
		433.94		90.50	1.79E-02		4.71E-02
		614.28		89.80	-3.54E-02		6.69E-02
		722.94		90.80	-1.86E-03		5.65E-02
	Sb-125	176.31		6.84	5.26E-02	1.27E-01	5.85E-01
		380.45		1.52	1.74E+00		2.86E+00
		427.87		29.60	-2.25E-02		1.27E-01
		463.36		10.49	-8.83E-02		4.10E-01
		600.60		17.65	-6.66E-02		2.46E-01
		606.71		4.98	2.75E+00		1.52E+00
		635.95		11.22	-2.93E-02		4.09E-01

Analysis Report for 18-Nov-19-10034

L1-10204A-FQGS-019SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	8.79E-01	1.27E-01	2.29E+00
Ba-133	79.61	2.65	4.39E-01	8.29E-02	4.67E+00
	81.00	32.90	-2.70E-01		3.20E-01
	276.40	7.16	2.39E-01		5.53E-01
	302.85	18.34	6.08E-02		2.43E-01
	356.01	62.05	-8.13E-02		8.29E-02
	383.85	8.94	1.80E-01		4.73E-01
Cs-134	475.36	1.48	1.14E+00	6.34E-02	3.23E+00
	563.25	8.34	-4.05E-01		4.61E-01
	569.33	15.37	1.22E-01		3.13E-01
	604.72	97.62	-2.71E-02		6.80E-02
	795.86	85.46	6.66E-03		6.34E-02
	801.95	8.69	9.92E-02		5.23E-01
	1038.61	0.99	-9.71E-01		5.13E+00
	1167.97	1.79	2.16E+00		3.70E+00
	1365.19	3.02	3.83E-01		1.72E+00
Cs-137	661.66	85.10	3.64E-02	6.72E-02	6.72E-02
Eu-152	121.78	28.67	1.06E-01	1.56E-01	1.68E-01
	244.70	7.61	5.11E-01		6.02E-01
	295.94	0.45	7.34E+00		1.20E+01
	344.28	26.60	4.48E-02		1.56E-01
	367.79	0.86	-2.51E+00		4.23E+00
	411.12	2.24	6.30E-02		2.00E+00
	443.96	2.83	1.29E+00		1.64E+00
	488.68	0.42	7.68E+00		1.08E+01
	563.99	0.49	-5.56E+00		7.95E+00
	586.26	0.46	-4.13E+00		1.44E+01
	678.62	0.47	3.23E+00		8.75E+00
	688.67	0.86	-3.60E+00		5.04E+00
	719.35	0.28	5.91E+00		1.63E+01
	778.90	12.96	2.68E-01		3.50E-01
	810.45	0.32	8.82E+00		1.53E+01
	867.37	4.26	-1.52E+00		1.14E+00
	919.33	0.43	-5.73E+00		1.09E+01
	964.08	14.65	7.89E-02		4.60E-01
	1085.87	10.24	-1.14E-02		5.55E-01
	1089.74	1.73	1.71E-01		3.65E+00
	1112.07	13.69	-1.62E-01		3.96E-01
	1212.95	1.43	-1.60E+00		4.97E+00
	1249.94	0.19	2.33E+01		3.77E+01
	1299.14	1.63	-2.66E-01		2.86E+00
	1408.01	21.07	9.34E-03		1.94E-01
	1457.64	0.50	1.10E+02		4.01E+01
	1528.10	0.28	3.07E+00		1.63E+01
Eu-154	123.07	40.40	-2.74E-02	1.17E-01	1.17E-01
	247.93	6.89	7.54E-02		5.38E-01
	591.76	4.95	8.07E-01		1.05E+00
	692.42	1.78	9.46E-01		2.65E+00
	723.30	20.06	3.50E-02		2.46E-01
	756.80	4.52	3.10E-01		1.23E+00
	873.18	12.08	-8.00E-02		4.05E-01

Analysis Report for 18-Nov-19-10034

L1-10204A-FQGS-019SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.97E-01	1.17E-01	5.02E-01
	1004.76	18.01	7.46E-02		3.05E-01
	1274.43	34.80	1.11E-01		1.78E-01
	1596.48	1.80	-8.35E-01		2.65E+00
Eu-155	45.30	1.31	-1.38E+00	2.75E-01	3.13E+01
	60.01	1.22	3.46E+00		3.17E+01
	86.55	30.70	2.04E-02		2.75E-01
	105.31	21.10	-5.56E-02		2.82E-01
Ra-226	186.21	3.64	1.88E+00	1.36E+00	1.36E+00
Pa-231	27.36	10.30	2.81E+00	1.77E+00	3.51E+00
	283.69	1.70	8.32E-02		1.98E+00
	300.07	2.47	-5.33E-01		1.77E+00
	302.65	2.20	8.07E-01		2.03E+00
	330.06	1.40	8.58E-01		3.18E+00
U-235	143.76	10.96	-1.89E-01	8.55E-02	4.01E-01
	163.33	5.08	1.69E-01		8.18E-01
	185.71	57.20	5.78E-02		8.55E-02
	202.11	1.08	1.24E+00		3.71E+00
	205.31	5.01	-3.92E-01		7.87E-01
Am-241	59.54	35.90	-5.78E-01	1.08E+00	1.08E+00

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

Apex-Gamma

Analysis Report for 19-Nov-19-10013
L1-10204A-FSGS-007SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 19-Nov-19-10013
Sample Description	: L1-10204A-FSGS-007SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.520E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 12:45:00PM
Acquisition Started	: 11/19/2019 9:58:42AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 11/19/2019
Efficiency Calibration Description	:
Sample Number	: 81396
Fill Height	: 1519.58 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/19/2019 10:13:45AM

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

Date Validated
1530 11-19-19

Analysis Report for 19-Nov-19-10013

L1-10204A-FSGS-007SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.13	368 -	376	372.56	4.32E+01	14.89	8.38E+01	1.08
2	238.63	474 -	481	477.44	1.32E+02	18.91	1.08E+02	1.09
3	295.03	585 -	594	590.13	5.72E+01	12.48	4.38E+01	1.20
4	338.19	674 -	681	676.34	3.51E+01	10.40	3.49E+01	1.13
5	351.69	698 -	708	703.32	9.38E+01	14.39	4.72E+01	1.40
6	583.15	1161 -	1171	1165.91	7.01E+01	10.17	1.39E+01	0.83
7	609.13	1212 -	1223	1217.83	8.50E+01	11.73	2.10E+01	1.17
8	911.17	1818 -	1827	1821.79	4.34E+01	8.87	1.56E+01	1.21
9	1460.61	2913 -	2928	2921.28	3.54E+02	19.29	6.03E+00	2.20

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.67E+00	4.65E-01
Tl-208	1.00	583.19	*	85.00	9.05E-02	1.42E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.85E-01	3.05E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.11E-01	3.18E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 19-Nov-19-10013

L1-10204A-FSGS-007SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.14E-01	4.98E-02
		351.93	*	35.60	2.06E-01	3.56E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	6.44E-01	2.28E-01
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.36E-01	7.27E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.48E-01	5.17E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.98	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.10E-02	1.45E-02
		202.11		1.08		
		205.31		5.01		

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

Analysis Report for 19-Nov-19-10013

L1-10204A-FSGS-007SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.993	6.67E+00	4.65E-01	
	Tl-208	1.000	9.05E-02	1.42E-02	
X	Bi-211	0.941			
	Pb-212	1.000	1.85E-01	3.05E-02	
	Bi-214	0.998	2.11E-01	3.18E-02	
	Pb-214	0.993	2.09E-01	2.90E-02	
?	Ra-226	0.999	6.44E-01	2.28E-01	
	Ac-228	1.000	2.44E-01	4.21E-02	
?	U-235	0.981	4.10E-02	1.45E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 19-Nov-19-10013

L1-10204A-FSGS-007SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/19/2019 10:13:45AM
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	1.02E-01	6.06E-02	6.06E-02
	BE-7	477.60		10.44	-5.00E-02	2.99E-01	2.99E-01
+	K-40	1460.82	*	10.66	6.67E+00	3.27E-01	3.27E-01
	Mn-54	834.85		99.98	4.46E-02	4.75E-02	4.75E-02
	Co-60	1173.23		99.85	3.43E-03	3.79E-02	5.55E-02
		1332.49		99.98	-4.28E-02		3.79E-02
	Nb-94	702.65		99.81	8.39E-06	3.47E-02	3.98E-02
		871.09		99.89	1.48E-02		3.47E-02
	Ag-108m	79.13		6.60	8.88E-01	3.89E-02	1.21E+00
		433.94		90.50	2.49E-03		3.89E-02
		614.28		89.80	-3.72E-02		4.98E-02
		722.94		90.80	1.24E-02		4.23E-02
	Sb-125	176.31		6.84	-5.95E-02	1.16E-01	4.82E-01
		380.45		1.52	4.25E-01		2.04E+00
		427.87		29.60	1.77E-02		1.16E-01
		463.36		10.49	5.64E-02		3.19E-01
		600.60		17.65	5.97E-02		2.06E-01
		606.71		4.98	1.36E-01		1.28E+00
		635.95		11.22	-1.02E-01		2.74E-01

Analysis Report for 19-Nov-19-10013

L1-10204A-FSGS-007SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.60E-01	1.16E-01	1.87E+00
Ba-133	79.61	2.65	1.26E+00	6.58E-02	2.81E+00
	81.00	32.90	-2.02E-01		1.83E-01
	276.40	7.16	-1.37E-01		4.08E-01
	302.85	18.34	9.12E-02		1.80E-01
	356.01	62.05	-1.26E-02		6.58E-02
	383.85	8.94	1.16E-01		3.39E-01
Cs-134	475.36	1.48	2.34E-02	5.06E-02	2.19E+00
	563.25	8.34	-1.32E-01		3.53E-01
	569.33	15.37	3.25E-02		2.12E-01
	604.72	97.62	5.36E-03		5.82E-02
	795.86	85.46	2.22E-02		5.06E-02
	801.95	8.69	-5.52E-01		3.54E-01
	1038.61	0.99	8.44E-01		4.80E+00
	1167.97	1.79	1.19E+00		3.13E+00
	1365.19	3.02	-1.94E-02		1.10E+00
Cs-137	661.66	85.10	9.08E-03	4.76E-02	4.76E-02
Eu-152	121.78	28.67	2.21E-02	1.18E-01	1.18E-01
	244.70	7.61	-1.63E-01		4.51E-01
	295.94	0.45	-1.40E+00		8.46E+00
	344.28	26.60	-2.89E-02		1.22E-01
	367.79	0.86	-4.34E-01		3.69E+00
	411.12	2.24	1.83E-01		1.54E+00
	443.96	2.83	9.75E-02		1.04E+00
	488.68	0.42	-7.31E-01		6.67E+00
	563.99	0.49	-4.50E+00		5.77E+00
	586.26	0.46	-1.34E+00		1.17E+01
	678.62	0.47	5.45E+00		7.82E+00
	688.67	0.86	-2.39E+00		4.09E+00
	719.35	0.28	-1.33E+01		1.02E+01
	778.90	12.96	-1.43E-01		2.60E-01
	810.45	0.32	8.68E-01		1.08E+01
	867.37	4.26	-5.48E-01		7.94E-01
	919.33	0.43	-4.21E+00		8.96E+00
	964.08	14.65	8.99E-02		3.76E-01
	1085.87	10.24	2.13E-02		4.47E-01
	1089.74	1.73	0.00E+00		2.70E+00
	1112.07	13.69	-1.52E-01		3.61E-01
	1212.95	1.43	1.22E+00		3.92E+00
	1249.94	0.19	-5.75E+00		2.82E+01
	1299.14	1.63	1.98E+00		3.16E+00
	1408.01	21.07	1.28E-01		2.26E-01
	1457.64	0.50	5.98E-01		3.77E+01
	1528.10	0.28	1.79E+00		1.15E+01
Eu-154	123.07	40.40	4.91E-03	8.30E-02	8.30E-02
	247.93	6.89	-2.40E-01		4.30E-01
	591.76	4.95	9.46E-02		6.23E-01
	692.42	1.78	2.97E-01		2.22E+00
	723.30	20.06	7.44E-02		1.95E-01
	756.80	4.52	1.54E-01		9.12E-01
	873.18	12.08	1.12E-01		2.81E-01

Analysis Report for 19-Nov-19-10013

L1-10204A-FSGS-007SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-2.20E-01	8.30E-02	3.78E-01
		1004.76		18.01	7.18E-02		2.30E-01
		1274.43		34.80	6.90E-02		1.64E-01
		1596.48		1.80	7.23E-01		2.16E+00
	Eu-155	45.30		1.31	-2.90E-01	1.76E-01	9.89E+00
		60.01		1.22	-5.88E+00		1.14E+01
		86.55		30.70	8.70E-02		1.76E-01
		105.31		21.10	3.73E-02		1.92E-01
+	Ra-226	186.21	*	3.64	6.44E-01	7.19E-01	7.19E-01
	Pa-231	27.36		10.30	5.06E-01	1.09E+00	1.09E+00
		283.69		1.70	-2.64E-01		1.72E+00
		300.07		2.47	-9.96E-01		1.19E+00
		302.65		2.20	7.60E-01		1.50E+00
		330.06		1.40	2.42E-01		2.32E+00
+	U-235	143.76		10.96	-1.23E-01	4.58E-02	2.55E-01
		163.33		5.08	-1.84E-01		6.54E-01
		185.71	*	57.20	4.10E-02		4.58E-02
		202.11		1.08	-1.65E-01		3.04E+00
		205.31		5.01	-3.83E-01		6.30E-01
	Am-241	59.54		35.90	-5.84E-02	4.18E-01	4.18E-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 19-Nov-19-10014

L1-10204A-FSGS-012SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 19-Nov-19-10014
Sample Description	: L1-10204A-FSGS-012SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.746E+03 grams
Facility	: Default
Sample Taken On	: 11/15/2019 12:55:00PM
Acquisition Started	: 11/19/2019 9:58:49AM
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	: 11/4/2019
Efficiency Calibration Used Done On	: 11/19/2019
Efficiency Calibration Description	:
Sample Number	: 81397
Fill Height	: 1746.00 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/19/2019 10:14:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Date Validated
1530 11-19-19

Analysis Report for 19-Nov-19-10014

L1-10204A-FSGS-012SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.66	949 -	960	954.73	1.03E+02	14.95	4.80E+01	0.69
2	295.20	1172 -	1185	1180.71	4.68E+01	11.14	2.83E+01	0.74
3	352.01	1402 -	1416	1407.77	5.73E+01	10.87	2.07E+01	1.21
4	583.06	2326 -	2336	2331.46	2.69E+01	6.86	8.15E+00	0.58
5	609.47	2431 -	2443	2437.06	4.85E+01	9.03	1.25E+01	0.83
6	1461.07	5832 -	5855	5844.13	2.80E+02	17.76	8.85E+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	6.75E+00	5.18E-01
Tl-208	0.99	583.19	*	85.00	4.36E-02	1.14E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.80E-01	2.99E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.51E-01	2.97E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 19-Nov-19-10014

L1-10204A-FSGS-012SB

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	2.18E-01	5.48E-02
		351.93	*	35.60	1.57E-01	3.22E-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	0.990	6.75E+00	5.18E-01	
	Tl-208	0.998	4.36E-02	1.14E-02	
X	Bi-211	0.869			
	Pb-212	1.000	1.80E-01	2.99E-02	
	Bi-214	0.998	1.51E-01	2.97E-02	
	Pb-214	0.999	1.72E-01	2.78E-02	

Analysis Report for 19-Nov-19-10014

L1-10204A-FSGS-012SB

? = 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 19-Nov-19-10014

L1-10204A-FSGS-012SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/19/2019 10:14:00AM
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	6.43E-02	5.85E-02	5.85E-02
	BE-7	477.60		10.44	3.17E-02	3.69E-01	3.69E-01
+	K-40	1460.82	*	10.66	6.75E+00	5.54E-01	5.54E-01
	Mn-54	834.85		99.98	1.30E-02	4.11E-02	4.11E-02
	Co-60	1173.23		99.85	2.46E-02	4.67E-02	5.82E-02
		1332.49		99.98	-3.24E-02		4.67E-02
	Nb-94	702.65		99.81	6.52E-03	4.68E-02	4.83E-02
		871.09		99.89	9.03E-04		4.68E-02
	Ag-108m	79.13		6.60	1.25E-01	4.50E-02	1.88E+00
		433.94		90.50	-1.13E-02		4.50E-02
		614.28		89.80	-5.72E-02		6.47E-02
		722.94		90.80	2.04E-02		5.83E-02
	Sb-125	176.31		6.84	-1.26E-01	1.40E-01	5.80E-01
		380.45		1.52	9.62E-01		2.48E+00
		427.87		29.60	3.69E-02		1.40E-01
		463.36		10.49	-4.46E-02		4.26E-01
		600.60		17.65	7.21E-02		2.43E-01
		606.71		4.98	1.86E+00		1.36E+00
		635.95		11.22	4.58E-03		3.18E-01

Analysis Report for 19-Nov-19-10014

L1-10204A-FSGS-012SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	5.42E-02	1.40E-01	2.44E+00
Ba-133	79.61	2.65	-3.12E+00	7.16E-02	4.42E+00
	81.00	32.90	-1.13E-01		3.27E-01
	276.40	7.16	-3.92E-02		5.42E-01
	302.85	18.34	4.77E-02		2.05E-01
	356.01	62.05	1.78E-02		7.16E-02
	383.85	8.94	-2.99E-01		3.80E-01
Cs-134	475.36	1.48	-2.56E+00	5.46E-02	2.34E+00
	563.25	8.34	1.88E-01		5.00E-01
	569.33	15.37	4.89E-02		2.73E-01
	604.72	97.62	2.94E-03		6.17E-02
	795.86	85.46	2.48E-02		5.46E-02
	801.95	8.69	-6.33E-02		5.11E-01
	1038.61	0.99	-8.99E-01		5.23E+00
	1167.97	1.79	-3.21E+00		3.25E+00
	1365.19	3.02	-1.08E-01		9.07E-01
Cs-137	661.66	85.10	-1.51E-02	4.66E-02	4.66E-02
Eu-152	121.78	28.67	9.03E-02	1.39E-01	1.64E-01
	244.70	7.61	3.04E-01		5.59E-01
	295.94	0.45	2.74E+00		9.86E+00
	344.28	26.60	-9.11E-02		1.39E-01
	367.79	0.86	3.17E+00		4.59E+00
	411.12	2.24	6.80E-01		1.74E+00
	443.96	2.83	-1.10E+00		1.37E+00
	488.68	0.42	-1.49E-01		9.67E+00
	563.99	0.49	-2.67E+00		8.01E+00
	586.26	0.46	-8.67E+00		1.17E+01
	678.62	0.47	-1.88E+00		9.30E+00
	688.67	0.86	9.37E-01		5.32E+00
	719.35	0.28	-6.27E+00		1.66E+01
	778.90	12.96	1.96E-01		3.15E-01
	810.45	0.32	4.30E+00		1.36E+01
	867.37	4.26	1.18E-01		1.14E+00
	919.33	0.43	-3.06E-01		1.04E+01
	964.08	14.65	-1.14E-01		4.08E-01
	1085.87	10.24	-5.42E-02		5.49E-01
	1089.74	1.73	1.97E+00		3.43E+00
	1112.07	13.69	3.59E-02		4.17E-01
	1212.95	1.43	2.13E+00		4.74E+00
	1249.94	0.19	-4.13E+01		3.02E+01
	1299.14	1.63	-1.77E-01		3.37E+00
	1408.01	21.07	8.10E-02		2.54E-01
	1457.64	0.50	1.49E+02		4.38E+01
	1528.10	0.28	-1.74E+00		1.28E+01
Eu-154	123.07	40.40	5.75E-03	1.14E-01	1.14E-01
	247.93	6.89	2.10E-01		5.27E-01
	591.76	4.95	1.06E-01		8.58E-01
	692.42	1.78	6.14E-01		2.51E+00
	723.30	20.06	2.08E-02		2.55E-01
	756.80	4.52	3.18E-01		8.66E-01
	873.18	12.08	9.94E-02		3.95E-01

Analysis Report for 19-Nov-19-10014

L1-10204A-FSGS-012SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	6.12E-02	1.14E-01	4.50E-01
	1004.76	18.01	-2.37E-01		2.51E-01
	1274.43	34.80	1.37E-02		1.70E-01
	1596.48	1.80	1.07E+00		2.38E+00
Eu-155	45.30	1.31	1.18E+01	2.70E-01	3.05E+01
	60.01	1.22	5.24E+00		3.15E+01
	86.55	30.70	3.81E-04		2.85E-01
	105.31	21.10	-9.82E-02		2.70E-01
Ra-226	186.21	3.64	2.68E-01	1.04E+00	1.04E+00
Pa-231	27.36	10.30	1.45E+00	1.48E+00	3.43E+00
	283.69	1.70	-1.12E+00		2.15E+00
	300.07	2.47	-1.98E+00		1.48E+00
	302.65	2.20	3.29E-01		1.69E+00
	330.06	1.40	-9.48E-02		2.78E+00
U-235	143.76	10.96	9.84E-02	6.53E-02	4.09E-01
	163.33	5.08	1.18E-01		7.80E-01
	185.71	57.20	2.71E-02		6.53E-02
	202.11	1.08	6.37E-01		3.74E+00
	205.31	5.01	-4.42E-01		7.44E-01
Am-241	59.54	35.90	-9.68E-02	1.09E+00	1.09E+00

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

ATTACHMENT 8
EBERLINE ANALYTICAL REPORTS

EBERLINE ANALYTICAL

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

EBS-OR-46668

February 4, 2020

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

CASE NARRATIVE
Work Order # 19-12107-OR

SAMPLE RECEIPT

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

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

ANALYTICAL METHODS

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

Laboratory qualifiers are as follows:

U - Result is less than the MDA.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

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

ANALYTICAL RESULTS CONTINUED

TOTAL STRONTIUM

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

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

TRITIUM

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

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

NICKEL-63

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

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

GAMMA SPECTROSCOPY

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

ANALYTICAL RESULTS CONTINUED

GAMMA SPECTROSCOPY CONTINUED

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

CERTIFICATION OF ACCURACY

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

M.R. McDougall
Laboratory Manager

Date: 2/4/2020

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

Eberline Analytical
Final Report of Analysis

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

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

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

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

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

Eberline Analytical
Final Report of Analysis

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

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

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

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

Eberline Analytical
Final Report of Analysis

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

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

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

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

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Eberline Analytical
Final Report of Analysis

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

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

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

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

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

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Sample Matrix: SO

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

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

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Eberline Analytical
Final Report of Analysis

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

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

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

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Final Report of Analysis

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2701 Deborah Ave
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Work Order Details:
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Purchase Order: 677118
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Sample Matrix: SO

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

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

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

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

Eberline Analytical
Final Report of Analysis

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

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

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

EBERLINE ANALYTICAL

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

Eberline Analytical
Final Report of Analysis

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

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

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

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

Eberline Analytical
Final Report of Analysis

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

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

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

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

0033

Eberline Analytical
Final Report of Analysis

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

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

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

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Eberline Analytical
Final Report of Analysis

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

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

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

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

Eberline Analytical
Final Report of Analysis

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

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

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

0036

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

Eberline Analytical
Final Report of Analysis

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

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

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

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

EBERLINE ANALYTICAL

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

Eberline Analytical
Final Report of Analysis

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

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

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

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

Eberline Analytical
Final Report of Analysis

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

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

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

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Eberline Analytical
Final Report of Analysis

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

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

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

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

Eberline Analytical
Final Report of Analysis

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

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

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

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

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Eberline Analytical
Final Report of Analysis

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

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

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

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

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ZION SOLUTIONS LLC
An EnergySolutions Company

ZS-WM-131
Revision 0
Information Use

REC'D DEC 23 2019

19-12107

Attachment 1 – Chain-of-Custody Form

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

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REC BS 12-23-19 @ 1038

19-12107 updated COC 1/24/20

ZIONSOLUTIONS LLC
An EnergySolutions Company

ZS-WM-131
Revision 0
Information Use

Attachment 1 – Chain-of-Custody Form

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

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ZIONSOLUTIONS LLC
An EnergySolutions Company

19-12107

REC'D DEC 23 2019

ZS-WM-131
Revision 0
Information Use

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

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

Comments

PO # HTD's 67718

14 Day Turn Around

0007

EBERLINE ANALYTICAL

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

EBS-OR-46720

February 7, 2020

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

CASE NARRATIVE
Work Order # 20-01057-OR

SAMPLE RECEIPT

This work order contains nine soil samples received 01/14/2020. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-10213B-QIGS-009-SS-A	20-01057-04	L1-10213B-FIGS-015-SS-A	20-01057-09
L1-10213B-FIGS-010-SS-A	20-01057-05	L1-10213B-FIGS-016-SS-A	20-01057-10
L1-10213B-FIGS-011-SS-A	20-01057-06	L1-10203F-FSGS-007-SS-A	20-01057-11
L1-10213B-FIGS-012-SS-A	20-01057-07	L1-10203F-FSGS-009-SS-A	20-01057-12
L1-10213B-FIGS-013-SS-A	20-01057-08		

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 Bismuth-214, Cesium-137 and Potassium-40 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Cobalt-60 and Cesium-137 laboratory control sample demonstrated an acceptable percent recovery.

CERTIFICATION OF ACCURACY

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

M.R. McDougall
Laboratory Manager

Date: 2/7/2020

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01057
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-01	LCS	KNOWN	01/14/20 00:00	1/14/2020	1/21/2020	20-01057	Tritium	LANL ER-210 Modified	2.13E+02	7.65E+00				pCi/g
20-01057-01	LCS	SPIKE	01/14/20 00:00	1/14/2020	1/21/2020	20-01057	Tritium	LANL ER-210 Modified	2.18E+02	7.91E+00	1.45E+01	5.64E+00		pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/21/2020	20-01057	Tritium	LANL ER-210 Modified	-1.86E+00	3.17E+00	3.17E+00	5.62E+00	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/22/2020	20-01057	Tritium	LANL ER-210 Modified	1.84E-01	3.23E+00	3.23E+00	5.59E+00	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/22/2020	20-01057	Tritium	LANL ER-210 Modified	3.69E+00	3.35E+00	3.36E+00	5.58E+00	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/22/2020	20-01057	Tritium	LANL ER-210 Modified	-1.61E+00	3.07E+00	3.07E+00	5.43E+00	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/22/2020	20-01057	Tritium	LANL ER-210 Modified	-2.20E+00	3.11E+00	3.12E+00	5.54E+00	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/22/2020	20-01057	Tritium	LANL ER-210 Modified	-3.70E-01	3.22E+00	3.22E+00	5.61E+00	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/22/2020	20-01057	Tritium	LANL ER-210 Modified	-1.12E+00	3.21E+00	3.21E+00	5.64E+00	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/22/2020	20-01057	Tritium	LANL ER-210 Modified	0.00E+00	3.09E+00	3.09E+00	5.36E+00	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/22/2020	20-01057	Tritium	LANL ER-210 Modified	-1.62E+00	3.09E+00	3.09E+00	5.46E+00	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/22/2020	20-01057	Tritium	LANL ER-210 Modified	2.48E+00	3.19E+00	3.19E+00	5.37E+00	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/22/2020	20-01057	Tritium	LANL ER-210 Modified	1.05E+01	3.52E+00	3.57E+00	5.47E+00		pCi/g
20-01057-01	LCS	KNOWN	01/14/20 00:00	1/14/2020	1/17/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	1.49E+03	4.46E+01				pCi/g
20-01057-01	LCS	SPIKE	01/14/20 00:00	1/14/2020	1/17/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	1.51E+03	1.31E+01	8.95E+01	3.13E+00		pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/17/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	5.16E-01	1.81E+00	1.81E+00	3.09E+00	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/17/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	1.32E+00	1.88E+00	1.88E+00	3.17E+00	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/17/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	-6.28E-01	1.85E+00	1.85E+00	3.22E+00	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/17/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	-8.95E-02	1.86E+00	1.86E+00	3.21E+00	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/17/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	-1.36E+00	1.84E+00	1.85E+00	3.26E+00	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/17/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	-4.60E-01	1.90E+00	1.90E+00	3.30E+00	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/17/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	-1.77E-01	1.84E+00	1.84E+00	3.18E+00	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/18/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	1.43E+01	2.22E+00	2.37E+00	3.14E+00		pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/18/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	1.44E+00	1.91E+00	1.92E+00	3.23E+00	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/18/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	8.44E-02	1.76E+00	1.76E+00	3.03E+00	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/18/2020	20-01057	Nickel-63	ASTM 3500-Ni Modified	4.54E-01	1.90E+00	1.90E+00	3.26E+00	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Jeffrey Graham	SDG:	20-01057
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-01	LCS	KNOWN	01/14/20 00:00	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	5.02E+01	2.81E-01				pCi/g
20-01057-01	LCS	SPIKE	01/14/20 00:00	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	4.85E+01	1.32E+00	1.69E+01	6.72E-01		pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	8.85E-03	2.93E-01	2.93E-01	6.27E-01	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	1.52E-01	3.19E-01	3.23E-01	6.65E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	6.36E-02	3.26E-01	3.27E-01	6.91E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	4.60E-01	3.07E-01	3.46E-01	6.01E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	1.18E-01	2.94E-01	2.97E-01	6.19E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	1.08E-01	3.21E-01	3.23E-01	6.76E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	2.16E-01	3.38E-01	3.46E-01	7.00E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	-7.05E-02	2.99E-01	3.00E-01	6.50E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	4.43E-01	3.81E-01	4.11E-01	7.68E-01	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	-5.68E-02	2.83E-01	2.84E-01	6.12E-01	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/21/2020	20-01057	Strontium-90	ElChroM SRW01 Modified	2.03E-01	2.87E-01	2.96E-01	5.91E-01	U	pCi/g
20-01057-01	LCS	KNOWN	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	2.62E+02	1.02E+01				pCi/g
20-01057-01	LCS	KNOWN	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	1.94E+02	7.96E+00				pCi/g
20-01057-01	LCS	SPIKE	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	2.46E+02	1.50E+01	1.96E+01	2.33E+00		pCi/g
20-01057-01	LCS	SPIKE	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	1.58E+02	1.39E+01	1.61E+01	3.08E+00		pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:

Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	**20-01057**
Purchase Order:	677118
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Actinium-228	EPA 901.1 Modified	-3.63E-02	1.02E-01	1.02E-01	1.51E-01	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Silver-108m	EPA 901.1 Modified	7.64E-03	2.79E-02	2.79E-02	3.54E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Americium-241	EPA 901.1 Modified	2.05E-02	4.26E-02	4.26E-02	6.19E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Barium-133	EPA 901.1 Modified	-6.25E-03	3.15E-02	3.15E-02	4.20E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Bismuth-214	EPA 901.1 Modified	2.08E-02	5.62E-02	5.62E-02	9.39E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	-3.79E-03	2.75E-02	2.75E-02	3.91E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Cesium-134	EPA 901.1 Modified	-2.15E-02	2.83E-02	2.84E-02	3.37E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	-4.28E-03	2.85E-02	2.85E-02	4.38E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Europium-152	EPA 901.1 Modified	-2.41E-02	1.05E-01	1.05E-01	9.50E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Europium-154	EPA 901.1 Modified	-1.51E-02	6.82E-02	6.82E-02	4.62E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Europium-155	EPA 901.1 Modified	5.04E-02	4.97E-02	4.97E-02	8.21E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Holmium-166m	EPA 901.1 Modified	-1.72E-03	4.88E-02	4.88E-02	3.90E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Iodine-129	EPA 901.1 Modified	-4.31E-03	7.26E-02	7.26E-02	9.96E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Potassium-40	EPA 901.1 Modified	2.34E-01	2.12E-01	2.12E-01	3.09E-01	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Manganese-54	EPA 901.1 Modified	-9.57E-03	2.39E-02	2.39E-02	3.50E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Molybdenum-93	EPA 901.1 Modified	7.29E-03	2.21E-02	2.21E-02	3.85E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Niobium-94	EPA 901.1 Modified	7.50E-04	2.30E-02	2.30E-02	3.76E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Lead-210	EPA 901.1 Modified	3.12E-01	4.57E-01	4.57E-01	6.69E-01	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Lead-212	EPA 901.1 Modified	4.06E-02	3.82E-02	3.83E-02	6.10E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Lead-214	EPA 901.1 Modified	2.59E-02	5.11E-02	5.11E-02	7.63E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Promethium-145	EPA 901.1 Modified	5.33E-02	7.40E-02	7.40E-02	9.84E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Radium-226	EPA 901.1 Modified	2.08E-02	5.62E-02	5.62E-02	9.39E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Antimony-125	EPA 901.1 Modified	6.40E-03	3.96E-02	3.96E-02	8.08E-02	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Thorium-234	EPA 901.1 Modified	3.89E-01	4.33E-01	4.33E-01	6.36E-01	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Thallium-208	EPA 901.1 Modified	-2.25E-02	7.50E-02	7.50E-02	1.08E-01	U	pCi/g
20-01057-02	MBL	BLANK	01/14/20 00:00	1/14/2020	1/16/2020	20-01057	Uranium-235	EPA 901.1 Modified	7.93E-02	1.31E-01	1.31E-01	1.92E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01057
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Actinium-228	EPA 901.1 Modified	6.40E-01	2.41E-01	2.43E-01	4.65E-01		pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Silver-108m	EPA 901.1 Modified	1.63E-02	3.48E-02	3.49E-02	8.61E-02	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Americium-241	EPA 901.1 Modified	-2.25E-01	1.24E-01	1.25E-01	1.78E-01	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Barium-133	EPA 901.1 Modified	2.18E-02	4.67E-02	4.67E-02	1.39E-01	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Bismuth-214	EPA 901.1 Modified	4.44E-01	1.96E-01	1.98E-01	1.40E-01		pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	-2.32E-02	5.29E-02	5.29E-02	1.54E-01	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Cesium-134	EPA 901.1 Modified	-6.21E-04	3.15E-02	3.15E-02	9.88E-02	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	6.98E-01	1.39E-01	1.43E-01	1.06E-01		pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Europium-152	EPA 901.1 Modified	-2.40E-01	2.39E-01	2.39E-01	2.18E-01	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Europium-154	EPA 901.1 Modified	-2.27E-02	2.03E-01	2.03E-01	1.15E-01	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Europium-155	EPA 901.1 Modified	3.84E-02	1.54E-01	1.54E-01	2.23E-01	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Holmium-166m	EPA 901.1 Modified	1.71E-02	1.13E-01	1.13E-01	9.48E-02	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Iodine-129	EPA 901.1 Modified	-6.93E-02	1.81E-01	1.81E-01	2.87E-01	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Potassium-40	EPA 901.1 Modified	1.27E+01	2.09E+00	2.19E+00	1.75E-01		pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Manganese-54	EPA 901.1 Modified	3.52E-02	7.46E-02	7.46E-02	1.29E-01	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Molybdenum-93	EPA 901.1 Modified	-3.31E-02	5.55E-02	5.55E-02	7.36E-02	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Niobium-94	EPA 901.1 Modified	6.01E-02	6.37E-02	6.37E-02	9.26E-02	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Lead-210	EPA 901.1 Modified	2.69E+00	1.89E+00	1.90E+00	3.11E+00	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Lead-212	EPA 901.1 Modified	6.55E-01	1.70E-01	1.74E-01	2.21E-01		pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Lead-214	EPA 901.1 Modified	5.33E-01	1.67E-01	1.70E-01	2.46E-01		pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Promethium-145	EPA 901.1 Modified	-1.03E-01	1.59E-01	1.59E-01	2.49E-01	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Radium-226	EPA 901.1 Modified	4.44E-01	1.96E-01	1.98E-01	1.40E-01		pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Antimony-125	EPA 901.1 Modified	1.96E-02	1.69E-01	1.69E-01	2.66E-01	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Thorium-234	EPA 901.1 Modified	1.91E+00	1.57E+00	1.57E+00	2.60E+00	U	pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Thallium-208	EPA 901.1 Modified	4.17E-01	1.84E-01	1.85E-01	2.60E-01		pCi/g
20-01057-03	DUP	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Uranium-235	EPA 901.1 Modified	2.43E-01	3.48E-01	3.48E-01	5.46E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Jeffrey Graham	SDG:	20-01057
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Actinium-228	EPA 901.1 Modified	4.54E-01	2.32E-01	2.33E-01	5.03E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Silver-108m	EPA 901.1 Modified	4.34E-03	5.12E-02	5.12E-02	8.38E-02	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Americium-241	EPA 901.1 Modified	-2.34E-01	1.23E-01	1.23E-01	1.70E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Barium-133	EPA 901.1 Modified	2.21E-02	5.18E-02	5.18E-02	1.45E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Bismuth-214	EPA 901.1 Modified	5.25E-01	1.86E-01	1.88E-01	1.40E-01		pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	1.16E-02	8.79E-02	8.79E-02	1.32E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Cesium-134	EPA 901.1 Modified	-8.80E-04	2.81E-02	2.81E-02	1.11E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	6.08E-01	1.32E-01	1.35E-01	2.23E-01		pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Europium-152	EPA 901.1 Modified	-1.25E-01	2.01E-01	2.02E-01	2.39E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Europium-154	EPA 901.1 Modified	-5.92E-02	1.92E-01	1.92E-01	1.24E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Europium-155	EPA 901.1 Modified	2.75E-01	1.33E-01	1.34E-01	2.53E-01		pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Holmium-166m	EPA 901.1 Modified	9.26E-02	1.02E-01	1.02E-01	9.18E-02	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Iodine-129	EPA 901.1 Modified	1.46E-02	1.70E-01	1.70E-01	2.78E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Potassium-40	EPA 901.1 Modified	1.21E+01	2.11E+00	2.20E+00	1.16E+00		pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Manganese-54	EPA 901.1 Modified	1.61E-02	8.57E-02	8.57E-02	1.37E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Molybdenum-93	EPA 901.1 Modified	1.04E-02	5.38E-02	5.38E-02	8.88E-02	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Niobium-94	EPA 901.1 Modified	1.26E-02	5.31E-02	5.31E-02	9.20E-02	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Lead-210	EPA 901.1 Modified	3.55E+00	1.84E+00	1.85E+00	2.95E+00		pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Lead-212	EPA 901.1 Modified	3.95E-01	1.18E-01	1.20E-01	2.37E-01		pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Lead-214	EPA 901.1 Modified	3.93E-01	1.37E-01	1.39E-01	2.33E-01		pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Promethium-145	EPA 901.1 Modified	1.10E-01	1.58E-01	1.58E-01	2.61E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Radium-226	EPA 901.1 Modified	5.25E-01	1.86E-01	1.88E-01	1.40E-01		pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Antimony-125	EPA 901.1 Modified	-1.84E-01	1.74E-01	1.74E-01	2.17E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Thorium-234	EPA 901.1 Modified	1.36E+00	1.08E+00	1.08E+00	1.84E+00	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Thallium-208	EPA 901.1 Modified	3.06E-01	1.61E-01	1.62E-01	3.76E-01	U	pCi/g
20-01057-04	DO	L1-10213B-QIGS-009-SS-A	10/23/19 09:14	1/14/2020	1/16/2020	20-01057	Uranium-235	EPA 901.1 Modified	-1.55E-02	3.47E-01	3.47E-01	5.14E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01057
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Actinium-228	EPA 901.1 Modified	1.89E-01	2.29E-01	2.30E-01	3.75E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Silver-108m	EPA 901.1 Modified	2.35E-02	3.48E-02	3.48E-02	7.71E-02	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Americium-241	EPA 901.1 Modified	-2.66E-01	1.35E-01	1.35E-01	1.69E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Barium-133	EPA 901.1 Modified	-1.79E-02	4.49E-02	4.49E-02	1.14E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Bismuth-214	EPA 901.1 Modified	3.14E-01	1.50E-01	1.51E-01	2.80E-01		pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	5.52E-02	3.70E-02	3.71E-02	6.95E-02	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Cesium-134	EPA 901.1 Modified	-2.91E-04	4.03E-02	4.03E-02	1.02E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	1.10E+00	1.65E-01	1.74E-01	1.41E-01		pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Europium-152	EPA 901.1 Modified	2.30E-02	1.39E-01	1.39E-01	2.34E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Europium-154	EPA 901.1 Modified	-1.29E-01	1.54E-01	1.54E-01	1.24E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Europium-155	EPA 901.1 Modified	4.33E-02	1.34E-01	1.34E-01	1.97E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Holmium-166m	EPA 901.1 Modified	-1.19E-03	1.08E-01	1.08E-01	9.91E-02	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Iodine-129	EPA 901.1 Modified	9.77E-03	1.86E-01	1.86E-01	2.75E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Potassium-40	EPA 901.1 Modified	9.49E+00	1.49E+00	1.57E+00	4.86E-01		pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Manganese-54	EPA 901.1 Modified	2.92E-02	6.95E-02	6.95E-02	1.12E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Molybdenum-93	EPA 901.1 Modified	1.78E-02	5.26E-02	5.26E-02	7.82E-02	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Niobium-94	EPA 901.1 Modified	1.01E-03	2.69E-02	2.69E-02	7.65E-02	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Lead-210	EPA 901.1 Modified	3.07E+00	1.45E+00	1.46E+00	2.30E+00		pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Lead-212	EPA 901.1 Modified	4.71E-01	1.30E-01	1.32E-01	2.92E-01		pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Lead-214	EPA 901.1 Modified	2.70E-01	1.43E-01	1.43E-01	2.15E-01		pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Promethium-145	EPA 901.1 Modified	-5.22E-02	1.69E-01	1.69E-01	2.44E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Radium-226	EPA 901.1 Modified	3.14E-01	1.50E-01	1.51E-01	2.80E-01		pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Antimony-125	EPA 901.1 Modified	-1.07E-02	1.67E-01	1.67E-01	2.44E-01	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Thorium-234	EPA 901.1 Modified	2.25E+00	1.11E+00	1.12E+00	1.78E+00	U	pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Thallium-208	EPA 901.1 Modified	5.33E-01	1.64E-01	1.66E-01	2.96E-01		pCi/g
20-01057-05	TRG	L1-10213B-FIGS-010-SS-A	10/23/19 09:16	1/14/2020	1/16/2020	20-01057	Uranium-235	EPA 901.1 Modified	1.41E-01	3.28E-01	3.28E-01	4.95E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01057
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Actinium-228	EPA 901.1 Modified	5.26E-01	2.79E-01	2.80E-01	5.51E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Silver-108m	EPA 901.1 Modified	-9.79E-04	3.42E-02	3.42E-02	1.02E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Americium-241	EPA 901.1 Modified	-1.07E-01	1.67E-01	1.67E-01	2.05E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Barium-133	EPA 901.1 Modified	-9.72E-03	6.83E-02	6.83E-02	1.44E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Bismuth-214	EPA 901.1 Modified	3.58E-01	1.80E-01	1.81E-01	3.12E-01		pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	4.87E-02	3.76E-02	3.76E-02	7.35E-02	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Cesium-134	EPA 901.1 Modified	2.33E-02	5.65E-02	5.65E-02	1.09E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	6.11E+00	6.54E-01	7.25E-01	1.79E-01		pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Europium-152	EPA 901.1 Modified	-1.96E-01	3.64E-01	3.64E-01	2.79E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Europium-154	EPA 901.1 Modified	1.41E-01	1.70E-01	1.70E-01	1.52E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Europium-155	EPA 901.1 Modified	-8.25E-02	1.88E-01	1.88E-01	2.31E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Holmium-166m	EPA 901.1 Modified	-4.55E-02	1.19E-01	1.19E-01	1.15E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Iodine-129	EPA 901.1 Modified	-8.22E-02	1.88E-01	1.88E-01	2.39E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Potassium-40	EPA 901.1 Modified	1.07E+01	1.87E+00	1.95E+00	1.14E+00		pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Manganese-54	EPA 901.1 Modified	-5.20E-02	8.01E-02	8.02E-02	1.11E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Molybdenum-93	EPA 901.1 Modified	-2.49E-02	5.83E-02	5.83E-02	7.91E-02	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Niobium-94	EPA 901.1 Modified	5.04E-02	5.77E-02	5.77E-02	9.74E-02	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Lead-210	EPA 901.1 Modified	3.63E+00	1.70E+00	1.71E+00	2.67E+00		pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Lead-212	EPA 901.1 Modified	5.12E-01	1.31E-01	1.34E-01	3.37E-01		pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Lead-214	EPA 901.1 Modified	4.86E-01	2.33E-01	2.34E-01	3.51E-01		pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Promethium-145	EPA 901.1 Modified	1.69E-01	2.35E-01	2.35E-01	3.18E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Radium-226	EPA 901.1 Modified	3.58E-01	1.80E-01	1.81E-01	3.12E-01		pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Antimony-125	EPA 901.1 Modified	4.60E-02	2.36E-01	2.36E-01	3.98E-01	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Thorium-234	EPA 901.1 Modified	-1.77E-02	1.52E+00	1.52E+00	1.99E+00	U	pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Thallium-208	EPA 901.1 Modified	3.97E-01	1.90E-01	1.91E-01	2.77E-01		pCi/g
20-01057-06	TRG	L1-10213B-FIGS-011-SS-A	10/23/19 09:18	1/14/2020	1/16/2020	20-01057	Uranium-235	EPA 901.1 Modified	-3.46E-01	4.96E-01	4.96E-01	5.97E-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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Jeffrey Graham	SDG:	20-01057
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Actinium-228	EPA 901.1 Modified	2.64E-01	2.67E-01	2.68E-01	4.36E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Silver-108m	EPA 901.1 Modified	-2.09E-02	7.63E-02	7.63E-02	1.03E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Americium-241	EPA 901.1 Modified	-2.52E-01	1.60E-01	1.60E-01	1.93E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Barium-133	EPA 901.1 Modified	2.54E-02	3.54E-02	3.54E-02	1.55E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Bismuth-214	EPA 901.1 Modified	3.02E-01	1.49E-01	1.50E-01	2.72E-01		pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	1.30E-01	6.96E-02	6.99E-02	1.33E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Cesium-134	EPA 901.1 Modified	-1.18E-02	4.11E-02	4.11E-02	1.14E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	3.68E+00	3.86E-01	4.30E-01	3.54E-01		pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Europium-152	EPA 901.1 Modified	2.73E-02	2.53E-01	2.53E-01	2.62E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Europium-154	EPA 901.1 Modified	-9.94E-02	1.78E-01	1.78E-01	1.34E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Europium-155	EPA 901.1 Modified	5.34E-02	1.60E-01	1.60E-01	2.34E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Holmium-166m	EPA 901.1 Modified	-1.64E-02	1.25E-01	1.25E-01	1.08E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Iodine-129	EPA 901.1 Modified	3.30E-02	8.86E-02	8.86E-02	3.67E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Potassium-40	EPA 901.1 Modified	8.31E+00	1.61E+00	1.67E+00	1.52E+00		pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Manganese-54	EPA 901.1 Modified	-6.58E-03	8.89E-02	8.89E-02	1.24E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Molybdenum-93	EPA 901.1 Modified	-7.23E-02	7.23E-02	7.24E-02	7.31E-02	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Niobium-94	EPA 901.1 Modified	-7.22E-02	6.90E-02	6.91E-02	7.52E-02	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Lead-210	EPA 901.1 Modified	4.62E+00	1.68E+00	1.70E+00	2.58E+00		pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Lead-212	EPA 901.1 Modified	5.56E-01	1.49E-01	1.52E-01	2.53E-01		pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Lead-214	EPA 901.1 Modified	4.60E-01	1.78E-01	1.80E-01	3.10E-01		pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Promethium-145	EPA 901.1 Modified	1.94E-01	1.73E-01	1.74E-01	2.96E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Radium-226	EPA 901.1 Modified	3.02E-01	1.49E-01	1.50E-01	2.72E-01		pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Antimony-125	EPA 901.1 Modified	2.49E-02	2.28E-01	2.28E-01	3.44E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Thorium-234	EPA 901.1 Modified	1.84E+00	1.22E+00	1.22E+00	1.91E+00	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Thallium-208	EPA 901.1 Modified	3.13E-01	1.57E-01	1.58E-01	3.70E-01	U	pCi/g
20-01057-07	TRG	L1-10213B-FIGS-012-SS-A	10/23/19 09:20	1/14/2020	1/16/2020	20-01057	Uranium-235	EPA 901.1 Modified	5.71E-01	3.83E-01	3.84E-01	6.16E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01057
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Actinium-228	EPA 901.1 Modified	4.22E-01	2.27E-01	2.28E-01	5.27E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Silver-108m	EPA 901.1 Modified	-2.20E-02	6.95E-02	6.95E-02	1.01E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Americium-241	EPA 901.1 Modified	-4.30E-02	1.59E-01	1.59E-01	1.98E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Barium-133	EPA 901.1 Modified	6.26E-02	8.24E-02	8.25E-02	1.62E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Bismuth-214	EPA 901.1 Modified	3.22E-01	1.35E-01	1.36E-01	3.57E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	6.86E-02	7.92E-02	7.92E-02	1.45E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Cesium-134	EPA 901.1 Modified	3.19E-02	6.18E-02	6.18E-02	8.92E-02	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	8.57E+00	8.78E-01	9.82E-01	1.75E-01		pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Europium-152	EPA 901.1 Modified	-1.92E-01	3.32E-01	3.33E-01	2.87E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Europium-154	EPA 901.1 Modified	-7.80E-02	1.95E-01	1.95E-01	1.47E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Europium-155	EPA 901.1 Modified	-4.40E-02	1.77E-01	1.77E-01	2.24E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Holmium-166m	EPA 901.1 Modified	-7.01E-02	1.14E-01	1.14E-01	1.14E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Iodine-129	EPA 901.1 Modified	-2.08E-01	2.10E-01	2.10E-01	2.43E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Potassium-40	EPA 901.1 Modified	1.15E+01	1.88E+00	1.97E+00	9.50E-01		pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Manganese-54	EPA 901.1 Modified	-1.41E-03	8.50E-02	8.50E-02	1.26E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Molybdenum-93	EPA 901.1 Modified	1.69E-02	5.22E-02	5.22E-02	6.41E-02	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Niobium-94	EPA 901.1 Modified	2.14E-02	5.60E-02	5.60E-02	8.30E-02	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Lead-210	EPA 901.1 Modified	4.18E+00	1.67E+00	1.69E+00	2.58E+00		pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Lead-212	EPA 901.1 Modified	3.87E-01	1.81E-01	1.82E-01	2.82E-01		pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Lead-214	EPA 901.1 Modified	3.31E-01	2.10E-01	2.11E-01	4.00E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Promethium-145	EPA 901.1 Modified	3.40E-01	2.28E-01	2.28E-01	3.22E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Radium-226	EPA 901.1 Modified	3.22E-01	1.35E-01	1.36E-01	3.57E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Antimony-125	EPA 901.1 Modified	8.43E-02	2.42E-01	2.42E-01	4.06E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Thorium-234	EPA 901.1 Modified	9.58E-01	1.46E+00	1.46E+00	2.00E+00	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Thallium-208	EPA 901.1 Modified	4.91E-01	2.52E-01	2.53E-01	4.26E-01	U	pCi/g
20-01057-08	TRG	L1-10213B-FIGS-013-SS-A	10/23/19 09:22	1/14/2020	1/16/2020	20-01057	Uranium-235	EPA 901.1 Modified	3.18E-02	4.52E-01	4.52E-01	6.00E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01057
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Actinium-228	EPA 901.1 Modified	2.74E-01	2.63E-01	2.63E-01	4.78E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Silver-108m	EPA 901.1 Modified	1.05E-02	5.36E-02	5.36E-02	8.31E-02	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Americium-241	EPA 901.1 Modified	-9.08E-02	1.06E-01	1.06E-01	1.61E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Barium-133	EPA 901.1 Modified	1.76E-02	3.21E-02	3.21E-02	1.37E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Bismuth-214	EPA 901.1 Modified	3.26E-01	1.54E-01	1.55E-01	2.66E-01		pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	5.76E-02	7.90E-02	7.90E-02	1.40E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Cesium-134	EPA 901.1 Modified	1.36E-02	3.01E-02	3.01E-02	9.89E-02	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	6.38E-01	1.34E-01	1.38E-01	1.17E-01		pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Europium-152	EPA 901.1 Modified	-4.04E-02	2.09E-01	2.09E-01	2.29E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Europium-154	EPA 901.1 Modified	7.83E-03	2.16E-01	2.16E-01	1.15E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Europium-155	EPA 901.1 Modified	5.93E-02	1.15E-01	1.15E-01	1.94E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Holmium-166m	EPA 901.1 Modified	1.50E-02	1.13E-01	1.13E-01	8.87E-02	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Iodine-129	EPA 901.1 Modified	-3.63E-03	1.61E-01	1.61E-01	2.61E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Potassium-40	EPA 901.1 Modified	9.89E+00	1.93E+00	1.99E+00	1.48E+00		pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Manganese-54	EPA 901.1 Modified	-2.42E-02	7.66E-02	7.66E-02	1.10E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Molybdenum-93	EPA 901.1 Modified	-2.23E-02	5.49E-02	5.49E-02	7.39E-02	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Niobium-94	EPA 901.1 Modified	1.32E-02	5.41E-02	5.41E-02	7.30E-02	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Lead-210	EPA 901.1 Modified	3.36E+00	1.74E+00	1.75E+00	2.80E+00		pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Lead-212	EPA 901.1 Modified	4.53E-01	1.34E-01	1.36E-01	1.79E-01		pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Lead-214	EPA 901.1 Modified	3.84E-01	1.81E-01	1.82E-01	3.04E-01		pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Promethium-145	EPA 901.1 Modified	1.00E-01	1.49E-01	1.49E-01	2.51E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Radium-226	EPA 901.1 Modified	3.26E-01	1.54E-01	1.55E-01	2.66E-01		pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Antimony-125	EPA 901.1 Modified	5.09E-02	1.62E-01	1.62E-01	2.56E-01	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Thorium-234	EPA 901.1 Modified	1.24E+00	9.42E-01	9.44E-01	1.62E+00	U	pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Thallium-208	EPA 901.1 Modified	2.72E-01	1.35E-01	1.36E-01	2.50E-01		pCi/g
20-01057-09	TRG	L1-10213B-FIGS-015-SS-A	11/12/19 08:02	1/14/2020	1/16/2020	20-01057	Uranium-235	EPA 901.1 Modified	7.68E-02	3.02E-01	3.02E-01	4.61E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:

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Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG: **20-01057**
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Actinium-228	EPA 901.1 Modified	4.97E-01	3.18E-01	3.19E-01	5.68E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Silver-108m	EPA 901.1 Modified	-2.02E-02	1.04E-01	1.04E-01	1.27E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Americium-241	EPA 901.1 Modified	-6.23E-01	2.21E-01	2.23E-01	2.45E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Barium-133	EPA 901.1 Modified	-1.04E-01	1.55E-01	1.55E-01	1.87E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Bismuth-214	EPA 901.1 Modified	4.37E-01	1.82E-01	1.83E-01	3.15E-01		pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	6.30E-02	9.03E-02	9.04E-02	1.64E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Cesium-134	EPA 901.1 Modified	1.85E-02	5.90E-02	5.90E-02	1.37E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	2.84E+00	3.50E-01	3.79E-01	2.39E-01		pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Europium-152	EPA 901.1 Modified	-8.10E-03	3.18E-01	3.18E-01	3.44E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Europium-154	EPA 901.1 Modified	4.72E-02	2.26E-01	2.26E-01	1.82E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Europium-155	EPA 901.1 Modified	2.00E-01	1.50E-01	1.50E-01	3.60E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Holmium-166m	EPA 901.1 Modified	-5.01E-02	1.46E-01	1.46E-01	1.44E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Iodine-129	EPA 901.1 Modified	-3.72E-02	1.10E-01	1.10E-01	4.42E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Potassium-40	EPA 901.1 Modified	1.63E+01	2.60E+00	2.74E+00	2.02E+00		pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Manganese-54	EPA 901.1 Modified	3.30E-02	9.86E-02	9.86E-02	1.50E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Molybdenum-93	EPA 901.1 Modified	8.65E-04	8.38E-02	8.38E-02	1.07E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Niobium-94	EPA 901.1 Modified	6.60E-02	7.87E-02	7.88E-02	1.24E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Lead-210	EPA 901.1 Modified	5.01E+00	2.20E+00	2.21E+00	3.46E+00		pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Lead-212	EPA 901.1 Modified	8.65E-01	2.44E-01	2.48E-01	3.42E-01		pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Lead-214	EPA 901.1 Modified	5.28E-01	2.36E-01	2.38E-01	4.37E-01		pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Promethium-145	EPA 901.1 Modified	1.70E-01	2.17E-01	2.17E-01	3.70E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Radium-226	EPA 901.1 Modified	4.37E-01	1.82E-01	1.83E-01	3.15E-01		pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Antimony-125	EPA 901.1 Modified	2.30E-01	2.61E-01	2.61E-01	4.25E-01	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Thorium-234	EPA 901.1 Modified	3.92E+00	1.68E+00	1.69E+00	2.70E+00	U	pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Thallium-208	EPA 901.1 Modified	4.74E-01	2.21E-01	2.22E-01	4.08E-01		pCi/g
20-01057-10	TRG	L1-10213B-FIGS-016-SS-A	11/12/19 08:04	1/14/2020	1/16/2020	20-01057	Uranium-235	EPA 901.1 Modified	3.89E-01	4.71E-01	4.72E-01	7.37E-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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Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Actinium-228	EPA 901.1 Modified	2.01E-01	1.54E-01	1.54E-01	2.76E-01	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Silver-108m	EPA 901.1 Modified	4.87E-03	3.70E-02	3.70E-02	4.45E-02	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Americium-241	EPA 901.1 Modified	-9.24E-02	6.24E-02	6.25E-02	8.86E-02	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Barium-133	EPA 901.1 Modified	7.39E-03	1.51E-02	1.51E-02	6.91E-02	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Bismuth-214	EPA 901.1 Modified	2.32E-01	1.01E-01	1.02E-01	6.80E-02		pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	6.28E-03	4.47E-02	4.47E-02	5.32E-02	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Cesium-134	EPA 901.1 Modified	2.68E-03	1.89E-02	1.89E-02	5.60E-02	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	2.19E-02	3.78E-02	3.79E-02	6.33E-02	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Europium-152	EPA 901.1 Modified	-5.17E-02	1.26E-01	1.26E-01	1.30E-01	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Europium-154	EPA 901.1 Modified	5.66E-02	3.60E-02	3.61E-02	6.85E-02	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Europium-155	EPA 901.1 Modified	5.20E-03	4.01E-02	4.01E-02	1.11E-01	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Holmium-166m	EPA 901.1 Modified	6.40E-02	4.85E-02	4.86E-02	4.72E-02	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Iodine-129	EPA 901.1 Modified	-5.11E-02	8.16E-02	8.16E-02	1.27E-01	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Potassium-40	EPA 901.1 Modified	1.06E+01	1.48E+00	1.57E+00	6.39E-01		pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Manganese-54	EPA 901.1 Modified	7.44E-03	4.46E-02	4.46E-02	7.20E-02	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Molybdenum-93	EPA 901.1 Modified	-9.13E-03	3.29E-02	3.29E-02	3.74E-02	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Niobium-94	EPA 901.1 Modified	6.72E-03	2.16E-02	2.16E-02	4.56E-02	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Lead-210	EPA 901.1 Modified	1.01E+00	5.65E-01	5.68E-01	9.83E-01	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Lead-212	EPA 901.1 Modified	2.10E-01	7.79E-02	7.87E-02	1.15E-01		pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Lead-214	EPA 901.1 Modified	2.26E-01	7.75E-02	7.84E-02	1.21E-01		pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Promethium-145	EPA 901.1 Modified	2.10E-02	7.49E-02	7.49E-02	1.23E-01	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Radium-226	EPA 901.1 Modified	2.32E-01	1.01E-01	1.02E-01	6.80E-02		pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Antimony-125	EPA 901.1 Modified	-4.48E-02	9.01E-02	9.01E-02	1.27E-01	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Thorium-234	EPA 901.1 Modified	9.81E-01	5.28E-01	5.30E-01	9.19E-01	U	pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Thallium-208	EPA 901.1 Modified	1.96E-01	8.73E-02	8.78E-02	1.26E-01		pCi/g
20-01057-11	TRG	L1-10203F-FSGS-007-SS-A	10/07/19 12:32	1/14/2020	1/16/2020	20-01057	Uranium-235	EPA 901.1 Modified	-4.77E-03	1.75E-01	1.75E-01	2.59E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:

Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	**20-01057**
Purchase Order:	677118
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Actinium-228	EPA 901.1 Modified	1.95E-01	1.21E-01	1.21E-01	2.45E-01	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Silver-108m	EPA 901.1 Modified	-2.71E-02	3.57E-02	3.57E-02	3.38E-02	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Americium-241	EPA 901.1 Modified	-1.28E-01	7.23E-02	7.26E-02	9.19E-02	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Barium-133	EPA 901.1 Modified	-5.91E-03	5.43E-02	5.43E-02	6.21E-02	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Bismuth-214	EPA 901.1 Modified	1.76E-01	7.75E-02	7.80E-02	1.40E-01		pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Cobalt-60	EPA 901.1 Modified	1.66E-02	3.42E-02	3.42E-02	6.04E-02	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Cesium-134	EPA 901.1 Modified	2.63E-04	1.37E-02	1.37E-02	6.60E-02	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Cesium-137	EPA 901.1 Modified	1.21E-02	3.68E-02	3.68E-02	5.46E-02	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Europium-152	EPA 901.1 Modified	-1.47E-01	1.21E-01	1.22E-01	1.29E-01	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Europium-154	EPA 901.1 Modified	-2.14E-02	1.04E-01	1.04E-01	6.65E-02	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Europium-155	EPA 901.1 Modified	-3.79E-02	3.77E-02	3.78E-02	1.06E-01	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Holmium-166m	EPA 901.1 Modified	-2.26E-02	6.01E-02	6.01E-02	4.89E-02	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Iodine-129	EPA 901.1 Modified	2.82E-02	9.07E-02	9.07E-02	1.36E-01	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Potassium-40	EPA 901.1 Modified	9.98E+00	1.29E+00	1.39E+00	9.46E-01		pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Manganese-54	EPA 901.1 Modified	-2.33E-02	4.07E-02	4.08E-02	5.21E-02	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Molybdenum-93	EPA 901.1 Modified	1.77E-02	2.74E-02	2.74E-02	4.37E-02	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Niobium-94	EPA 901.1 Modified	-2.94E-02	3.90E-02	3.91E-02	4.82E-02	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Lead-210	EPA 901.1 Modified	1.90E-01	5.69E-01	5.69E-01	8.54E-01	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Lead-212	EPA 901.1 Modified	2.57E-01	8.82E-02	8.92E-02	1.30E-01		pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Lead-214	EPA 901.1 Modified	1.95E-01	6.45E-02	6.53E-02	1.99E-01	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Promethium-145	EPA 901.1 Modified	6.97E-03	7.95E-02	7.95E-02	1.18E-01	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Radium-226	EPA 901.1 Modified	1.76E-01	7.75E-02	7.80E-02	1.40E-01		pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Antimony-125	EPA 901.1 Modified	4.67E-02	8.19E-02	8.19E-02	1.33E-01	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Thorium-234	EPA 901.1 Modified	7.70E-01	6.01E-01	6.02E-01	9.34E-01	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Thallium-208	EPA 901.1 Modified	1.60E-01	8.26E-02	8.30E-02	1.78E-01	U	pCi/g
20-01057-12	TRG	L1-10203F-FSGS-009-SS-A	10/07/19 12:36	1/14/2020	1/16/2020	20-01057	Uranium-235	EPA 901.1 Modified	-3.55E-02	1.77E-01	1.77E-01	2.58E-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

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Revision 0
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+Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L1-10213B-FIGS-001-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/15/2019	1300	5 ROC HTD	NA	264.48
L1-10213B-QIGS-001-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/15/2019	1300	5 ROC HTD	NA	231.59
L1-10213B-FIGS-002-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/15/2019	1302	5 ROC HTD	NA	248.31
L1-10213B-FIGS-003-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/17/2019	0804	5 ROC HTD	NA	320.06
L1-10213B-FIGS-004-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/17/2019	0806	5 ROC HTD	NA	275.90
L1-10213B-FIGS-005-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/17/2019	0808	5 ROC HTD	NA	297.28
L1-10213B-FIGS-006-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/17/2019	0810	5 ROC HTD	NA	276.17
L1-10213B-FIGS-007-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/21/2019	0915	5 ROC HTD	NA	288.85
L1-10213B-FIGS-008-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/21/2019	0917	5 ROC HTD	NA	313.71
L1-10213B-FIGS-009-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/23/2019	0914	5 ROC HTD	NA	275.86
L1-10213B-QIGS-009-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/23/2019	0914	5 ROC HTD	NA	282.35
L1-10213B-FIGS-010-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/23/2019	0916	5 ROC HTD	NA	287.41
L1-10213B-FIGS-011-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/23/2019	0918	5 ROC HTD	NA	271.42
L1-10213B-FIGS-012-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/23/2019	0920	5 ROC HTD	NA	292.24
L1-10213B-FIGS-013-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	10/23/2019	0922	5 ROC HTD	NA	283.37
L1-10213B-FIGS-015-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	11/12/2019	0802	5 ROC HTD	NA	297.21
L1-10213B-FIGS-016-SS-A	NA	NA	SOIL	250	ml	MARINELLI	1	11/12/2019	0804	5 ROC HTD	NA	263.28

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Rec BB 1-14-20 0956

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REC'D JAN 14 2020

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Attachment 1 – Chain-of-Custody Form

	Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
11	L1-10203F-FSGS-007-SS-A	NA	NA	**SOIL**	250	ml	**MARINELLI**	1	**10/7/19**	**1232**	**5 ROC HTD**	**NA**	**508.96**
12	L1-10203F-FSGS-009-SS-A	NA	NA	**SOIL**	250	ml	**MARINELLI**	1	**10/7/19**	**1236**	**5 ROC HTD**	**NA**	**501.65**

Rec RB 1-14-20 0956

ZIONSOLUTIONS LLC
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REC'D JAN 14 2020

20-01057

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Information Use

Laboratory:	Date Submitted To Lab:		Ship Container No.:	Cooler Temperature:		Airbill Number:
EBERLINE LABS			**NA**	**N/A**		FedEx Standard Overnight 8132 0229 4937
Relinquished by: Dave McKay	Date (mm/dd/yyyy): 1/10/20	Time: 0800	Received by: Richard F. Rickert	Date: (mm/dd/yyyy): 01/10/2020	0800	
Relinquished by: Richard F. Rickert	Date (mm/dd/yyyy): 01/13/2020	Time: 1600	Received by: FedEx Standard Overnight	Date: (mm/dd/yyyy): 01/13/2020	1600	
Relinquished by: Fedex	Date (mm/dd/yyyy):	Time:	Received by: Kimberly Spencer	Date: (mm/dd/yyyy): 1/14/2020	0956	
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):		
Comments						