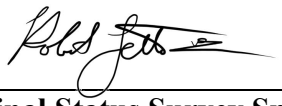
ZION SOLUTIONS LLC
An EnergySolutions Company

ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

GATE HOUSE AND SOUTHWEST YARD

SURVEY UNIT 12202B

REVISION 1

PREPARED BY / DATE: Robert Yetter III  Robert F. Yetter III Apr 29 2020 10:01 AM cosign

Final Status Survey Specialist

REVIEWED BY / DATE: Robert Yetter  Robert F. Yetter Apr 29 2020 2:11 PM cosign

Director, Radiological Site Closure

APPROVED BY / DATE: Sarah Roberts  Sarah Roberts Apr 29 2020 6:53 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 DCGLs
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 12202B, the "Gate House and Southwest Yard," 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 (L1-12202B-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 1. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I (α) and Type II (β) decision error rates were set at 0.05. Seventeen (17) systematic surface soil samples were acquired from the survey unit. In addition, surface scanning was performed on 100% of the total surface area in the survey unit. No areas of elevated activity were detected during the scans. The analytical results for all soil samples taken in survey unit 12202B 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) was 0.072. The mean OpSOF for the systematic samples was 0.032. The mean Base Case SOF (BcSOF), when the analytical results were compared to the Base Case DCGLs (BcDCGL), was 0.008, which results in a dose assigned to the survey unit of 0.202 mrem/yr Total Effective Dose Equivalent (TEDE). Therefore, the null hypothesis is rejected and survey unit 12202B is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 12202B, the Gate House and Southwest Yard, is a Class 1 open land survey unit and is 1,999 m^2 in size. It is bounded on the west by survey unit 10206E and 10207E, the south by survey unit 12202C, the east by survey units 12107, 12108, and 12109, and the north by survey unit 12202A.

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

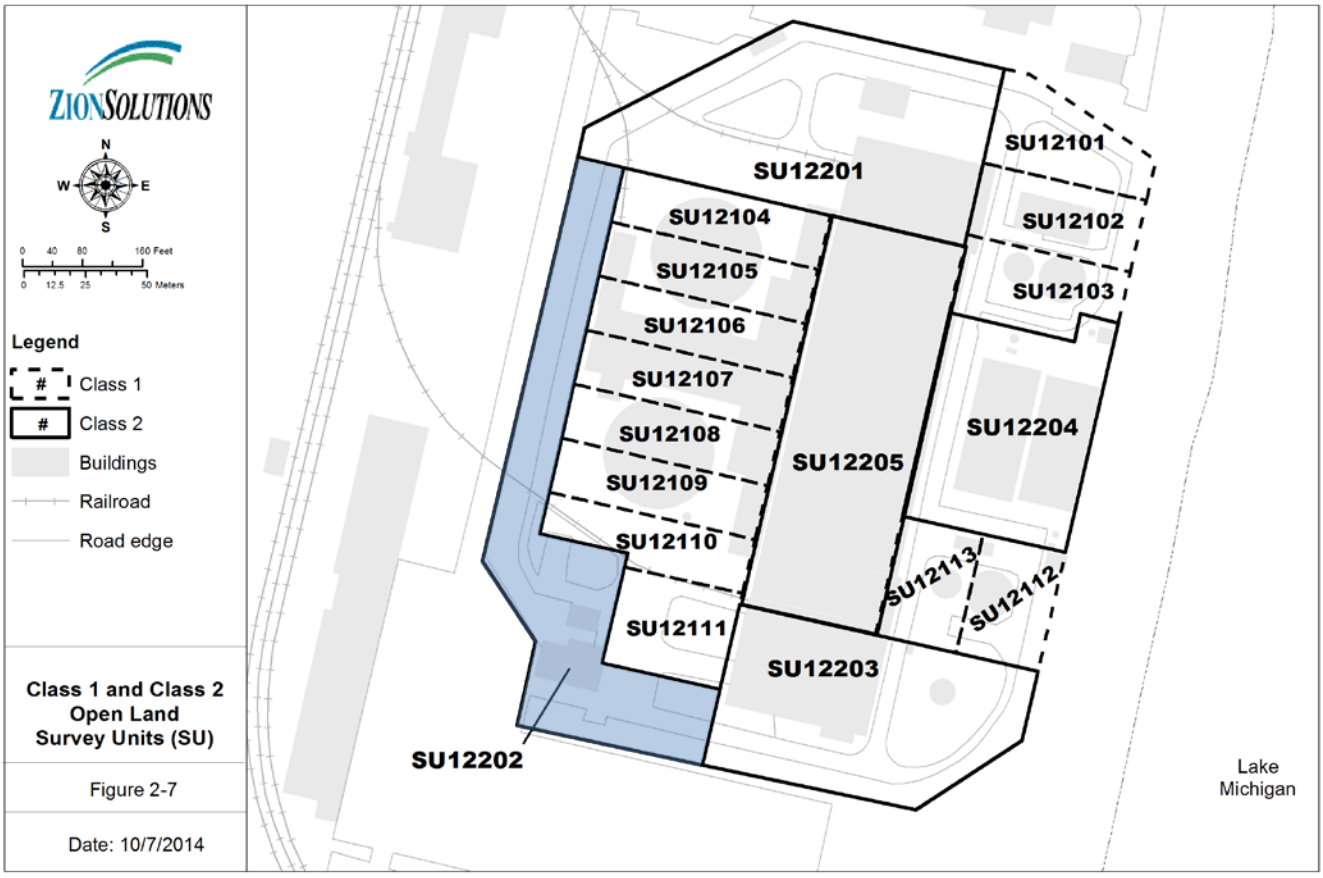
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 12202B was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 5).

The area encompassing this survey unit is made up of the majority of survey unit 10106 and portions of survey units 10104, 10105, 10108, 10206, 10207 and 10208 as identified in Figure 3 of the *"Zion Station Historical Site Assessment"* (HSA) (Reference 6). The HSA initially classified survey units 10104, 10106 and 10108 as Class 2; and survey units 10105, 10206, 10207 and 10208 as Class 3. Subsequently, this area was designated as survey unit 12202, a class 2 open land survey unit, and described as the "Gate House and Southwest Yard" in Table 2-30 of the LTP as represented in Figure 2-7 of the ZSRP LTP which is replicated below as Figure 1.

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

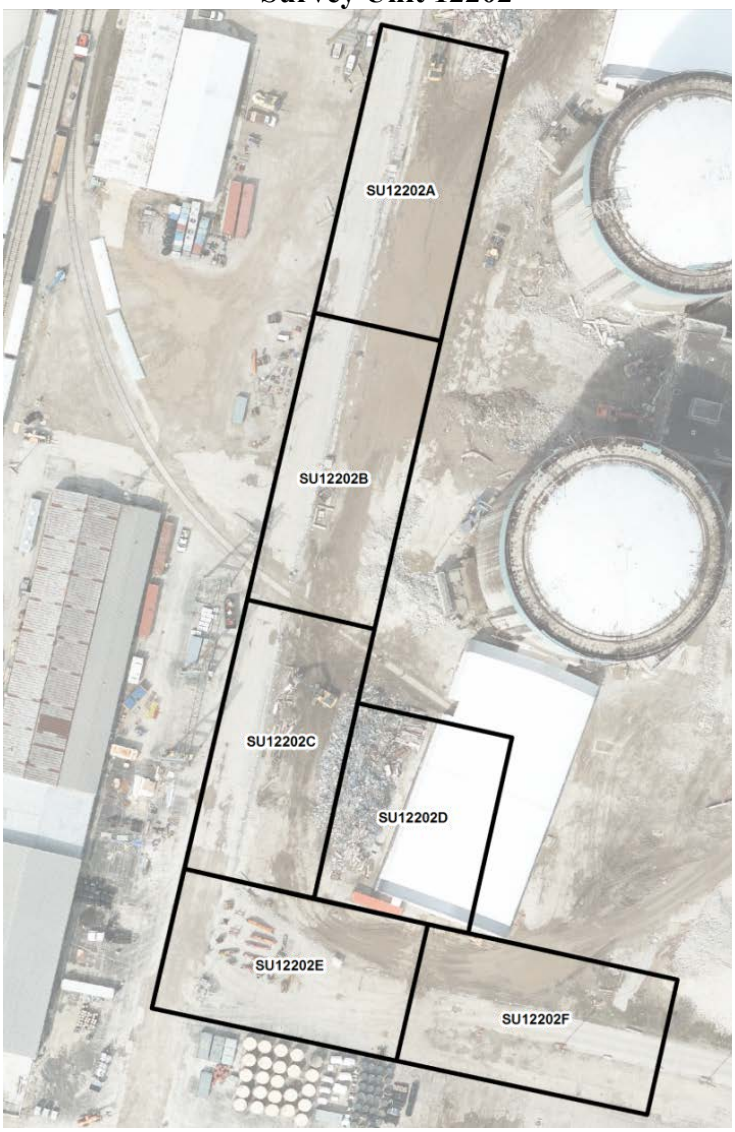


The HSA states that this area contained the Dry Active Waste (DAW) Storage Building, Illinois Department of Nuclear Safety (IDNS) Building, Meeting Trailers, Security Office and Gate House. Also, the area between the Fuel Handling Building (FHB) and Unit 2 Containment was a storage area for radioactive waste containers awaiting shipment. The HSA also notes that there were several instances of contaminated materials being found in the area. The most significant

occurrence was in 1979 when a contaminated trailer was found parked outside the FHB trackway door with contamination levels up to 300k dpm and a hot spot of 120 mR/h.

On July 15, 2016, due to changing radiological and operational conditions brought about by site decommissioning activities inside or adjacent to this area, survey unit 12202 was reclassified as a Class 1, and divided into six survey units: 12202A, 12202B, 12202C, 12202D, 12202E and 12202F to comply with the survey unit size recommendations from MARSSIM Section 4.6. Figure 2 below shows the boundaries of the resulting Class 1 survey units. The change in classification was a conservative response and ensured that the survey unit would be surveyed with the appropriate rigor.

Figure 2 - The Six Class 1 Open Land Survey Units Created from the Original Class 2 Survey Unit 12202



A Radiological Engineer (RE) and a Characterization/License Termination (C/LT) Supervisor performed a visual inspection and walk-down of the survey unit on October 8, 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 12202B was correctly classified as Class 1.

4. DATA QUALITY OBJECTIVES

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

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

The primary objective of the FSS sample plan is to demonstrate that the level of residual radioactivity in survey unit 12202B does not exceed the release criteria specified in the LTP and that the potential dose from residual radioactivity is As Low As Reasonably Achievable (ALARA).

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

Zion*Solutions* TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* (Reference 8), was written to refine the initial selection of ROC for decommissioning at the ZSRP. The list of ROC was evaluated using Containment Building(s) and Auxiliary Building concrete core analysis data to evaluate the dose significance of each radionuclide in the end state model. Section 4.4 of TSD 14-019 evaluated the results of the characterization data of surveys taken of soils. The following conclusion was reached: *"The results of surface and subsurface soil characterization in the impacted area surrounding Zion indicate that there is minimal*

residual radioactivity in soil. Essentially all of the soil results were reported as non-detectable. Other than Cs-137 at very low levels, and Co-60 at a concentration of 0.24 pCi/g in one sample, the results for all radionuclides were less than MDC. Therefore, the direct determination of radionuclide mixture fractions for initial suite radionuclides in soil is not technically feasible due to the MDC biasing issues discussed above. Based on a generalized assumption that the contaminated water that caused concrete contamination would be similar to the source of soil contamination, the ROC and radionuclide mixture derived for the Auxiliary Building concrete was considered to be reasonably representative of soils for FSS planning and implementation."

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

Table 1 - Dose Significant Radionuclides and Mixture

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

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

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

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

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

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

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

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

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

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

Each radionuclide-specific BcDCGL is equivalent to the level of residual radioactivity (above background levels) that could, when considered independently, result in a TEDE of 25 mrem/year to an Average Member of the Critical Group (AMCG). To ensure that the summation of dose from each source term is 25 mrem/year or less after all FSS is completed, the BcDCGLs are reduced based on an expected, or *a priori*, fraction of the 25 mrem/year dose limit from each source term. The reduced DCGLs, or "Operational" DCGLs, can be related to the BcDCGLs as an expected fraction of dose based on an *a priori* assessment of what the expected

dose should be based on the results of site characterization, process knowledge and the extent of planned remediation. The OpDCGL is then used as the DCGL for the FSS design of the survey unit (calculation of surrogate DCGLs, investigations levels, etc.). Details of the OpDCGLs derived for each dose component and the basis for the applied *a priori* dose fractions are provided in Zion*Solutions* TSD 17-004, *"Operational Derived Concentration Guideline Levels for Final Status Survey"* (Reference 10).

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

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

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

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

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

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

Instrument DQOs included a verification of the ability of the survey instrument to detect the radiation(s) of interest at the required scan Minimum Detectable Concentration (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 12202B. During FSS, concentrations for Hard-to-Detect (HTD) ROC Ni-63 and Sr-90 are 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 12202B, the surrogate OpDCGLs for Co-60 and Cs-137 were computed based on the maximum ratios from Table 6.

The equation for calculating a surrogate DCGL is as follows:

Equation 1

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

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

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

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

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

Equation 2

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

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

Equation 3

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

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

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

Equation 4

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

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

Equation 5

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

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

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

Table 7 - Investigation Levels

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

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

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

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

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

The number of soil samples for FSS was determined in accordance with ZS-LT-300-001-001. The relative shift (Δ/σ) for the survey unit data set is defined as shift (Δ), which is the Upper Bound of the Gray Region (UBGR), or the DCGL (SOF of 1), minus the Lower Bound of the Gray Region (LBGR) (SOF of 0.5), divided by sigma (σ), which is the standard deviation of the data set used for survey design. The optimal value for Δ/σ should range between 1 and 3. The largest value the Δ/σ can have is 3. If the Δ/σ exceeds 3, then the value of 3 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 seventeen (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 (17). The Prospective Power Curve generated by VSP showed adequate power for the survey design.

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

- To calculate the area bounded by the systematic samples: $A = \frac{A_{SU}}{N} = \frac{1999}{17} = 117.6\ m^2$
- From the LTP, Table 5-16, the Area Factors for the next larger area, (300 m^2) area were used:
  - Cs-137 - 1.46
  - Cs-134 - 1.30
  - Co-60 - 1.16
- The $DCGL_{EMC}$ is the Surrogate Base Case DCGL times the Area Factor:
  - The $DCGL_{EMC}$ for Cs-137 = $1.46 * 14.15 = 20.66\ pCi/g$
  - The $DCGL_{EMC}$ for Cs-134 = $1.30 * 6.77 = 8.80\ pCi/g$
  - The $DCGL_{EMC}$ for Co-60 = $1.16 * 3.51 = 4.07\ pCi/g$

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

The implementation of quality control (QC) measures as referenced by LTP, Section 5.9 and Zion*Solutions* procedure ZS-LT-01, "*Quality Assurance Project Plan (for Characterization and FSS)*" (QAPP) (Reference 12) includes the collection of a soil sample for "split sample" analysis on 5% of the soil samples taken in a survey unit with the locations selected at random. One (1) surface soil sample (L1-12202B-FQGS-007-SS) was selected randomly for split sample analysis for the FSS of this survey unit.

In accordance with Section 5.7.1.6.2 of the LTP, a subsurface soil sample was taken at 10% of the systematic surface soil sample locations in the survey unit with the location(s) selected

at random. Locations L1-12202B-FSGS-014-SB and L1-12202B-FSGS-015-SB were selected for this survey unit.

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

Table 8 - Systematic Sample Measurement Locations

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L1-12202B-FSGS-001-SS	641741.28	343556.55
L1-12202B-FSGS-002-SS	641741.28	343568.21
L1-12202B-FSGS-003-SS	641741.28	343579.86
L1-12202B-FSGS-004-SS	641751.37	343562.38
L1-12202B-FSGS-005-SS	641751.37	343574.03
L1-12202B-FSGS-006-SS	641761.46	343556.55
L1-12202B-FSGS-007-SS	641761.46	343568.21
L1-12202B-FSGS-008-SS	641761.46	343579.86
L1-12202B-FSGS-009-SS	641771.55	343562.38
L1-12202B-FSGS-010-SS	641771.55	343574.03
L1-12202B-FSGS-011-SS	641771.55	343585.69
L1-12202B-FSGS-012-SS	641781.64	343568.21
L1-12202B-FSGS-013-SS	641781.64	343579.86
L1-12202B-FSGS-014-SS	641791.74	343562.38
L1-12202B-FSGS-015-SS	641791.74	343574.03
L1-12202B-FSGS-016-SS	641791.74	343585.69
L1-12202B-FSGS-017-SS	641801.83	343568.21
L1-12202B-FSGS-014-SB	641791.74	343562.38
L1-12202B-FSGS-015-SB	641791.74	343574.03

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

Two (2) soil samples, L1-12202B-FSGS-002-SS and L1-12202B-FSGS-007-SS, were selected to meet the requirement that 10% of the samples collected for the FSS of survey unit 12202B 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.

In addition, LTP, Section 5.1 states that if levels of residual gamma radioactivity in an individual soil sample exceed an OpSOF of 0.1, then the sample(s) will be analyzed for HTD ROC. No samples exceeded on OpSOF of 0.1 during the FSS of survey unit 12202B.

Table 9 provides a synopsis of the survey design for survey unit 12202B.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	1,999 m^2	GPS measurements of area
Number of Surface Soil Samples	17 (Systematic)	• σ = 0.30 • UBGR = SOF of 1 • LBGR = SOF of 0.5 • Type I error = 0.05 • Type II error = 0.05 • Δ/σ = 1.67 (MARSSIM Table 5.5)
Grid Spacing	11.7 m	(LTP, Section 5.6.4.5.2)
DCGLs	• Co-60 – 1.091 pCi/g • Cs-134 – 1.733 pCi/g • Cs-137 – 3.630 pCi/g • Ni-63 – 914.458 pCi/g • Sr-90 – 3.095 pCi/g	Operational DCGLs for Surface Soils, (LTP, Table 5-7)
HTD ROC Analysis	A minimum of two (2) soil samples selected for HTD ROC analysis	(LTP, Section 5.1)
Measurement Investigation Level	Operational DCGL	(LTP, Table 5-25)
Scan Survey Area Coverage	100%	(LTP, Table 5-24)
QC	One (1) surface soil sample selected randomly for split sample analysis	(LTP, Section 5.9)
Number of Subsurface Soil Samples	Two (2) systematic surface soil sample locations selected, at locations 14 and 15	(LTP, Section 5.7.1.6.2)

6. SURVEY IMPLEMENTATION

Survey instructions for this FSS were incorporated into and performed in accordance with FSS sample plan L1-12202B-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 12202B, 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 12202B.

FSS field activities were conducted under FSS sample plan L1-12202B-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 October 8, 2019, and concluding on October 9, 2019.

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

Gamma scans were performed on 100% of the surface area of the survey unit using a Ludlum 2350-1 paired with a Model 44-10 (2-inch x 2-inch) NaI detector operated in the rate-meter mode and using audio response. The probe was positioned within 2-inches to 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 a check source to ranges established for normal background and detector source response to ensure that the detector was working properly.

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

Table 10 - Instruments and Detectors

Instrument/Detector Type	Serial #	Calibration Due Date
Ludlum 2350-1/Ludlum 44-10	95361/PR372150	12/5/2019
Ludlum 2350-1/Ludlum 44-10	304726/PR363452	8/28/2020
Ludlum 2350-1/Ludlum 44-10	304730/PR375273	1/16/2020
Ludlum 2350-1/Ludlum 44-10	304711/PR321902	1/18/2020
Ludlum 2350-1/Ludlum 44-10	304718/PR363311	9/19/2020

In accordance with the survey design, seventeen (17) surface soil samples were collected at the designated systematic sample points. In addition, two (2) subsurface samples were collected at the randomly selected sample locations.

Two (2) samples (L1-12202B-FSGS-002-SS, and L1-12202B-FSGS-007-SS) were selected for HTD radionuclide analysis.

7. SURVEY RESULTS

One hundred percent (100%) of the surface of the survey unit was scanned for elevated radiation levels. Sixty-eight (68) 1-meter wide scan rows, as shown on the map in Attachment 1, were marked in the field and scanned with the 2350-1/44-10 using latching mode. Readings were recorded at approximately 10-meter intervals during the scans. No elevated measurement locations were identified by surface scan. Table 11 provides an overview of the scan results. Complete scan results are provided in Attachment 2.

Table 11 - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[(1)] (cpm)	# of Scan Alarms	Investigation Samples
Row 1	2719	2965	None	None
Row 2	2659	2965	None	None
Row 3	2723	2965	None	None
Row 4	2761	2965	None	None
Row 5	2740	2965	None	None
Row 6	2702	2965	None	None
Row 7	2811	2965	None	None
Row 8	2676	2965	None	None
Row 9	2774	2965	None	None
Row 10	2555	2965	None	None
Row 11	2648	2965	None	None
Row 12	2676	2965	None	None
Row 13	2533	2965	None	None
Row 14	2649	2965	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 15	2820	2997	None	None
Row 16	2546	2997	None	None
Row 17	2809	2997	None	None
Row 18	2563	2997	None	None
Row 19	2592	2997	None	None
Row 20	2576	2997	None	None
Row 21	2620	2997	None	None
Row 22	2696	2997	None	None
Row 23	2828	2997	None	None
Row 24	2646	2997	None	None
Row 25	2691	2997	None	None
Row 26	2753	2997	None	None
Row 27	2699	2997	None	None
Row 28	2649	2997	None	None
Row 29	2356	2809	None	None
Row 30	2460	2809	None	None
Row 31	2445	2809	None	None
Row 32	2541	2809	None	None
Row 33	2416	2809	None	None
Row 34	2480	2809	None	None
Row 35	2402	2809	None	None
Row 36	2411	2809	None	None
Row 37	2421	2809	None	None
Row 38	2553	2809	None	None
Row 39	2441	2809	None	None
Row 40	2369	2809	None	None
Row 41	2372	2809	None	None
Row 42	2540	2809	None	None
Row 43	2299	2843	None	None
Row 44	2269	2843	None	None
Row 45	2285	2843	None	None
Row 46	2353	2843	None	None
Row 47	2318	2843	None	None
Row 48	2277	2843	None	None
Row 49	2388	2843	None	None
Row 50	2338	2843	None	None
Row 51	2300	2843	None	None
Row 52	2301	2843	None	None
Row 53	2362	2843	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 54	2304	2843	None	None
Row 55	2375	2843	None	None
Row 56	2400	2843	None	None
Row 57	2781	2955	None	None
Row 58	2640	2955	None	None
Row 59	2479	2955	None	None
Row 60	2746	2955	None	None
Row 61	2623	2955	None	None
Row 62	2538	2955	None	None
Row 63	2635	2955	None	None
Row 64	2545	2955	None	None
Row 65	2675	2955	None	None
Row 66	2631	2955	None	None
Row 67	2664	2955	None	None
Row 68	2576	2955	None	None

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

The seventeen (17) soil samples taken for non-parametric statistical testing 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 19. The gamma spectroscopy results revealed no samples with activity levels above the MDC for Co-60, Cs-137 or Cs-134. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6. The mean of the gamma spectroscopic analysis results for the sample population indicated that Cs-137 was present at levels lower than the concentrations of Cs-137 expected to be found in off-site soil in the vicinity of the ZNPS as presented in Zion*Solutions* TSD 13-004, "*Examination of Cs-137 Global Fallout In Soils At Zion Station*" (Reference 15). The complete gamma spectroscopy reports are presented in Attachment 7.

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

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L1-12202B-FSGS-001-SS	2.39E-02	0.00E+00	0.00E+00	4.31E+00	0.00E+00
L1-12202B-FSGS-002-SS	1.37E-02	2.72E-02	1.01E-02	2.47E+00	6.02E-04
L1-12202B-FSGS-003-SS	3.44E-03	0.00E+00	0.00E+00	6.21E-01	0.00E+00
L1-12202B-FSGS-004-SS	1.70E-02	1.58E-02	0.00E+00	3.07E+00	0.00E+00
L1-12202B-FSGS-005-SS	0.00E+00	1.38E-02	0.00E+00	0.00E+00	0.00E+00
L1-12202B-FSGS-006-SS	4.17E-02	0.00E+00	0.00E+00	7.52E+00	0.00E+00
L1-12202B-FSGS-007-SS	4.86E-02	3.08E-02	0.00E+00	8.77E+00	0.00E+00
L1-12202B-FSGS-008-SS	2.61E-02	2.75E-02	2.67E-02	4.71E+00	5.34E-05
L1-12202B-FSGS-009-SS	0.00E+00	6.65E-03	0.00E+00	0.00E+00	0.00E+00
L1-12202B-FSGS-010-SS	4.13E-02	0.00E+00	2.16E-02	7.45E+00	4.32E-05
L1-12202B-FSGS-011-SS	7.65E-03	2.07E-02	0.00E+00	1.38E+00	0.00E+00
L1-12202B-FSGS-012-SS	2.74E-02	1.67E-02	0.00E+00	4.94E+00	0.00E+00
L1-12202B-FSGS-013-SS	3.55E-02	0.00E+00	3.85E-03	6.41E+00	7.70E-06
L1-12202B-FSGS-014-SS	2.00E-02	0.00E+00	4.24E-02	3.61E+00	8.48E-05
L1-12202B-FSGS-015-SS	1.49E-02	9.38E-03	4.52E-03	2.69E+00	9.04E-06
L1-12202B-FSGS-016-SS	2.49E-02	1.34E-02	1.17E-02	4.49E+00	2.34E-05
L1-12202B-FSGS-017-SS	0.00E+00	1.97E-02	6.62E-03	0.00E+00	1.32E-05

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

Table 13 - Summary of Gamma Spectroscopy Results for 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)
L1-12202B-FSGS-014-SB	0.00E+00	2.35E-02	0.00E+00	0.00E+00	0.00E+00
L1-12202B-FSGS-015-SB	2.73E-02	3.66E-02	1.85E-02	4.93E+00	3.70E-05

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

The off-site laboratory, Eberline Analytical, processed the two (2) samples selected for HTD ROC analysis. Samples L1-12202B-FSGS-002-SS-A and L1-12202B-FSGS-007-SS-A were selected. Only HTD radionuclides included as ROC (Ni-63 and Sr-90 for soils) were included in the analysis. All analyses met the required MDC. No activity was positively detected in either of 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 # L1-12202B-FSGS-002-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	-1.94E-02	6.66E-02	8.39E-02	No
Cs-134	1.62E-03	2.19E-02	6.56E-02	No
Cs-137	-5.13E-04	4.25E-02	6.65E-02	No
Ni-63	1.23E+00	1.82E+00	3.08E+00	No
Sr-90	2.73E-01	3.14E-01	6.42E-01	No

Sample # L1-12202B -FSGS-007-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	3.20E-04	5.03E-02	5.90E-02	No
Cs-134	-1.45E-02	2.48E-02	7.69E-02	No
Cs-137	-2.04E-02	5.38E-02	7.14E-02	No
Ni-63	-4.64E-01	1.87E+00	3.25E+00	No
Sr-90	-1.09E-01	3.52E-01	7.64E-01	No

The implementation of survey specific QC measures included the collection of one (1) systematic sample (L1-12202B-FQGS-007-SS) for "split sample" analysis. The on-site laboratory analyzed the designated QC sample 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 concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6.

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

MEASUREMENT ID	Co-60(1) (pCi/g)	Cs-134(1) (pCi/g)	Cs-137(1) (pCi/g)	Ni-63(2) (pCi/g)	Sr-90(2) (pCi/g)
L1-12202B-FQGS-007-SS	2.61E-02	1.15E-02	3.53E-02	4.71E+00	7.06E-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

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

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 12202B are provided in Table 16. The results of the unity rule calculations for the ROC for the subsurface samples are presented in Table 17 and the results for the QC samples are presented in Table 18.

Table 16 - Sum of Fractions for Individual Systematic Surface Soil Samples, when compared to the OpDCGLs

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12202B-FSGS-001-SS	2.19E-02	0.00E+00	0.00E+00	4.72E-03	0.00E+00	0.027
L1-12202B-FSGS-002-SS	1.26E-02	1.57E-02	2.78E-03	2.70E-03	6.53E-06	0.034
L1-12202B-FSGS-003-SS	3.15E-03	0.00E+00	0.00E+00	6.79E-04	0.00E+00	0.004
L1-12202B-FSGS-004-SS	1.56E-02	9.12E-03	0.00E+00	3.35E-03	0.00E+00	0.028
L1-12202B-FSGS-005-SS	0.00E+00	7.96E-03	0.00E+00	0.00E+00	0.00E+00	0.008
L1-12202B-FSGS-006-SS	3.82E-02	0.00E+00	0.00E+00	8.23E-03	0.00E+00	0.046
L1-12202B-FSGS-007-SS	4.45E-02	1.78E-02	0.00E+00	9.59E-03	0.00E+00	0.072
L1-12202B-FSGS-008-SS	2.39E-02	1.59E-02	7.36E-03	5.15E-03	1.73E-05	0.052
L1-12202B-FSGS-009-SS	0.00E+00	3.84E-03	0.00E+00	0.00E+00	0.00E+00	0.004
L1-12202B-FSGS-010-SS	3.79E-02	0.00E+00	5.95E-03	8.15E-03	1.40E-05	0.052
L1-12202B-FSGS-011-SS	7.01E-03	1.19E-02	0.00E+00	1.51E-03	0.00E+00	0.020
L1-12202B-FSGS-012-SS	2.51E-02	9.64E-03	0.00E+00	5.41E-03	0.00E+00	0.040
L1-12202B-FSGS-013-SS	3.25E-02	0.00E+00	1.06E-03	7.01E-03	2.49E-06	0.041
L1-12202B-FSGS-014-SS	1.83E-02	0.00E+00	1.17E-02	3.95E-03	2.74E-05	0.034
L1-12202B-FSGS-015-SS	1.37E-02	5.41E-03	1.25E-03	2.94E-03	2.92E-06	0.023
L1-12202B-FSGS-016-SS	2.28E-02	7.73E-03	3.22E-03	4.91E-03	7.56E-06	0.039
L1-12202B-FSGS-017-SS	0.00E+00	1.14E-02	1.82E-03	0.00E+00	4.28E-06	0.013

Systematic Measurements

Number of Systematic Measurements =	17
# of Systematic Measurements with OpSOF $\geq$ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	0
Max Individual Systematic Measurement OpSOF =	0.072
Mean Systematic Measurement OpSOF =	0.032

Table 17 - Sum of Fractions for Individual Subsurface Soil Samples, when compared to the OpDCGLs

MEASUREMENT ID	Fraction of the OpDCGLs for Subsurface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12202B-FSGS-014-SB	0.00E+00	2.07E-02	0.00E+00	0.00E+00	0.00E+00	0.021
L1-12202B-FSGS-015-SB	3.10E-02	3.22E-02	9.32E-03	2.52E-02	8.71E-05	0.098

Table 18 - Sum of Fractions for Individual QC Soil Samples, when compared to the OpDCGLs

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12202B-FQGS-007-SS	2.39E-02	6.64E-03	9.72E-03	5.15E-03	2.28E-05	0.045

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	2.04E-02	2.00E-02	4.86E-02	0.00E+00	0.015	4.26	4.78E-03	1.19E-01
Cs-134	1.19E-02	1.34E-02	3.08E-02	0.00E+00	0.011	6.77	1.75E-03	4.38E-02
Cs-137	7.50E-03	0.00E+00	4.24E-02	0.00E+00	0.012	14.18	5.29E-04	1.32E-02
Ni-63	3.67E+00	3.61E+00	8.77E+00	0.00E+00	2.786	3572.1	1.03E-03	2.57E-02
Sr-90	1.50E-05	0.00E+00	8.48E-05	0.00E+00	0.000	12.09	1.24E-06	3.10E-05

The mean BcSOF for survey unit 12202B is 0.008, which equates to a dose of 0.202 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 one (1) split sample, L1-12202B-FQGS-007-SS, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in ZS-LT-01. The standard sample and the QC sample did not both have positive results for gamma-emitting ROC; therefore, K-40 was used for the QC comparison. There was acceptable agreement between field split results. Refer to Attachment 5 for data and QC analysis results.

9. INVESTIGATIONS AND RESULTS

No investigations were performed in survey unit 12202B.

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 12202B has met the DQOs of the FSS plan. The ALARA criteria for soils as specified in Chapter 4 of the LTP were achieved. The EMC for soils was not needed for this survey unit.

All identified ROC were used for statistical testing to determine the adequacy of the survey unit for FSS. Evaluation of the data shows that none of the ROC concentration values exceed the

OpDCGL or any investigational levels; therefore, in accordance with the LTP Section 5.10, the survey unit meets the release criterion.

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

The mean BcSOF, when the analytical results were compared to the BcDCGLs, was 0.008, which results in a dose contribution from soil in survey unit 12202B of 0.202 mrem/year TEDE, based on the average concentration of the ROC in samples used for non-parametric statistical sampling.

The conclusion of this Release Record is that survey unit 12202B is acceptable for unrestricted release.

15. REFERENCES

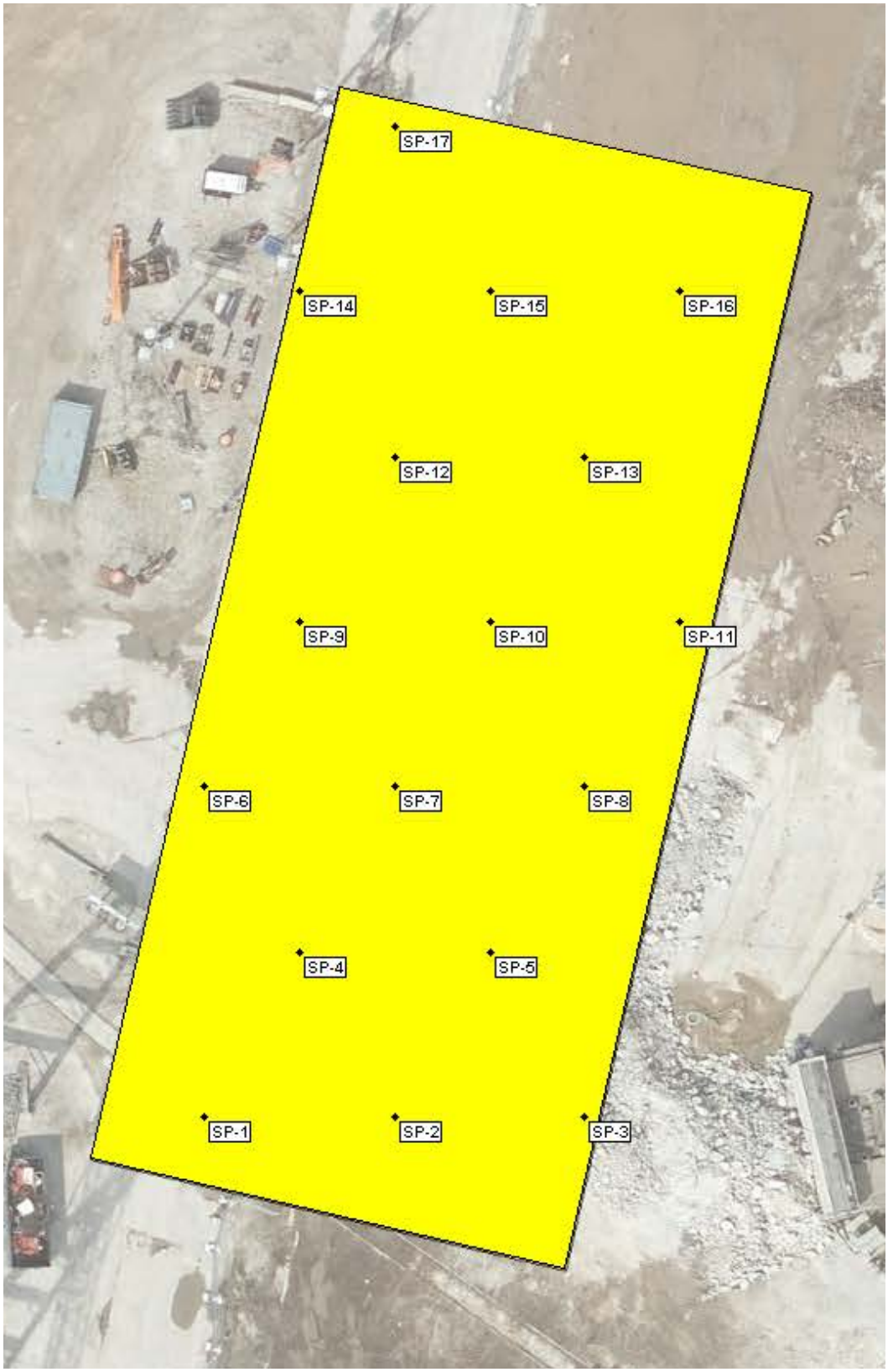
1. Zion*Solutions* procedure ZS-LT-300-001-005, "Final Status Survey Data Reporting"
2. Zion Station Restoration Project License Termination Plan
3. Zion*Solutions* procedure ZS-LT-300-001-001, "Final Status Survey Package Development"
4. NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation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

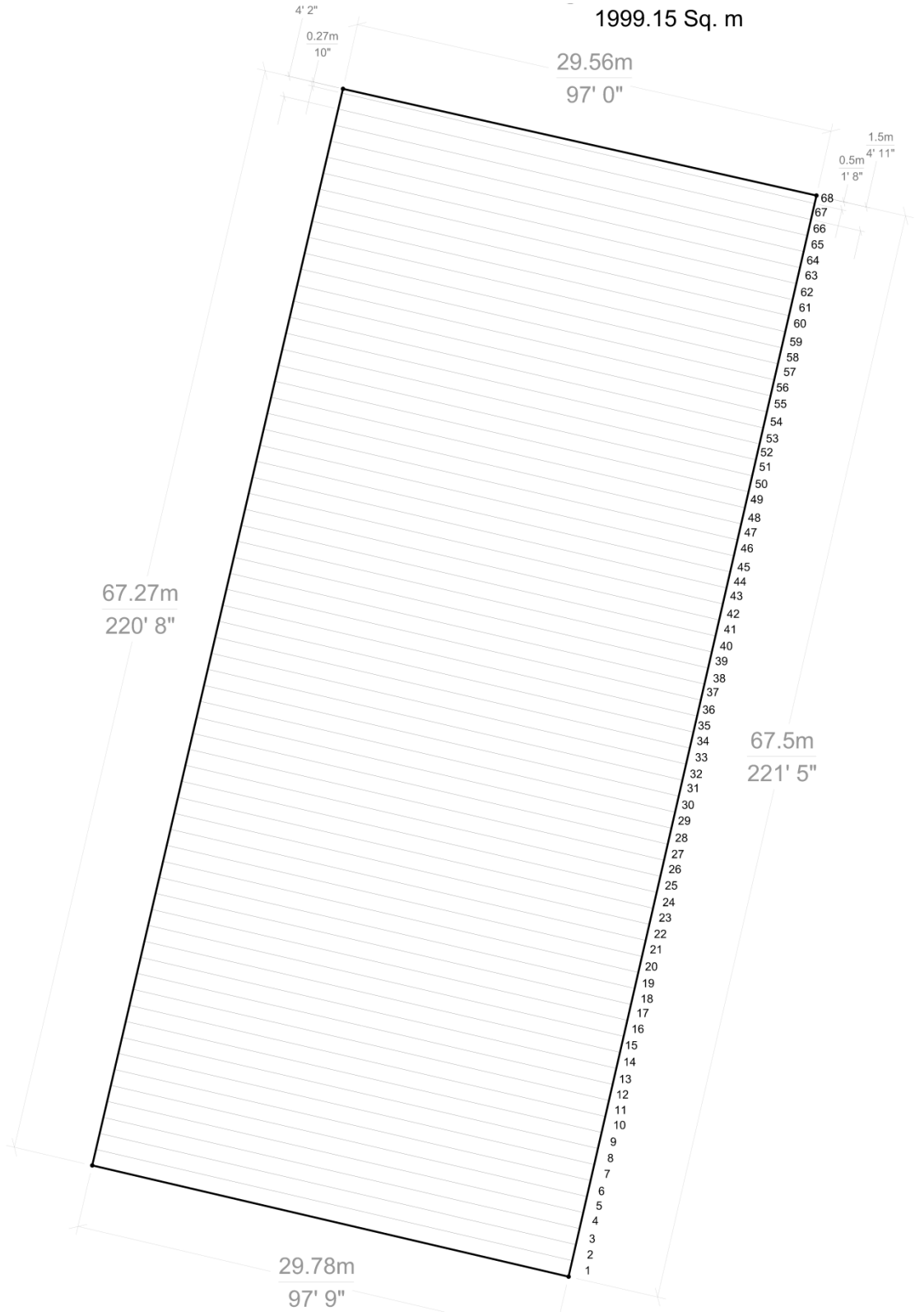
1. Attachment 1 - Figure and Map
2. Attachment 2 - Scan Data
3. Attachment 3 - Consultation Triggers for Residential and Commercial/Industrial Soil Contamination
4. Attachment 4 - Sign Test
5. Attachment 5 - QC Sample Assessment
6. Attachment 6 - Graphical Presentations
7. Attachment 7 - Sample Analytical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

ATTACHMENT 1
FIGURE AND MAP

Survey Unit 12202B Final Status Survey Boundaries and Systematic Sample Points



Survey Unit 12202B 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	PR372150	95361	12202B	GS001	10/9/2019 7:37	2719	2248	2965	No
44-10	PR372150	95361	12202B	GS001	10/9/2019 7:39	2519	2248	2965	No
44-10	PR372150	95361	12202B	GS001	10/9/2019 7:42	2622	2248	2965	No
44-10	PR372150	95361	12202B	GS002	10/9/2019 7:44	2605	2248	2965	No
44-10	PR372150	95361	12202B	GS002	10/9/2019 7:47	2614	2248	2965	No
44-10	PR372150	95361	12202B	GS002	10/9/2019 7:49	2659	2248	2965	No
44-10	PR372150	95361	12202B	GS003	10/9/2019 7:51	2664	2248	2965	No
44-10	PR372150	95361	12202B	GS003	10/9/2019 7:54	2723	2248	2965	No
44-10	PR372150	95361	12202B	GS003	10/9/2019 7:56	2523	2248	2965	No
44-10	PR372150	95361	12202B	GS004	10/9/2019 7:59	2676	2248	2965	No
44-10	PR372150	95361	12202B	GS004	10/9/2019 8:01	2761	2248	2965	No
44-10	PR372150	95361	12202B	GS004	10/9/2019 8:03	2666	2248	2965	No
44-10	PR372150	95361	12202B	GS005	10/9/2019 8:06	2736	2248	2965	No
44-10	PR372150	95361	12202B	GS005	10/9/2019 8:08	2740	2248	2965	No
44-10	PR372150	95361	12202B	GS005	10/9/2019 8:11	2668	2248	2965	No
44-10	PR372150	95361	12202B	GS006	10/9/2019 8:13	2548	2248	2965	No
44-10	PR372150	95361	12202B	GS006	10/9/2019 8:16	2702	2248	2965	No
44-10	PR372150	95361	12202B	GS006	10/9/2019 8:18	2631	2248	2965	No
44-10	PR372150	95361	12202B	GS007	10/9/2019 8:23	2472	2248	2965	No
44-10	PR372150	95361	12202B	GS007	10/9/2019 8:25	2811	2248	2965	No
44-10	PR372150	95361	12202B	GS007	10/9/2019 8:27	2508	2248	2965	No
44-10	PR372150	95361	12202B	GS008	10/9/2019 8:30	2524	2248	2965	No
44-10	PR372150	95361	12202B	GS008	10/9/2019 8:32	2627	2248	2965	No
44-10	PR372150	95361	12202B	GS008	10/9/2019 8:35	2676	2248	2965	No
44-10	PR372150	95361	12202B	GS009	10/9/2019 8:50	2774	2248	2965	No
44-10	PR372150	95361	12202B	GS009	10/9/2019 8:52	2390	2248	2965	No
44-10	PR372150	95361	12202B	GS009	10/9/2019 8:54	2610	2248	2965	No
44-10	PR372150	95361	12202B	GS010	10/9/2019 8:57	2408	2248	2965	No
44-10	PR372150	95361	12202B	GS010	10/9/2019 8:59	2512	2248	2965	No
44-10	PR372150	95361	12202B	GS010	10/9/2019 9:02	2555	2248	2965	No
44-10	PR372150	95361	12202B	GS011	10/9/2019 9:04	2648	2248	2965	No
44-10	PR372150	95361	12202B	GS011	10/9/2019 9:07	2603	2248	2965	No
44-10	PR372150	95361	12202B	GS011	10/9/2019 9:09	2535	2248	2965	No
44-10	PR372150	95361	12202B	GS012	10/9/2019 9:11	2511	2248	2965	No
44-10	PR372150	95361	12202B	GS012	10/9/2019 9:14	2676	2248	2965	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	PR372150	95361	12202B	GS012	10/9/2019 9:16	2605	2248	2965	No
44-10	PR372150	95361	12202B	GS013	10/9/2019 9:19	2533	2248	2965	No
44-10	PR372150	95361	12202B	GS013	10/9/2019 9:21	2462	2248	2965	No
44-10	PR372150	95361	12202B	GS013	10/9/2019 9:23	2492	2248	2965	No
44-10	PR372150	95361	12202B	GS014	10/9/2019 9:26	2520	2248	2965	No
44-10	PR372150	95361	12202B	GS014	10/9/2019 9:28	2649	2248	2965	No
44-10	PR372150	95361	12202B	GS014	10/9/2019 9:31	2587	2248	2965	No
44-10	PR363452	304726	12202B	GS015	10/9/2019 8:13	2572	2276	2997	No
44-10	PR363452	304726	12202B	GS015	10/9/2019 8:15	2820	2276	2997	No
44-10	PR363452	304726	12202B	GS015	10/9/2019 8:18	2765	2276	2997	No
44-10	PR363452	304726	12202B	GS016	10/9/2019 8:20	2546	2276	2997	No
44-10	PR363452	304726	12202B	GS016	10/9/2019 8:23	2535	2276	2997	No
44-10	PR363452	304726	12202B	GS016	10/9/2019 8:26	2494	2276	2997	No
44-10	PR363452	304726	12202B	GS017	10/9/2019 8:29	2630	2276	2997	No
44-10	PR363452	304726	12202B	GS017	10/9/2019 8:31	2809	2276	2997	No
44-10	PR363452	304726	12202B	GS017	10/9/2019 8:33	2575	2276	2997	No
44-10	PR363452	304726	12202B	GS018	10/9/2019 8:36	2556	2276	2997	No
44-10	PR363452	304726	12202B	GS018	10/9/2019 8:38	2533	2276	2997	No
44-10	PR363452	304726	12202B	GS018	10/9/2019 8:41	2563	2276	2997	No
44-10	PR363452	304726	12202B	GS019	10/9/2019 8:43	2592	2276	2997	No
44-10	PR363452	304726	12202B	GS019	10/9/2019 8:45	2584	2276	2997	No
44-10	PR363452	304726	12202B	GS019	10/9/2019 8:48	2570	2276	2997	No
44-10	PR363452	304726	12202B	GS020	10/9/2019 8:51	2557	2276	2997	No
44-10	PR363452	304726	12202B	GS020	10/9/2019 8:55	2576	2276	2997	No
44-10	PR363452	304726	12202B	GS020	10/9/2019 8:57	2560	2276	2997	No
44-10	PR363452	304726	12202B	GS021	10/9/2019 9:00	2620	2276	2997	No
44-10	PR363452	304726	12202B	GS021	10/9/2019 9:02	2489	2276	2997	No
44-10	PR363452	304726	12202B	GS021	10/9/2019 9:05	2598	2276	2997	No
44-10	PR363452	304726	12202B	GS022	10/9/2019 9:07	2696	2276	2997	No
44-10	PR363452	304726	12202B	GS022	10/9/2019 9:10	2646	2276	2997	No
44-10	PR363452	304726	12202B	GS022	10/9/2019 9:12	2520	2276	2997	No
44-10	PR363452	304726	12202B	GS023	10/9/2019 9:15	2509	2276	2997	No
44-10	PR363452	304726	12202B	GS023	10/9/2019 9:17	2440	2276	2997	No
44-10	PR363452	304726	12202B	GS023	10/9/2019 9:20	2828	2276	2997	No
44-10	PR363452	304726	12202B	GS024	10/9/2019 9:24	2646	2276	2997	No
44-10	PR363452	304726	12202B	GS024	10/9/2019 9:26	2531	2276	2997	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR363452	304726	12202B	GS024	10/9/2019 9:29	2580	2276	2997	No
44-10	PR363452	304726	12202B	GS025	10/9/2019 9:32	2614	2276	2997	No
44-10	PR363452	304726	12202B	GS025	10/9/2019 9:36	2578	2276	2997	No
44-10	PR363452	304726	12202B	GS025	10/9/2019 9:38	2691	2276	2997	No
44-10	PR363452	304726	12202B	GS026	10/9/2019 9:41	2597	2276	2997	No
44-10	PR363452	304726	12202B	GS026	10/9/2019 9:43	2753	2276	2997	No
44-10	PR363452	304726	12202B	GS026	10/9/2019 9:45	2493	2276	2997	No
44-10	PR363452	304726	12202B	GS027	10/9/2019 9:48	2495	2276	2997	No
44-10	PR363452	304726	12202B	GS027	10/9/2019 9:50	2699	2276	2997	No
44-10	PR363452	304726	12202B	GS027	10/9/2019 9:53	2644	2276	2997	No
44-10	PR363452	304726	12202B	GS028	10/9/2019 9:56	2649	2276	2997	No
44-10	PR363452	304726	12202B	GS028	10/9/2019 9:58	2609	2276	2997	No
44-10	PR363452	304726	12202B	GS028	10/9/2019 10:00	2618	2276	2997	No
44-10	PR363311	304718	12202B	GS029	10/9/2019 8:41	2400	2114	2809	No
44-10	PR363311	304718	12202B	GS029	10/9/2019 8:43	2356	2114	2809	No
44-10	PR363311	304718	12202B	GS029	10/9/2019 8:45	2444	2114	2809	No
44-10	PR363311	304718	12202B	GS030	10/9/2019 8:47	2383	2114	2809	No
44-10	PR363311	304718	12202B	GS030	10/9/2019 8:49	2353	2114	2809	No
44-10	PR363311	304718	12202B	GS030	10/9/2019 8:51	2460	2114	2809	No
44-10	PR363311	304718	12202B	GS031	10/9/2019 8:53	2445	2114	2809	No
44-10	PR363311	304718	12202B	GS031	10/9/2019 8:55	2374	2114	2809	No
44-10	PR363311	304718	12202B	GS031	10/9/2019 8:57	2383	2114	2809	No
44-10	PR363311	304718	12202B	GS032	10/9/2019 8:59	2439	2114	2809	No
44-10	PR363311	304718	12202B	GS032	10/9/2019 9:01	2474	2114	2809	No
44-10	PR363311	304718	12202B	GS032	10/9/2019 9:03	2541	2114	2809	No
44-10	PR363311	304718	12202B	GS033	10/9/2019 9:05	2414	2114	2809	No
44-10	PR363311	304718	12202B	GS033	10/9/2019 9:07	2416	2114	2809	No
44-10	PR363311	304718	12202B	GS033	10/9/2019 9:09	2374	2114	2809	No
44-10	PR363311	304718	12202B	GS034	10/9/2019 9:11	2393	2114	2809	No
44-10	PR363311	304718	12202B	GS034	10/9/2019 9:13	2425	2114	2809	No
44-10	PR363311	304718	12202B	GS034	10/9/2019 9:15	2480	2114	2809	No
44-10	PR363311	304718	12202B	GS035	10/9/2019 9:21	2281	2114	2809	No
44-10	PR363311	304718	12202B	GS035	10/9/2019 9:23	2402	2114	2809	No
44-10	PR363311	304718	12202B	GS035	10/9/2019 9:25	2231	2114	2809	No
44-10	PR363311	304718	12202B	GS036	10/9/2019 9:27	2411	2114	2809	No
44-10	PR363311	304718	12202B	GS036	10/9/2019 9:29	2364	2114	2809	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	12202B	GS036	10/9/2019 9:31	2356	2114	2809	No
44-10	PR363311	304718	12202B	GS037	10/9/2019 9:33	2381	2114	2809	No
44-10	PR363311	304718	12202B	GS037	10/9/2019 9:35	2363	2114	2809	No
44-10	PR363311	304718	12202B	GS037	10/9/2019 9:37	2421	2114	2809	No
44-10	PR363311	304718	12202B	GS038	10/9/2019 9:39	2324	2114	2809	No
44-10	PR363311	304718	12202B	GS038	10/9/2019 9:41	2365	2114	2809	No
44-10	PR363311	304718	12202B	GS038	10/9/2019 9:43	2553	2114	2809	No
44-10	PR363311	304718	12202B	GS039	10/9/2019 9:45	2407	2114	2809	No
44-10	PR363311	304718	12202B	GS039	10/9/2019 9:47	2322	2114	2809	No
44-10	PR363311	304718	12202B	GS039	10/9/2019 9:49	2441	2114	2809	No
44-10	PR363311	304718	12202B	GS040	10/9/2019 9:51	2369	2114	2809	No
44-10	PR363311	304718	12202B	GS040	10/9/2019 9:53	2359	2114	2809	No
44-10	PR363311	304718	12202B	GS040	10/9/2019 9:55	2280	2114	2809	No
44-10	PR363311	304718	12202B	GS041	10/9/2019 9:57	2372	2114	2809	No
44-10	PR363311	304718	12202B	GS041	10/9/2019 9:59	2300	2114	2809	No
44-10	PR363311	304718	12202B	GS041	10/9/2019 10:01	2352	2114	2809	No
44-10	PR363311	304718	12202B	GS042	10/9/2019 10:03	2442	2114	2809	No
44-10	PR363311	304718	12202B	GS042	10/9/2019 10:05	2378	2114	2809	No
44-10	PR363311	304718	12202B	GS042	10/9/2019 10:07	2540	2114	2809	No
44-10	PR321902	304711	12202B	GS043	10/9/2019 8:28	2269	2143	2843	No
44-10	PR321902	304711	12202B	GS043	10/9/2019 8:30	2255	2143	2843	No
44-10	PR321902	304711	12202B	GS043	10/9/2019 8:34	2299	2143	2843	No
44-10	PR321902	304711	12202B	GS044	10/9/2019 8:37	2220	2143	2843	No
44-10	PR321902	304711	12202B	GS044	10/9/2019 8:39	2258	2143	2843	No
44-10	PR321902	304711	12202B	GS044	10/9/2019 8:41	2269	2143	2843	No
44-10	PR321902	304711	12202B	GS045	10/9/2019 8:44	2284	2143	2843	No
44-10	PR321902	304711	12202B	GS045	10/9/2019 8:46	2285	2143	2843	No
44-10	PR321902	304711	12202B	GS045	10/9/2019 8:48	2254	2143	2843	No
44-10	PR321902	304711	12202B	GS046	10/9/2019 8:50	2252	2143	2843	No
44-10	PR321902	304711	12202B	GS046	10/9/2019 8:52	2278	2143	2843	No
44-10	PR321902	304711	12202B	GS046	10/9/2019 8:55	2353	2143	2843	No
44-10	PR321902	304711	12202B	GS047	10/9/2019 8:57	2288	2143	2843	No
44-10	PR321902	304711	12202B	GS047	10/9/2019 9:00	2318	2143	2843	No
44-10	PR321902	304711	12202B	GS047	10/9/2019 9:02	2288	2143	2843	No
44-10	PR321902	304711	12202B	GS048	10/9/2019 9:04	2178	2143	2843	No
44-10	PR321902	304711	12202B	GS048	10/9/2019 9:06	2277	2143	2843	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR321902	304711	12202B	GS048	10/9/2019 9:08	2181	2143	2843	No
44-10	PR321902	304711	12202B	GS049	10/9/2019 9:11	2300	2143	2843	No
44-10	PR321902	304711	12202B	GS049	10/9/2019 9:13	2236	2143	2843	No
44-10	PR321902	304711	12202B	GS049	10/9/2019 9:15	2388	2143	2843	No
44-10	PR321902	304711	12202B	GS050	10/9/2019 9:18	2281	2143	2843	No
44-10	PR321902	304711	12202B	GS050	10/9/2019 9:20	2334	2143	2843	No
44-10	PR321902	304711	12202B	GS050	10/9/2019 9:22	2338	2143	2843	No
44-10	PR321902	304711	12202B	GS051	10/9/2019 9:25	2285	2143	2843	No
44-10	PR321902	304711	12202B	GS051	10/9/2019 9:27	2300	2143	2843	No
44-10	PR321902	304711	12202B	GS051	10/9/2019 9:29	2284	2143	2843	No
44-10	PR321902	304711	12202B	GS052	10/9/2019 9:32	2280	2143	2843	No
44-10	PR321902	304711	12202B	GS052	10/9/2019 9:35	2301	2143	2843	No
44-10	PR321902	304711	12202B	GS052	10/9/2019 9:37	2263	2143	2843	No
44-10	PR321902	304711	12202B	GS053	10/9/2019 9:40	2287	2143	2843	No
44-10	PR321902	304711	12202B	GS053	10/9/2019 9:42	2277	2143	2843	No
44-10	PR321902	304711	12202B	GS053	10/9/2019 9:44	2362	2143	2843	No
44-10	PR321902	304711	12202B	GS054	10/9/2019 9:47	2265	2143	2843	No
44-10	PR321902	304711	12202B	GS054	10/9/2019 9:49	2296	2143	2843	No
44-10	PR321902	304711	12202B	GS054	10/9/2019 9:51	2304	2143	2843	No
44-10	PR321902	304711	12202B	GS055	10/9/2019 9:54	2269	2143	2843	No
44-10	PR321902	304711	12202B	GS055	10/9/2019 9:56	2375	2143	2843	No
44-10	PR321902	304711	12202B	GS055	10/9/2019 9:58	2342	2143	2843	No
44-10	PR375273	304730	12202B	GS056	10/9/2019 10:01	2288	2143	2843	No
44-10	PR375273	304730	12202B	GS056	10/9/2019 10:03	2300	2143	2843	No
44-10	PR375273	304730	12202B	GS056	10/9/2019 10:05	2400	2143	2843	No
44-10	PR375273	304730	12202B	GS056	10/9/2019 8:40	2488	2240	2955	No
44-10	PR375273	304730	12202B	GS056	10/9/2019 8:43	2504	2240	2955	No
44-10	PR375273	304730	12202B	GS056	10/9/2019 8:45	2561	2240	2955	No
44-10	PR375273	304730	12202B	GS057	10/9/2019 8:51	2781	2240	2955	No
44-10	PR375273	304730	12202B	GS057	10/9/2019 8:54	2617	2240	2955	No
44-10	PR375273	304730	12202B	GS057	10/9/2019 8:56	2555	2240	2955	No
44-10	PR375273	304730	12202B	GS058	10/9/2019 8:59	2567	2240	2955	No
44-10	PR375273	304730	12202B	GS058	10/9/2019 9:03	2485	2240	2955	No
44-10	PR375273	304730	12202B	GS058	10/9/2019 9:05	2640	2240	2955	No
44-10	PR375273	304730	12202B	GS059	10/9/2019 9:08	2479	2240	2955	No
44-10	PR375273	304730	12202B	GS059	10/9/2019 9:10	2444	2240	2955	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR375273	304730	12202B	GS059	10/9/2019 9:13	2468	2240	2955	No
44-10	PR375273	304730	12202B	GS060	10/9/2019 9:16	2604	2240	2955	No
44-10	PR375273	304730	12202B	GS060	10/9/2019 9:19	2746	2240	2955	No
44-10	PR375273	304730	12202B	GS060	10/9/2019 9:22	2568	2240	2955	No
44-10	PR375273	304730	12202B	GS061	10/9/2019 9:29	2623	2240	2955	No
44-10	PR375273	304730	12202B	GS061	10/9/2019 9:31	2590	2240	2955	No
44-10	PR375273	304730	12202B	GS061	10/9/2019 9:33	2545	2240	2955	No
44-10	PR375273	304730	12202B	GS062	10/9/2019 9:36	2482	2240	2955	No
44-10	PR375273	304730	12202B	GS062	10/9/2019 9:39	2521	2240	2955	No
44-10	PR375273	304730	12202B	GS062	10/9/2019 9:41	2538	2240	2955	No
44-10	PR375273	304730	12202B	GS063	10/9/2019 9:44	2635	2240	2955	No
44-10	PR375273	304730	12202B	GS063	10/9/2019 9:46	2614	2240	2955	No
44-10	PR375273	304730	12202B	GS063	10/9/2019 9:49	2387	2240	2955	No
44-10	PR375273	304730	12202B	GS064	10/9/2019 9:51	2501	2240	2955	No
44-10	PR375273	304730	12202B	GS064	10/9/2019 9:53	2397	2240	2955	No
44-10	PR375273	304730	12202B	GS064	10/9/2019 9:55	2545	2240	2955	No
44-10	PR375273	304730	12202B	GS065	10/9/2019 9:58	2444	2240	2955	No
44-10	PR375273	304730	12202B	GS065	10/9/2019 10:00	2675	2240	2955	No
44-10	PR375273	304730	12202B	GS065	10/9/2019 10:02	2365	2240	2955	No
44-10	PR375273	304730	12202B	GS066	10/9/2019 10:05	2631	2240	2955	No
44-10	PR375273	304730	12202B	GS066	10/9/2019 10:08	2491	2240	2955	No
44-10	PR375273	304730	12202B	GS066	10/9/2019 10:10	2436	2240	2955	No
44-10	PR375273	304730	12202B	GS067	10/9/2019 10:13	2429	2240	2955	No
44-10	PR375273	304730	12202B	GS067	10/9/2019 10:15	2664	2240	2955	No
44-10	PR375273	304730	12202B	GS067	10/9/2019 10:17	2536	2240	2955	No
44-10	PR375273	304730	12202B	GS068	10/9/2019 10:19	2575	2240	2955	No
44-10	PR375273	304730	12202B	GS068	10/9/2019 10:21	2576	2240	2955	No
44-10	PR375273	304730	12202B	GS068	10/9/2019 10:24	2526	2240	2955	No

ATTACHMENT 3

CONSULTATION TRIGGERS FOR RESIDENTIAL AND COMMERCIAL/INDUSTRIAL SOIL CONTAMINATION

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

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

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

ATTACHMENT 4
SIGN TEST

Attachment 12
Sign Statistical Test

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

Survey Area: No. 12000 **Description:** Security Restricted Area Grounds
Survey Unit: No. 12202B **Description:** Gate House and Southwest Yard
Classification: 1 **Type I (α) Error:** 0.05 **Number of Samples:** 17

#	Fraction of the Release Criterion						Weighted Sum (W_s)	1-W_s	Sign
	Radionuclides of Concern					Activity or SOF (as applicable)			
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90				
1	2.19E-02	0.00E+00	0.00E+00	4.72E-03	0.00E+00	SOF	0.027	0.973	+
2	1.26E-02	1.57E-02	2.78E-03	2.70E-03	6.53E-06	SOF	0.034	0.966	+
3	3.15E-03	0.00E+00	0.00E+00	6.79E-04	0.00E+00	SOF	0.004	0.996	+
4	1.56E-02	9.12E-03	0.00E+00	3.35E-03	0.00E+00	SOF	0.028	0.972	+
5	0.00E+00	7.96E-03	0.00E+00	0.00E+00	0.00E+00	SOF	0.008	0.992	+
6	3.82E-02	0.00E+00	0.00E+00	8.23E-03	0.00E+00	SOF	0.046	0.954	+
7	4.45E-02	1.78E-02	0.00E+00	9.59E-03	0.00E+00	SOF	0.072	0.928	+
8	2.39E-02	1.59E-02	7.36E-03	5.15E-03	1.73E-05	SOF	0.052	0.948	+
9	0.00E+00	3.84E-03	0.00E+00	0.00E+00	0.00E+00	SOF	0.004	0.996	+
10	3.79E-02	0.00E+00	5.95E-03	8.15E-03	1.40E-05	SOF	0.052	0.948	+
11	7.01E-03	1.19E-02	0.00E+00	1.51E-03	0.00E+00	SOF	0.020	0.980	+
12	2.51E-02	9.64E-03	0.00E+00	5.41E-03	0.00E+00	SOF	0.040	0.960	+
13	3.25E-02	0.00E+00	1.06E-03	7.01E-03	2.49E-06	SOF	0.041	0.959	+
14	1.83E-02	0.00E+00	1.17E-02	3.95E-03	2.74E-05	SOF	0.034	0.966	+
15	1.37E-02	5.41E-03	1.25E-03	2.94E-03	2.92E-06	SOF	0.023	0.977	+
16	2.28E-02	7.73E-03	3.22E-03	4.91E-03	7.56E-06	SOF	0.039	0.961	+
17	0.00E+00	1.14E-02	1.82E-03	0.00E+00	4.28E-06	SOF	0.013	0.987	+

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

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

Prepared By (RE): J Graham (Print Name) (Signature) 10/15/19 (Date)

Peer Reviewed By (RE): R.J. Mandic (Print Name) (Signature) 10-15-19 (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #:	12000	Survey Unit #:	12202B	Survey Unit Name:	Gate House and Southwest Yard
Sample Plan#:	L1-12202B-F				

Sample Description: Comparison of split samples collected from systematic surface soil sample #7. The samples were analyzed using gamma spectroscopy by on-site HPGe system. The standard/comparison samples were L1-12202B-FSGS-007SS / L1-12202B-FQGS-007SS.

STANDARD					COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
K-40	8.19E+00	5.63E-01	14.50	0.6 - 1.66	8.75E+00	5.96E-01	0.94	Y

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

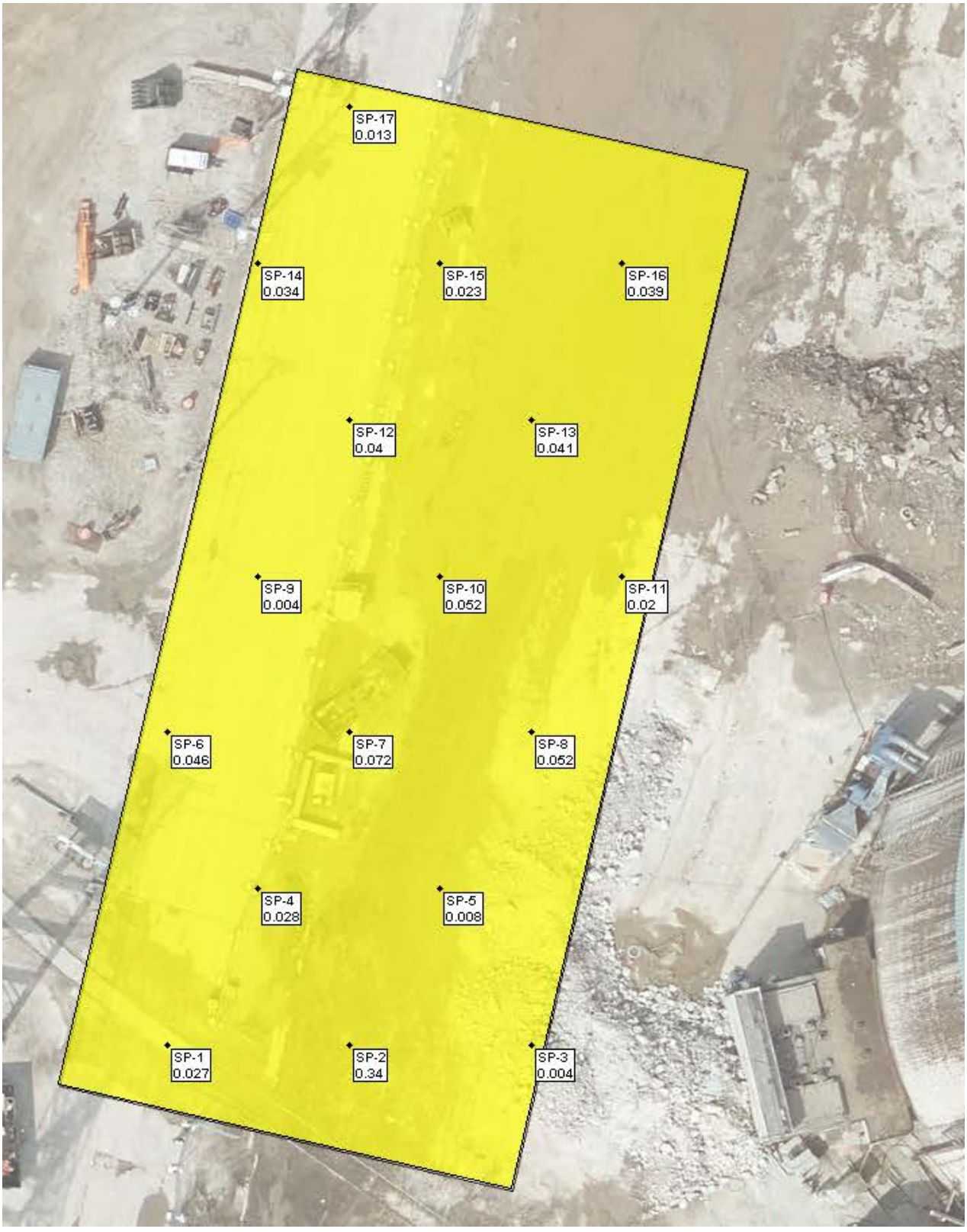
Table 4-1 from the QAPP is reproduced below to show acceptance criteria used to assess split samples.

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

Performed by:	Date:	Reveiwed by:	Date:
T Graham	10/15/19	R.J. Mandia	10-15-19

ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot

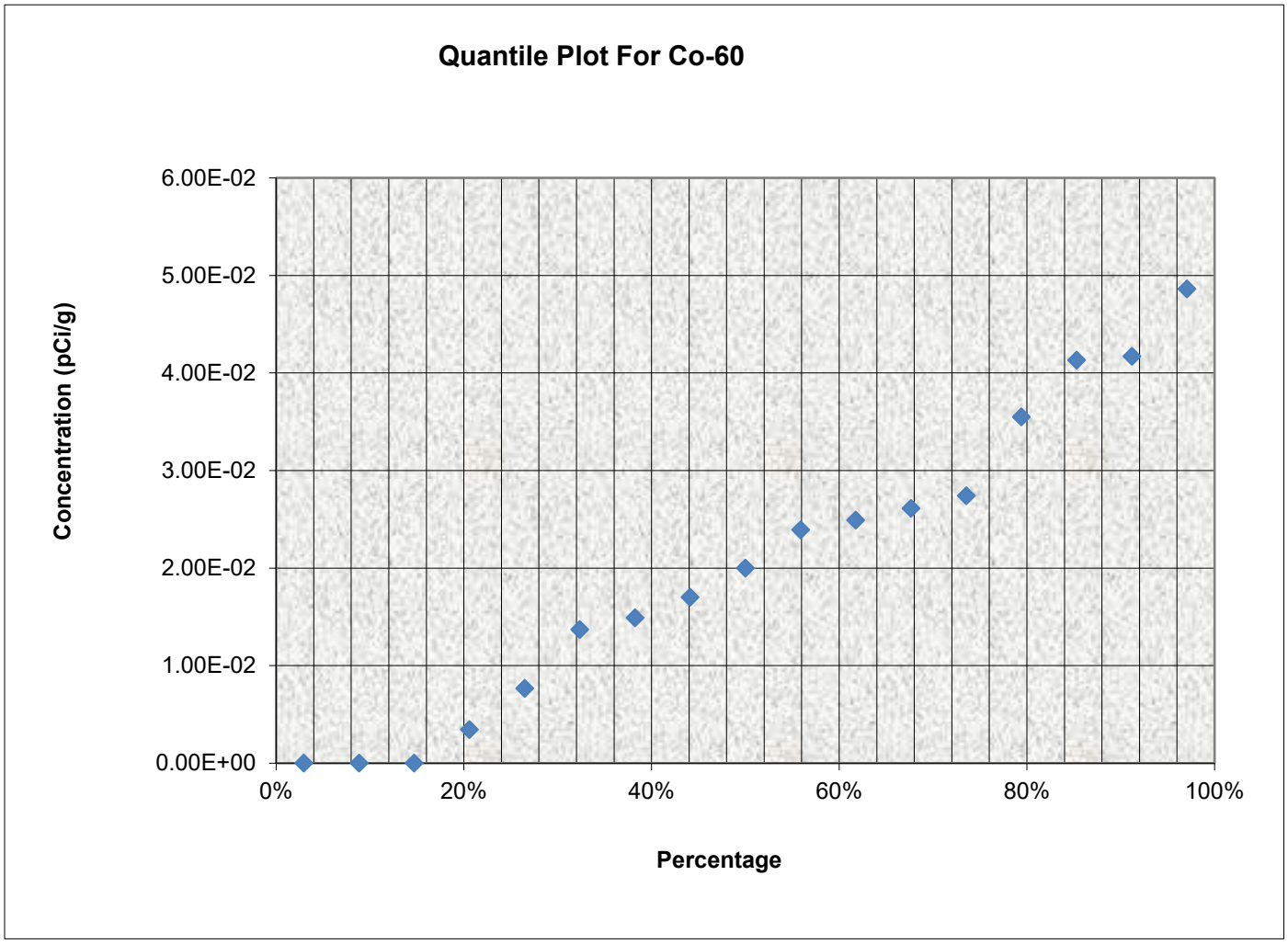


QUANTILE PLOT FOR Co-60

Survey Unit: 12202B

Survey Unit Name: Gate House and Southwest Yard

Mean: 2.04E-02 pCi/g

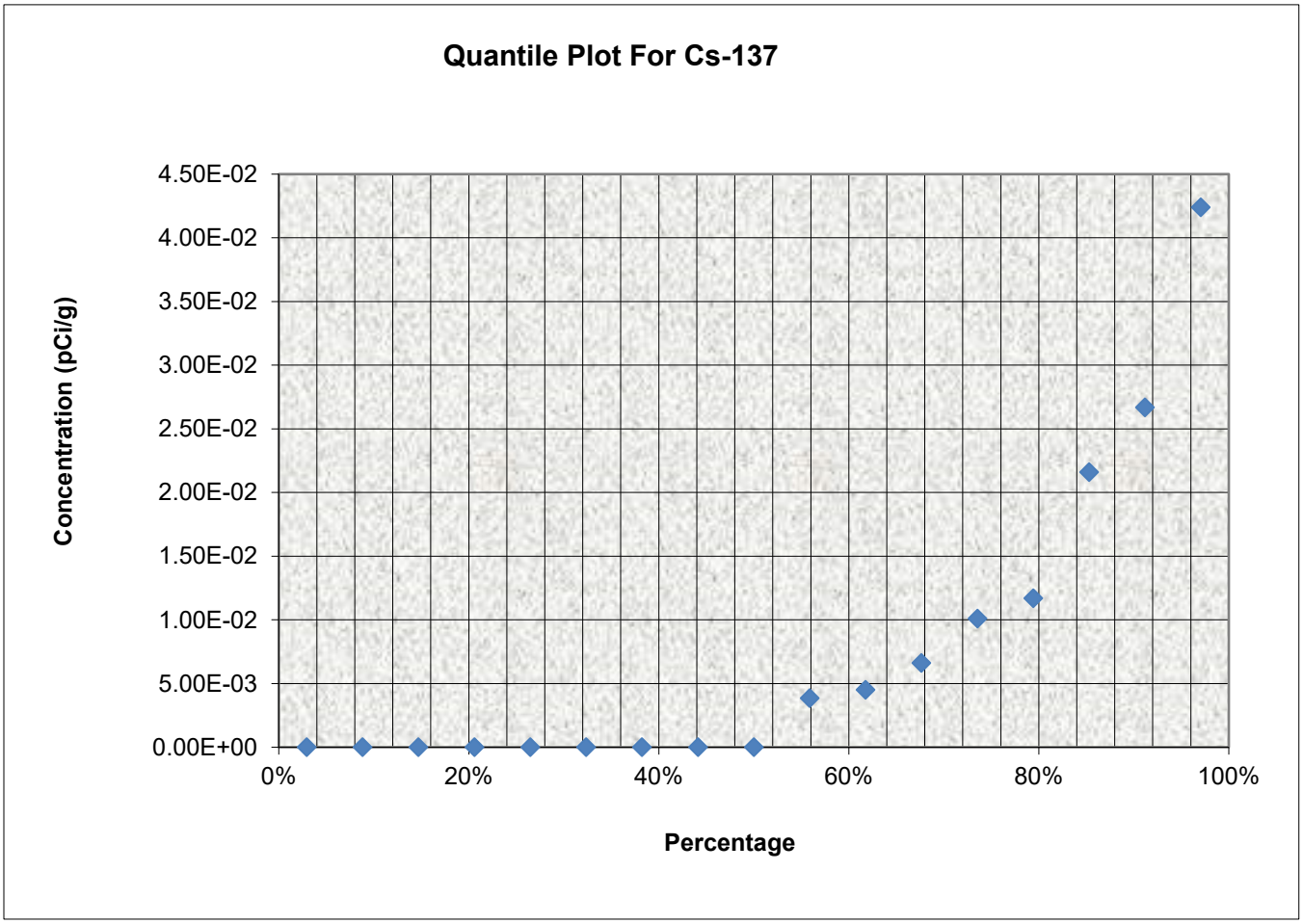


QUANTILE PLOT FOR Cs-137

Survey Unit: 12202B

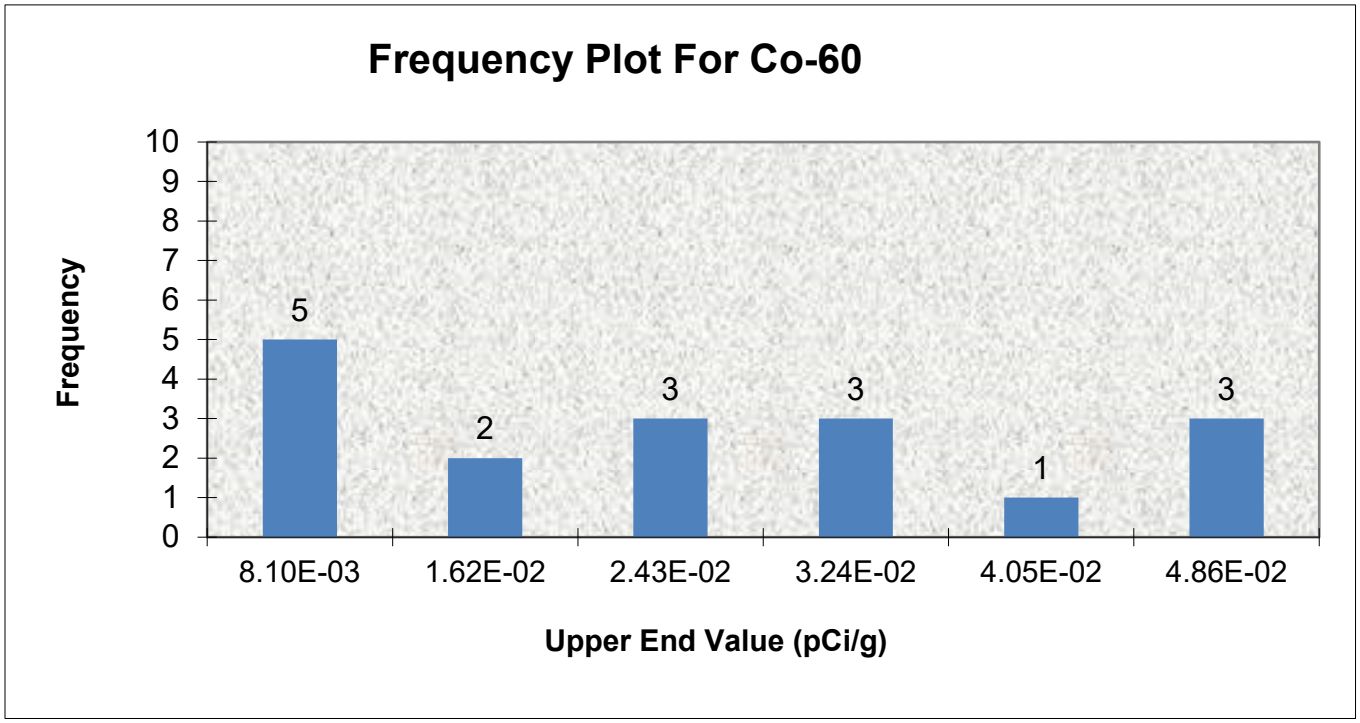
Survey Unit Name: Gate House and Southwest Yard

Mean: 7.05E-03 pCi/g



HISTOGRAM FOR Co-60

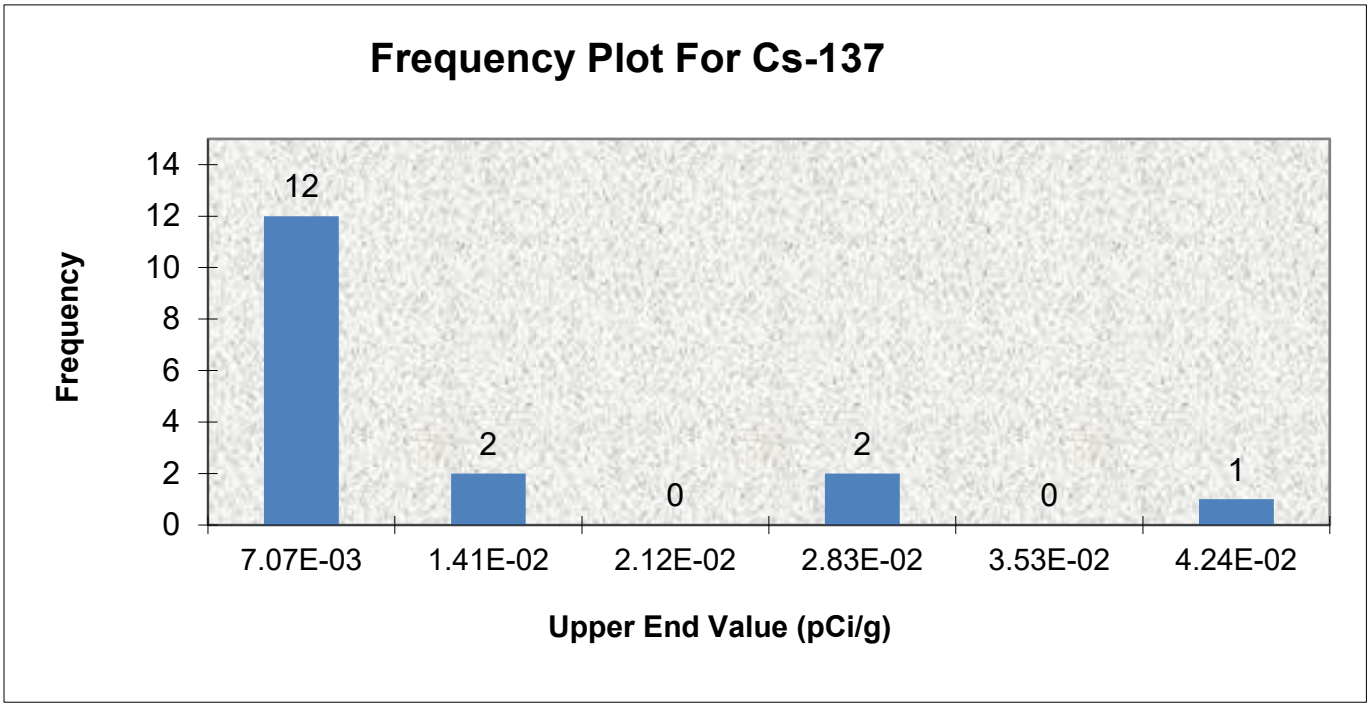
Survey Unit:	12202B	
Survey Unit Name:	Gate House and Southwest Yard	
Mean:	2.04E-02	pCi/g
Median:	2.00E-02	pCi/g
ST DEV:	0.015	
Skew:	0.248	



Upper Value	Observation Frequency	Observation %
8.10E-03	5	29%
1.62E-02	2	12%
2.43E-02	3	18%
3.24E-02	3	18%
4.05E-02	1	6%
4.86E-02	3	18%
TOTAL	17	100%

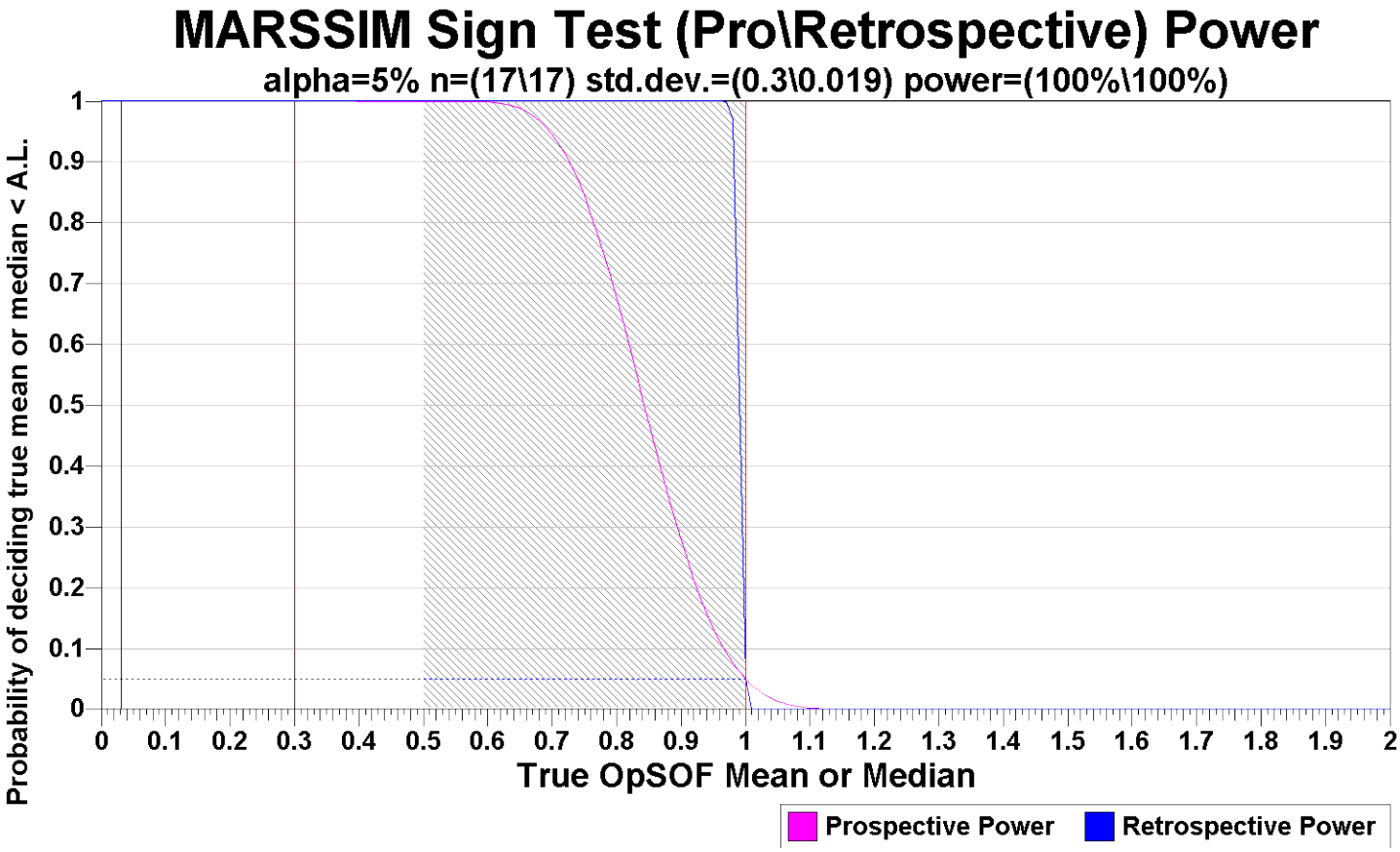
HISTOGRAM FOR Cs-137

Survey Unit:	12202B	
Survey Unit Name:	Gate House and Southwest Yard	
Mean:	7.50E-03	pCi/g
Median:	0.00E+00	pCi/g
ST DEV:	0.012	
Skew:	1.948	



Upper Value	Observation Frequency	Observation %
7.07E-03	12	71%
1.41E-02	2	12%
2.12E-02	0	0%
2.83E-02	2	12%
3.53E-02	0	0%
4.24E-02	1	6%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Unit 12202B



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 09-Oct-19-10026

L1-12202B-FSGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10026
Sample Description	: L1-12202B-FSGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.561E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:20:00AM
Acquisition Started	: 10/9/2019 11:03:56AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.3 seconds
Dead Time	: 0.15 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80360
Fill Height	: 1561.07 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 11:19:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/9/19 - 1500

T Graham

Analysis Report for 09-Oct-19-10026

L1-12202B-FSGS-001SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	238.73	948 -	959	955.01	1.03E+02	15.12	5.04E+01	1.00
M	2	295.59	1175 -	1207	1182.28	4.34E+01	56.47	1.60E+01	0.29
m	3	300.66	1175 -	1207	1202.51	1.93E+01	14.85	2.62E+01	0.30
	4	351.91	1400 -	1415	1407.39	8.56E+01	11.20	1.34E+01	0.93
	5	583.20	2327 -	2339	2332.02	3.17E+01	9.06	1.83E+01	0.34
	6	609.19	2427 -	2443	2435.94	4.98E+01	10.22	1.72E+01	1.30
	7	910.93	3635 -	3650	3642.68	2.90E+01	8.79	1.60E+01	0.39
	8	1460.71	5830 -	5854	5842.68	3.41E+02	18.80	3.08E+00	1.40

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.45E+00	5.93E-01
Tl-208	1.00	583.19	*	85.00	5.27E-02	1.54E-02
Bi-211	0.89	351.07	*	13.02	6.52E-01	1.00E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.83E-01	3.07E-02
		300.09	*	3.30	5.16E-01	4.00E-01
Bi-214	0.99	609.32	*	45.49	1.59E-01	3.40E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 09-Oct-19-10026

L1-12202B-FSGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
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	2.15E-01	6.58E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

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

Analysis Report for 09-Oct-19-10026

L1-12202B-FSGS-001SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	8.45E+00	5.93E-01	
	Tl-208	1.000	5.27E-02	1.54E-02	
	Bi-211	0.892	6.52E-01	1.00E-01	
	Pb-212	0.995	1.85E-01	3.06E-02	
	Bi-214	0.999	1.59E-01	3.40E-02	
X	Pb-214	0.993			
	Ac-228	0.996	2.15E-01	6.58E-02	
X	Pa-231	0.993			

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10026
L1-12202B-FSGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 11:19:00AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

	Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
M	2	295.59	4.81881E-02	130.22	Tol.	Eu-152 Pb-214

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.75E-02	5.74E-02	5.74E-02
	BE-7	477.60		10.44	2.35E-01	4.71E-01	4.71E-01
+	K-40	1460.82	*	10.66	8.45E+00	3.70E-01	3.70E-01
	Mn-54	834.85		99.98	-4.04E-02	4.76E-02	4.76E-02
	Co-60	1173.23		99.85	-3.97E-03	5.44E-02	7.09E-02
		1332.49		99.98	2.39E-02		5.44E-02
	Nb-94	702.65		99.81	7.76E-03	4.31E-02	4.31E-02
		871.09		99.89	2.78E-03		4.89E-02
	Ag-108m	79.13		6.60	7.89E-01	4.59E-02	1.95E+00
		433.94		90.50	-5.50E-02		4.59E-02
		614.28		89.80	-2.68E-02		6.26E-02
		722.94		90.80	2.91E-02		6.31E-02
	Sb-125	176.31		6.84	2.80E-02	1.32E-01	5.58E-01
		380.45		1.52	7.31E-01		2.69E+00
		427.87		29.60	-2.03E-02		1.32E-01
		463.36		10.49	-2.78E-01		3.86E-01
		600.60		17.65	-4.55E-02		2.27E-01

Analysis Report for 09-Oct-19-10026

L1-12202B-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	606.71	4.98	1.33E+00	1.32E-01	1.32E+00
	635.95	11.22	-2.57E-04		4.39E-01
	671.44	1.79	3.72E-02		2.72E+00
Ba-133	79.61	2.65	2.95E+00	7.72E-02	4.75E+00
	81.00	32.90	-3.58E-01		3.27E-01
	276.40	7.16	1.77E-02		5.23E-01
	302.85	18.34	5.58E-02		2.25E-01
	356.01	62.05	2.43E-02		7.72E-02
	383.85	8.94	-2.19E-01		4.58E-01
Cs-134	475.36	1.48	9.32E-01	6.08E-02	2.94E+00
	563.25	8.34	1.87E-01		5.17E-01
	569.33	15.37	-1.54E-01		2.20E-01
	604.72	97.62	-1.04E-02		6.08E-02
	795.86	85.46	-1.02E-02		6.46E-02
	801.95	8.69	2.47E-01		5.61E-01
	1038.61	0.99	-1.36E+00		5.36E+00
	1167.97	1.79	-9.98E-01		3.62E+00
	1365.19	3.02	5.38E-01		1.68E+00
Cs-137	661.66	85.10	-4.12E-02	4.95E-02	4.95E-02
Eu-152	121.78	28.67	-6.42E-02	1.26E-01	1.66E-01
	244.70	7.61	1.03E-01		5.38E-01
	295.94	0.45	-7.39E-01		9.70E+00
	344.28	26.60	-1.29E-02		1.26E-01
	367.79	0.86	-8.47E-01		4.25E+00
	411.12	2.24	1.52E+00		1.87E+00
	443.96	2.83	-7.75E-03		1.37E+00
	488.68	0.42	4.72E+00		1.02E+01
	563.99	0.49	4.95E+00		8.79E+00
	586.26	0.46	7.93E+00		1.34E+01
	678.62	0.47	6.64E-01		1.11E+01
	688.67	0.86	1.73E+00		5.12E+00
	719.35	0.28	2.85E+00		1.70E+01
	778.90	12.96	1.52E-01		3.68E-01
	810.45	0.32	-5.55E+00		1.34E+01
	867.37	4.26	-2.63E-01		1.10E+00
	919.33	0.43	-2.49E-01		1.27E+01
	964.08	14.65	-4.06E-01		3.77E-01
	1085.87	10.24	2.47E-01		6.48E-01
	1089.74	1.73	-4.58E+00		3.52E+00
	1112.07	13.69	-2.24E-01		5.18E-01
	1212.95	1.43	5.21E+00		5.69E+00
	1249.94	0.19	5.69E+00		3.29E+01
	1299.14	1.63	-1.59E+00		3.70E+00
	1408.01	21.07	6.96E-02		2.38E-01
	1457.64	0.50	1.68E+02		4.86E+01
	1528.10	0.28	-3.64E+00		1.09E+01
Eu-154	123.07	40.40	-2.33E-02	1.19E-01	1.19E-01
	247.93	6.89	-1.70E-01		5.24E-01
	591.76	4.95	1.07E+00		9.79E-01
	692.42	1.78	-8.83E-01		2.02E+00
	723.30	20.06	1.48E-01		2.91E-01

Analysis Report for 09-Oct-19-10026

L1-12202B-FSGS-001SS

Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	756.80		4.52	-2.64E-01	1.19E-01	1.09E+00
	873.18		12.08	4.28E-02		4.12E-01
	996.29		10.48	8.55E-02		4.92E-01
	1004.76		18.01	1.23E-02		2.99E-01
	1274.43		34.80	-4.49E-02		1.60E-01
	1596.48		1.80	7.88E-01		2.14E+00
Eu-155	45.30		1.31	6.01E+00	2.75E-01	3.25E+01
	60.01		1.22	-5.29E+00		2.79E+01
	86.55		30.70	4.25E-02		2.77E-01
	105.31		21.10	-3.72E-02		2.75E-01
Ra-226	186.21		3.64	4.55E-01	1.14E+00	1.14E+00
Pa-231	27.36		10.30	2.07E+00	9.82E-01	3.27E+00
	283.69		1.70	1.88E-01		2.21E+00
	300.07	*	2.47	6.90E-01		9.82E-01
	302.65		2.20	-1.49E-01		1.84E+00
	330.06		1.40	1.08E+00		3.04E+00
U-235	143.76		10.96	-2.26E-01	7.20E-02	3.82E-01
	163.33		5.08	2.35E-01		8.14E-01
	185.71		57.20	3.13E-02		7.20E-02
	202.11		1.08	3.48E+00		3.81E+00
	205.31		5.01	3.65E-01		7.96E-01
Am-241	59.54		35.90	-3.44E-01	9.49E-01	9.49E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10027
L1-12202B-FSGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10027
Sample Description	: L1-12202B-FSGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.771E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:22:00AM
Acquisition Started	: 10/9/2019 11:04:04AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80361
Fill Height	: 1770.91 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 11:19:15AM

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

DATA VALIDATED 10/9/19 - 1500
J Graham

Analysis Report for 09-Oct-19-10027

L1-12202B-FSGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.77	948 -	962	954.66	1.39E+02	16.16	4.18E+01	1.09
2	295.08	1174 -	1186	1179.61	3.36E+01	9.53	2.14E+01	0.37
3	352.02	1399 -	1412	1407.10	6.24E+01	10.64	1.86E+01	0.88
4	609.17	2429 -	2441	2434.71	5.83E+01	9.10	8.69E+00	0.69
5	910.90	3636 -	3647	3641.06	2.57E+01	7.18	1.03E+01	0.64
6	1460.03	5826 -	5850	5838.04	3.91E+02	20.08	3.05E+00	1.77

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.90	1460.82	*	10.66	8.44E+00	5.68E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.16E-01	3.06E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.64E-01	2.74E-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 09-Oct-19-10027

L1-12202B-FSGS-002SS

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	1.40E-01	4.13E-02
		351.93	*	35.60	1.53E-01	2.88E-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	1.67E-01	4.72E-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 09-Oct-19-10027

L1-12202B-FSGS-002SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.903	8.44E+00	5.68E-01	
X	Bi-211	0.865			
	Pb-212	0.997	2.16E-01	3.06E-02	
	Bi-214	0.998	1.64E-01	2.74E-02	
	Pb-214	0.998	1.49E-01	2.36E-02	
	Ac-228	0.996	1.67E-01	4.72E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10027

L1-12202B-FSGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 11:19:15AM
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	6.33E-02	5.42E-02	5.42E-02
	BE-7	477.60		10.44	7.92E-02	3.65E-01	3.65E-01
+	K-40	1460.82	*	10.66	8.44E+00	3.20E-01	3.20E-01
	Mn-54	834.85		99.98	1.57E-02	4.47E-02	4.47E-02
	Co-60	1173.23		99.85	-1.82E-02	4.87E-02	6.43E-02
		1332.49		99.98	1.37E-02		4.87E-02
	Nb-94	702.65		99.81	3.84E-02	4.29E-02	4.52E-02
		871.09		99.89	-1.71E-02		4.29E-02
	Ag-108m	79.13		6.60	8.02E-01	3.80E-02	1.14E+00
		433.94		90.50	2.42E-03		3.80E-02
		614.28		89.80	-2.76E-03		5.02E-02
		722.94		90.80	-3.71E-02		5.25E-02
	Sb-125	176.31		6.84	-1.89E-01	1.07E-01	4.28E-01
		380.45		1.52	4.00E-01		2.18E+00
		427.87		29.60	-8.56E-02		1.07E-01
		463.36		10.49	3.26E-01		3.39E-01
		600.60		17.65	8.61E-02		2.12E-01
		606.71		4.98	1.97E+00		1.17E+00
		635.95		11.22	1.44E-01		3.47E-01

Analysis Report for 09-Oct-19-10027

L1-12202B-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.56E+00	1.07E-01	2.22E+00
Ba-133	79.61	2.65	1.49E+00	6.46E-02	2.73E+00
	81.00	32.90	-2.15E-01		1.83E-01
	276.40	7.16	-1.68E-01		4.67E-01
	302.85	18.34	2.18E-03		1.77E-01
	356.01	62.05	-6.24E-02		6.46E-02
	383.85	8.94	-5.60E-01		3.83E-01
Cs-134	475.36	1.48	-4.14E-01	5.14E-02	2.48E+00
	563.25	8.34	-1.38E-01		4.89E-01
	569.33	15.37	-4.97E-03		2.32E-01
	604.72	97.62	-6.88E-02		5.14E-02
	795.86	85.46	2.72E-02		5.30E-02
	801.95	8.69	-4.25E-01		5.16E-01
	1038.61	0.99	4.06E+00		6.00E+00
	1167.97	1.79	2.48E+00		3.66E+00
	1365.19	3.02	1.53E-01		1.13E+00
Cs-137	661.66	85.10	1.01E-02	4.34E-02	4.34E-02
Eu-152	121.78	28.67	1.43E-02	1.18E-01	1.18E-01
	244.70	7.61	-1.78E-02		4.63E-01
	295.94	0.45	-2.21E+00		8.05E+00
	344.28	26.60	1.92E-02		1.24E-01
	367.79	0.86	-1.42E+00		3.00E+00
	411.12	2.24	-1.33E+00		1.40E+00
	443.96	2.83	2.72E-01		1.35E+00
	488.68	0.42	1.71E+00		8.49E+00
	563.99	0.49	-8.08E+00		7.72E+00
	586.26	0.46	1.14E+01		1.16E+01
	678.62	0.47	-3.45E+00		7.39E+00
	688.67	0.86	2.02E+00		4.85E+00
	719.35	0.28	-1.27E+01		1.56E+01
	778.90	12.96	-1.91E-02		3.18E-01
	810.45	0.32	-7.15E-02		1.45E+01
	867.37	4.26	-1.23E-01		9.83E-01
	919.33	0.43	-2.59E+00		1.00E+01
	964.08	14.65	4.96E-01		4.76E-01
	1085.87	10.24	-1.91E-02		4.84E-01
	1089.74	1.73	0.00E+00		3.08E+00
	1112.07	13.69	-5.63E-02		4.07E-01
	1212.95	1.43	1.71E+00		5.17E+00
	1249.94	0.19	-5.65E+00		3.54E+01
	1299.14	1.63	2.51E+00		3.55E+00
	1408.01	21.07	8.51E-03		1.45E-01
	1457.64	0.50	1.79E+02		4.52E+01
	1528.10	0.28	5.07E+00		1.24E+01
Eu-154	123.07	40.40	1.44E-02	8.26E-02	8.26E-02
	247.93	6.89	-2.33E-01		4.32E-01
	591.76	4.95	-1.53E-01		7.04E-01
	692.42	1.78	1.37E-01		2.32E+00
	723.30	20.06	-1.12E-01		2.43E-01
	756.80	4.52	-2.84E-01		9.82E-01
	873.18	12.08	-2.36E-02		4.04E-01

Analysis Report for 09-Oct-19-10027

L1-12202B-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.67E-02	8.26E-02	5.02E-01
	1004.76	18.01	5.86E-02		3.10E-01
	1274.43	34.80	9.34E-02		1.83E-01
	1596.48	1.80	3.38E-01		2.14E+00
Eu-155	45.30	1.31	-4.99E+00	1.87E-01	1.03E+01
	60.01	1.22	-8.20E-01		1.33E+01
	86.55	30.70	9.51E-02		1.87E-01
	105.31	21.10	8.59E-02		1.99E-01
Ra-226	186.21	3.64	8.77E-01	8.96E-01	8.96E-01
Pa-231	27.36	10.30	9.49E-01	1.25E+00	1.25E+00
	283.69	1.70	2.87E-01		1.93E+00
	300.07	2.47	2.89E-01		1.27E+00
	302.65	2.20	1.44E-02		1.48E+00
	330.06	1.40	2.27E+00		2.56E+00
U-235	143.76	10.96	-5.44E-02	5.65E-02	3.03E-01
	163.33	5.08	1.58E-01		6.15E-01
	185.71	57.20	3.51E-02		5.65E-02
	202.11	1.08	-8.85E-01		2.62E+00
	205.31	5.01	-3.35E-01		6.26E-01
Am-241	59.54	35.90	9.44E-02	4.66E-01	4.66E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10028

L1-12202B-FSGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10028
Sample Description	: L1-12202B-FSGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.608E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:24:00AM
Acquisition Started	: 10/9/2019 11:04:11AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80362
Fill Height	: 1607.53 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 11:19:15AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/9/19 - 1500

J Graham

Analysis Report for 09-Oct-19-10028

L1-12202B-FSGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.79	948 -	960	955.63	1.06E+02	16.73	6.63E+01	1.12
2	295.10	1172 -	1185	1180.62	4.30E+01	11.59	3.30E+01	0.76
3	351.86	1399 -	1413	1407.43	6.04E+01	11.75	2.66E+01	1.45
4	510.73	2037 -	2048	2042.39	4.10E+01	10.06	2.40E+01	0.72
5	583.18	2325 -	2339	2332.03	3.11E+01	9.29	1.89E+01	0.41
6	609.40	2429 -	2444	2436.87	7.32E+01	9.63	6.81E+00	0.47
7	910.95	3637 -	3649	3642.84	3.74E+01	7.03	4.64E+00	1.61
8	968.83	3869 -	3880	3874.41	1.77E+01	6.60	1.03E+01	0.89
9	1460.67	5829 -	5854	5843.06	4.37E+02	21.25	3.40E+00	1.97

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.98	511.00	*	100.00	4.60E-02	1.17E-02
K-40	0.99	1460.82	*	10.66	9.02E+00	5.88E-01
Tl-208	1.00	583.19	*	85.00	4.40E-02	1.34E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.64E-01	2.92E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.99E-01	2.88E-02
		768.36		4.89		

Analysis Report for 09-Oct-19-10028

L1-12202B-FSGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.77E-01	4.98E-02
		351.93	*	35.60	1.46E-01	3.06E-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	2.33E-01	4.50E-02
		964.77		4.99		
		968.97	*	15.80	1.88E-01	7.05E-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 09-Oct-19-10028

L1-12202B-FSGS-003SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.988	4.60E-02	1.17E-02	
	K-40	0.996	9.02E+00	5.88E-01	
	Tl-208	1.000	4.40E-02	1.34E-02	
X	Bi-211	0.905			
	Pb-212	0.996	1.64E-01	2.92E-02	
	Bi-214	1.000	1.99E-01	2.88E-02	
	Pb-214	0.999	1.54E-01	2.61E-02	
	Ac-228	0.996	2.20E-01	3.80E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10028

L1-12202B-FSGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 11:19:15AM
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	4.60E-02	3.27E-02	3.27E-02
	BE-7	477.60		10.44	-8.09E-02	4.24E-01	4.24E-01
+	K-40	1460.82	*	10.66	9.02E+00	3.31E-01	3.31E-01
	Mn-54	834.85		99.98	-8.52E-03	4.94E-02	4.94E-02
	Co-60	1173.23		99.85	3.44E-03	4.66E-02	6.72E-02
		1332.49		99.98	-1.12E-02		4.66E-02
	Nb-94	702.65		99.81	7.69E-03	4.20E-02	4.20E-02
		871.09		99.89	-2.35E-02		4.76E-02
	Ag-108m	79.13		6.60	1.94E-01	4.35E-02	1.43E+00
		433.94		90.50	1.12E-02		4.35E-02
		614.28		89.80	-2.06E-02		6.12E-02
		722.94		90.80	4.73E-02		5.91E-02
	Sb-125	176.31		6.84	1.75E-01	1.17E-01	5.28E-01
		380.45		1.52	-6.90E-01		2.01E+00
		427.87		29.60	-9.12E-03		1.17E-01
		463.36		10.49	-1.43E-02		3.70E-01
		600.60		17.65	1.75E-01		2.56E-01
		606.71		4.98	1.77E+00		1.29E+00
		635.95		11.22	2.84E-01		3.64E-01

Analysis Report for 09-Oct-19-10028

L1-12202B-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.02E+00	1.17E-01	2.27E+00
Ba-133	79.61	2.65	1.87E+00	6.61E-02	3.48E+00
	81.00	32.90	-2.03E-01		2.47E-01
	276.40	7.16	2.30E-02		5.38E-01
	302.85	18.34	1.62E-01		1.99E-01
	356.01	62.05	-4.01E-02		6.61E-02
	383.85	8.94	-1.23E-01		3.57E-01
Cs-134	475.36	1.48	3.02E+00	5.10E-02	2.94E+00
	563.25	8.34	1.49E-02		3.93E-01
	569.33	15.37	1.41E-02		2.44E-01
	604.72	97.62	-5.67E-02		6.24E-02
	795.86	85.46	-1.68E-02		5.10E-02
	801.95	8.69	-3.60E-01		5.26E-01
	1038.61	0.99	-9.90E-01		4.93E+00
	1167.97	1.79	8.34E-01		3.59E+00
	1365.19	3.02	-1.56E-01		1.35E+00
Cs-137	661.66	85.10	-1.54E-02	4.80E-02	4.80E-02
Eu-152	121.78	28.67	-4.99E-04	1.14E-01	1.38E-01
	244.70	7.61	8.44E-02		5.14E-01
	295.94	0.45	7.61E+00		9.60E+00
	344.28	26.60	-4.37E-02		1.32E-01
	367.79	0.86	2.68E-01		3.88E+00
	411.12	2.24	-1.47E+00		1.60E+00
	443.96	2.83	1.64E-01		1.44E+00
	488.68	0.42	-4.12E+00		8.29E+00
	563.99	0.49	-4.08E+00		6.33E+00
	586.26	0.46	9.97E+00		1.19E+01
	678.62	0.47	2.48E+00		9.13E+00
	688.67	0.86	-4.49E+00		5.75E+00
	719.35	0.28	6.18E-01		1.55E+01
	778.90	12.96	-1.58E-01		3.12E-01
	810.45	0.32	2.15E+00		1.45E+01
	867.37	4.26	-1.18E+00		1.05E+00
	919.33	0.43	-1.09E+01		9.80E+00
	964.08	14.65	-5.53E-03		4.57E-01
	1085.87	10.24	-4.40E-03		5.72E-01
	1089.74	1.73	2.35E-01		3.55E+00
	1112.07	13.69	2.15E-01		4.18E-01
	1212.95	1.43	1.46E-01		4.81E+00
	1249.94	0.19	-7.62E-01		3.31E+01
	1299.14	1.63	7.26E-01		3.22E+00
	1408.01	21.07	-1.14E-01		1.14E-01
	1457.64	0.50	1.88E+02		4.54E+01
	1528.10	0.28	2.42E+00		9.03E+00
Eu-154	123.07	40.40	7.10E-02	9.94E-02	9.94E-02
	247.93	6.89	4.62E-02		5.15E-01
	591.76	4.95	1.85E-01		8.95E-01
	692.42	1.78	1.39E+00		2.71E+00
	723.30	20.06	-1.65E-02		2.56E-01
	756.80	4.52	-3.77E-02		8.77E-01
	873.18	12.08	1.65E-02		3.89E-01

Analysis Report for 09-Oct-19-10028

L1-12202B-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.34E-01	9.94E-02	4.89E-01
	1004.76	18.01	1.03E-02		2.86E-01
	1274.43	34.80	2.87E-03		1.62E-01
	1596.48	1.80	-1.33E+00		2.15E+00
Eu-155	45.30	1.31	5.40E+00	2.19E-01	1.97E+01
	60.01	1.22	-1.07E+01		2.06E+01
	86.55	30.70	1.70E-01		2.32E-01
	105.31	21.10	4.14E-02		2.19E-01
Ra-226	186.21	3.64	5.01E-01	9.27E-01	9.27E-01
Pa-231	27.36	10.30	1.67E+00	1.49E+00	2.35E+00
	283.69	1.70	6.67E-01		2.16E+00
	300.07	2.47	-1.89E+00		1.49E+00
	302.65	2.20	1.09E+00		1.64E+00
	330.06	1.40	1.95E+00		2.59E+00
U-235	143.76	10.96	-4.18E-02	6.03E-02	3.46E-01
	163.33	5.08	-1.03E-02		6.87E-01
	185.71	57.20	3.25E-02		6.03E-02
	202.11	1.08	-7.44E-01		3.19E+00
	205.31	5.01	-8.64E-01		6.37E-01
Am-241	59.54	35.90	-3.22E-01	7.21E-01	7.21E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10029

L1-12202B-FSGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10029
Sample Description	: L1-12202B-FSGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.659E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:26:00AM
Acquisition Started	: 10/9/2019 11:29:44AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80363
Fill Height	: 1658.72 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 11:44:47AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 10/9/19 - 1500

J Graham

Analysis Report for 09-Oct-19-10029

L1-12202B-FSGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.63	474 -	481	477.44	1.52E+02	20.02	1.19E+02	1.07
2	295.18	587 -	595	590.42	5.79E+01	12.62	4.71E+01	1.02
3	351.86	698 -	708	703.67	9.27E+01	14.51	4.93E+01	1.46
4	583.41	1160 -	1172	1166.42	6.62E+01	11.24	2.28E+01	1.22
5	609.23	1212 -	1223	1218.03	7.71E+01	11.04	1.79E+01	1.68
6	911.41	1816 -	1828	1822.28	5.00E+01	8.42	7.97E+00	1.41
7	1460.71	2914 -	2928	2921.48	4.36E+02	21.38	7.50E+00	2.28

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.01E+00	5.25E-01
Tl-208	0.99	583.19	*	85.00	8.39E-02	1.51E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.10E-01	3.25E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.88E-01	2.92E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 09-Oct-19-10029

L1-12202B-FSGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.14E-01	4.96E-02
		351.93	*	35.60	2.00E-01	3.52E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.79E-01	4.85E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 09-Oct-19-10029

L1-12202B-FSGS-004SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	8.01E+00	5.25E-01	
	Tl-208	0.992	8.39E-02	1.51E-02	
X	Bi-211	0.904			
	Pb-212	1.000	2.10E-01	3.25E-02	
	Bi-214	0.999	1.88E-01	2.92E-02	
	Pb-214	0.999	2.05E-01	2.87E-02	
	Ac-228	0.998	2.79E-01	4.85E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10029

L1-12202B-FSGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 11:44:47AM
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	7.12E-02	5.21E-02	5.21E-02
	BE-7	477.60		10.44	3.48E-02	3.50E-01	3.50E-01
+	K-40	1460.82	*	10.66	8.01E+00	3.43E-01	3.43E-01
	Mn-54	834.85		99.98	-7.16E-03	4.15E-02	4.15E-02
	Co-60	1173.23		99.85	-2.15E-02	4.26E-02	5.56E-02
		1332.49		99.98	1.70E-02		4.26E-02
	Nb-94	702.65		99.81	1.06E-02	3.66E-02	3.66E-02
		871.09		99.89	1.07E-02		3.89E-02
	Ag-108m	79.13		6.60	4.08E-01	3.14E-02	1.18E+00
		433.94		90.50	-3.54E-02		3.14E-02
		614.28		89.80	-1.52E-02		5.12E-02
		722.94		90.80	-1.60E-02		4.37E-02
	Sb-125	176.31		6.84	-3.32E-02	1.18E-01	4.80E-01
		380.45		1.52	4.76E-01		2.19E+00
		427.87		29.60	-8.63E-03		1.18E-01
		463.36		10.49	1.50E-01		3.59E-01
		600.60		17.65	-1.43E-01		1.92E-01
		606.71		4.98	-1.80E-01		1.16E+00
		635.95		11.22	-1.35E-02		3.53E-01

Analysis Report for 09-Oct-19-10029

L1-12202B-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.69E-01	1.18E-01	1.98E+00
Ba-133	79.61	2.65	-5.05E-01	6.56E-02	2.71E+00
	81.00	32.90	-2.32E-01		1.89E-01
	276.40	7.16	1.59E-01		4.59E-01
	302.85	18.34	2.64E-02		1.82E-01
	356.01	62.05	-5.50E-02		6.56E-02
	383.85	8.94	-1.64E-02		3.51E-01
Cs-134	475.36	1.48	1.42E+00	4.76E-02	2.51E+00
	563.25	8.34	-1.50E-01		4.05E-01
	569.33	15.37	-1.17E-01		2.13E-01
	604.72	97.62	-5.14E-03		5.15E-02
	795.86	85.46	1.58E-02		4.76E-02
	801.95	8.69	-1.30E-01		4.71E-01
	1038.61	0.99	-1.35E+00		4.33E+00
	1167.97	1.79	9.96E-01		2.87E+00
	1365.19	3.02	2.94E-01		1.16E+00
Cs-137	661.66	85.10	-7.20E-03	4.57E-02	4.57E-02
Eu-152	121.78	28.67	1.57E-02	1.14E-01	1.14E-01
	244.70	7.61	-1.63E-01		4.94E-01
	295.94	0.45	6.53E+00		8.75E+00
	344.28	26.60	-1.02E-01		1.28E-01
	367.79	0.86	1.28E+00		3.85E+00
	411.12	2.24	-4.30E-01		1.27E+00
	443.96	2.83	-7.14E-01		9.93E-01
	488.68	0.42	9.75E-01		7.83E+00
	563.99	0.49	-7.31E-01		7.05E+00
	586.26	0.46	-1.05E+00		1.21E+01
	678.62	0.47	2.12E+00		7.35E+00
	688.67	0.86	1.54E+00		4.37E+00
	719.35	0.28	-1.44E+00		1.29E+01
	778.90	12.96	-3.41E-01		2.60E-01
	810.45	0.32	7.44E-01		1.21E+01
	867.37	4.26	-7.74E-01		7.78E-01
	919.33	0.43	-8.30E-01		8.42E+00
	964.08	14.65	-1.50E-01		3.79E-01
	1085.87	10.24	8.72E-02		4.07E-01
	1089.74	1.73	2.33E-01		2.64E+00
	1112.07	13.69	-1.06E-01		3.96E-01
	1212.95	1.43	-9.54E-01		3.97E+00
	1249.94	0.19	-3.72E+00		3.16E+01
	1299.14	1.63	9.19E-01		2.93E+00
	1408.01	21.07	1.27E-01		2.35E-01
	1457.64	0.50	-3.50E+00		4.07E+01
	1528.10	0.28	-8.09E+00		1.18E+01
Eu-154	123.07	40.40	-6.13E-03	8.06E-02	8.06E-02
	247.93	6.89	1.91E-01		4.90E-01
	591.76	4.95	-2.47E-01		7.78E-01
	692.42	1.78	-7.52E-02		2.04E+00
	723.30	20.06	1.24E-02		2.05E-01
	756.80	4.52	2.47E-01		9.59E-01
	873.18	12.08	1.55E-01		3.48E-01

Analysis Report for 09-Oct-19-10029

L1-12202B-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.03E-03	8.06E-02	4.49E-01
	1004.76	18.01	6.83E-02		2.41E-01
	1274.43	34.80	5.43E-02		1.60E-01
	1596.48	1.80	1.06E+00		2.27E+00
Eu-155	45.30	1.31	1.91E+00	1.77E-01	1.07E+01
	60.01	1.22	-3.54E+00		1.15E+01
	86.55	30.70	-1.37E-02		1.77E-01
	105.31	21.10	8.53E-02		1.95E-01
Ra-226	186.21	3.64	1.01E-01	9.95E-01	9.95E-01
Pa-231	27.36	10.30	-1.05E-01	1.09E+00	1.09E+00
	283.69	1.70	-2.97E-01		1.76E+00
	300.07	2.47	4.43E-03		1.38E+00
	302.65	2.20	2.20E-01		1.51E+00
	330.06	1.40	3.28E-01		2.26E+00
U-235	143.76	10.96	2.14E-03	6.36E-02	2.99E-01
	163.33	5.08	4.71E-01		7.24E-01
	185.71	57.20	2.59E-02		6.36E-02
	202.11	1.08	-1.29E-01		3.17E+00
	205.31	5.01	7.04E-02		7.14E-01
Am-241	59.54	35.90	-2.03E-02	4.21E-01	4.21E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10030

L1-12202B-FSGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10030
Sample Description	: L1-12202B-FSGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.503E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:28:00AM
Acquisition Started	: 10/9/2019 11:29:50AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.3 seconds
Dead Time	: 0.15 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80364
Fill Height	: 1502.88 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 11:44:54AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 10/9/19 - 1500

J Graham

Analysis Report for 09-Oct-19-10030

L1-12202B-FSGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.28	307 -	314	309.85	1.82E+01	11.21	5.28E+01	0.65
2	238.64	946 -	959	954.66	1.17E+02	15.98	5.02E+01	0.66
3	351.90	1401 -	1415	1407.34	6.45E+01	11.90	2.65E+01	1.26
4	583.13	2324 -	2336	2331.74	2.39E+01	9.72	2.61E+01	0.74
5	608.94	2428 -	2443	2434.93	4.70E+01	9.12	1.20E+01	0.63
6	1460.71	5830 -	5854	5842.65	3.61E+02	20.00	9.44E+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	9.04E+00	6.36E-01
Tl-208	1.00	583.19	*	85.00	4.01E-02	1.65E-02
Bi-211	0.89	351.07	*	13.02	4.96E-01	9.98E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.09E-01	3.33E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.21E-01	1.38E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.52E-01	3.08E-02

Analysis Report for 09-Oct-19-10030

L1-12202B-FSGS-005SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.81E-01	3.64E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	3.89E-01	2.44E-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	0.998	9.04E+00	6.36E-01	
Tl-208	1.000	4.01E-02	1.65E-02	

Analysis Report for 09-Oct-19-10030

L1-12202B-FSGS-005SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
?	Bi-211	0.895	4.96E-01	9.98E-02	
	Pb-212	1.000	2.09E-01	3.33E-02	
?	Pb212-XR	0.997	2.21E-01	1.38E-01	
	Bi-214	0.991	1.52E-01	3.08E-02	
?	Pb-214	1.000	1.81E-01	3.64E-02	
?	Pb214-XR	0.997	3.89E-01	2.44E-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 09-Oct-19-10030
L1-12202B-FSGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 11:44:54AM
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	4.96E-02	5.94E-02	5.94E-02
	BE-7	477.60		10.44	4.65E-01	4.68E-01	4.68E-01
+	K-40	1460.82	*	10.66	9.04E+00	6.06E-01	6.06E-01
	Mn-54	834.85		99.98	3.60E-02	5.62E-02	5.62E-02
	Co-60	1173.23		99.85	-3.13E-02	4.68E-02	6.58E-02
		1332.49		99.98	-4.36E-03		4.68E-02
	Nb-94	702.65		99.81	-5.14E-02	4.11E-02	4.11E-02
		871.09		99.89	5.80E-03		5.54E-02
	Ag-108m	79.13		6.60	-1.42E-01	4.40E-02	1.76E+00
		433.94		90.50	-3.37E-02		4.40E-02
		614.28		89.80	-1.38E-02		5.99E-02
		722.94		90.80	2.20E-02		5.68E-02
	Sb-125	176.31		6.84	-2.21E-01	1.49E-01	5.98E-01
		380.45		1.52	3.49E-01		2.50E+00
		427.87		29.60	1.27E-01		1.49E-01
		463.36		10.49	-9.67E-02		4.02E-01
		600.60		17.65	8.51E-02		2.71E-01
		606.71		4.98	7.90E-01		1.37E+00
		635.95		11.22	7.76E-02		4.22E-01

Analysis Report for 09-Oct-19-10030

L1-12202B-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.72E+00	1.49E-01	2.52E+00
Ba-133	79.61	2.65	-6.85E-01	8.03E-02	4.26E+00
	81.00	32.90	-2.44E-01		2.89E-01
	276.40	7.16	-2.75E-02		5.52E-01
	302.85	18.34	-1.22E-01		1.91E-01
	356.01	62.05	4.43E-03		8.03E-02
	383.85	8.94	-1.38E-01		4.22E-01
Cs-134	475.36	1.48	1.00E+00	6.19E-02	3.20E+00
	563.25	8.34	2.01E-01		5.29E-01
	569.33	15.37	4.15E-03		3.00E-01
	604.72	97.62	1.38E-02		6.69E-02
	795.86	85.46	1.06E-03		6.19E-02
	801.95	8.69	-2.44E-01		6.29E-01
	1038.61	0.99	1.34E+00		5.63E+00
	1167.97	1.79	-1.89E+00		4.19E+00
	1365.19	3.02	1.89E-01		1.81E+00
Cs-137	661.66	85.10	-7.76E-03	4.91E-02	4.91E-02
Eu-152	121.78	28.67	-1.85E-02	1.53E-01	1.65E-01
	244.70	7.61	-2.76E-01		5.90E-01
	295.94	0.45	1.18E+01		1.15E+01
	344.28	26.60	5.13E-02		1.53E-01
	367.79	0.86	-2.64E+00		4.45E+00
	411.12	2.24	-4.47E-01		1.75E+00
	443.96	2.83	-1.96E-01		1.48E+00
	488.68	0.42	2.98E+00		1.06E+01
	563.99	0.49	2.34E+00		8.98E+00
	586.26	0.46	-7.62E+00		1.42E+01
	678.62	0.47	3.34E+00		9.16E+00
	688.67	0.86	4.57E+00		5.42E+00
	719.35	0.28	3.83E+00		1.64E+01
	778.90	12.96	-2.16E-01		3.11E-01
	810.45	0.32	1.03E+01		1.82E+01
	867.37	4.26	-9.68E-02		1.20E+00
	919.33	0.43	-1.26E+01		1.20E+01
	964.08	14.65	1.22E-01		4.50E-01
	1085.87	10.24	-4.03E-01		5.90E-01
	1089.74	1.73	-3.23E+00		3.44E+00
	1112.07	13.69	-5.04E-01		4.77E-01
	1212.95	1.43	6.80E-01		4.56E+00
	1249.94	0.19	1.33E+01		3.95E+01
	1299.14	1.63	3.49E+00		4.39E+00
	1408.01	21.07	-3.79E-01		2.13E-01
	1457.64	0.50	1.95E+02		5.09E+01
	1528.10	0.28	5.89E+00		1.44E+01
Eu-154	123.07	40.40	-1.10E-01	1.12E-01	1.12E-01
	247.93	6.89	3.90E-01		6.08E-01
	591.76	4.95	2.28E-02		8.48E-01
	692.42	1.78	7.14E-01		2.78E+00
	723.30	20.06	2.14E-02		2.57E-01
	756.80	4.52	-2.11E-01		1.10E+00
	873.18	12.08	2.50E-01		4.72E-01

Analysis Report for 09-Oct-19-10030

L1-12202B-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.38E-01	1.12E-01	4.77E-01
	1004.76	18.01	1.75E-01		2.79E-01
	1274.43	34.80	-1.00E-01		1.87E-01
	1596.48	1.80	5.43E-01		2.62E+00
Eu-155	45.30	1.31	5.99E+00	2.66E-01	3.05E+01
	60.01	1.22	-8.64E+00		2.97E+01
	86.55	30.70	-1.91E-02		2.66E-01
	105.31	21.10	6.27E-02		2.88E-01
Ra-226	186.21	3.64	4.31E-01	1.14E+00	1.14E+00
Pa-231	27.36	10.30	1.44E+00	1.50E+00	3.14E+00
	283.69	1.70	6.31E-01		2.51E+00
	300.07	2.47	-2.22E+00		1.50E+00
	302.65	2.20	-8.27E-01		1.60E+00
	330.06	1.40	-1.19E+00		2.93E+00
U-235	143.76	10.96	-4.02E-02	7.17E-02	4.05E-01
	163.33	5.08	-7.42E-02		7.79E-01
	185.71	57.20	1.61E-02		7.17E-02
	202.11	1.08	-5.05E-01		3.59E+00
	205.31	5.01	-1.37E-01		7.65E-01
Am-241	59.54	35.90	4.54E-01	1.07E+00	1.07E+00

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

Apex-Gamma

Analysis Report for 09-Oct-19-10031

L1-12202B-FSGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10031
Sample Description	: L1-12202B-FSGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.734E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:30:00AM
Acquisition Started	: 10/9/2019 11:29:57AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80365
Fill Height	: 1733.59 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 11:45:10AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/9/19 - 1500

J Graham

Analysis Report for 09-Oct-19-10031

L1-12202B-FSGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.84	947 -	960	954.94	1.42E+02	16.59	4.85E+01	1.03
2	295.40	1175 -	1185	1180.90	3.74E+01	10.61	3.16E+01	0.95
3	352.07	1398 -	1412	1407.30	8.68E+01	10.92	1.13E+01	1.11
4	583.01	2324 -	2336	2330.18	4.26E+01	7.72	6.43E+00	0.60
5	609.18	2428 -	2441	2434.76	6.02E+01	9.62	1.18E+01	0.40
6	1460.03	5828 -	5851	5838.07	3.97E+02	20.63	7.81E+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	0.90	1460.82	*	10.66	8.62E+00	5.84E-01
Tl-208	0.99	583.19	*	85.00	6.24E-02	1.19E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.20E-01	3.14E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.70E-01	2.90E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 09-Oct-19-10031

L1-12202B-FSGS-006SS

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	1.57E-01	4.61E-02
		351.93	*	35.60	2.14E-01	3.19E-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	0.905	8.62E+00	5.84E-01	
Tl-208	0.995	6.24E-02	1.19E-02	
Pb-212	0.994	2.20E-01	3.14E-02	
Bi-214	0.999	1.70E-01	2.90E-02	
Pb-214	0.997	1.95E-01	2.62E-02	

Analysis Report for 09-Oct-19-10031

L1-12202B-FSGS-006SS

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10031

L1-12202B-FSGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 11:45:10AM
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	8.80E-02	5.32E-02	5.32E-02
	BE-7	477.60		10.44	5.41E-01	4.23E-01	4.23E-01
+	K-40	1460.82	*	10.66	8.62E+00	4.55E-01	4.55E-01
	Mn-54	834.85		99.98	-6.57E-03	3.60E-02	3.60E-02
	Co-60	1173.23		99.85	9.33E-03	5.80E-02	7.59E-02
		1332.49		99.98	4.17E-02		5.80E-02
	Nb-94	702.65		99.81	1.34E-02	4.13E-02	4.13E-02
		871.09		99.89	2.57E-02		4.46E-02
	Ag-108m	79.13		6.60	7.18E-01	3.51E-02	1.17E+00
		433.94		90.50	5.21E-04		3.51E-02
		614.28		89.80	-5.06E-02		5.71E-02
		722.94		90.80	3.03E-02		5.56E-02
	Sb-125	176.31		6.84	1.29E-01	1.10E-01	4.25E-01
		380.45		1.52	-2.29E-01		2.33E+00
		427.87		29.60	6.98E-02		1.10E-01
		463.36		10.49	1.88E-01		3.56E-01
		600.60		17.65	9.59E-02		2.28E-01
		606.71		4.98	2.07E+00		1.31E+00
		635.95		11.22	8.36E-02		3.59E-01

Analysis Report for 09-Oct-19-10031

L1-12202B-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	6.50E-01	1.10E-01	2.13E+00
Ba-133	79.61	2.65	2.29E+00	6.33E-02	2.83E+00
	81.00	32.90	-4.72E-01		1.67E-01
	276.40	7.16	-4.36E-03		4.62E-01
	302.85	18.34	1.06E-01		1.65E-01
	356.01	62.05	-7.44E-02		6.33E-02
	383.85	8.94	2.57E-01		4.08E-01
Cs-134	475.36	1.48	8.32E-01	4.83E-02	2.84E+00
	563.25	8.34	-6.53E-01		4.68E-01
	569.33	15.37	-2.04E-01		2.14E-01
	604.72	97.62	-5.02E-02		5.78E-02
	795.86	85.46	-1.71E-03		4.83E-02
	801.95	8.69	4.44E-02		5.48E-01
	1038.61	0.99	-5.01E+00		4.31E+00
	1167.97	1.79	2.74E+00		4.19E+00
	1365.19	3.02	1.64E-01		1.57E+00
Cs-137	661.66	85.10	-2.07E-02	4.29E-02	4.29E-02
Eu-152	121.78	28.67	-2.70E-02	1.09E-01	1.09E-01
	244.70	7.61	4.84E-01		4.60E-01
	295.94	0.45	4.48E+00		9.12E+00
	344.28	26.60	1.83E-02		1.09E-01
	367.79	0.86	-5.81E-01		3.53E+00
	411.12	2.24	-3.83E-01		1.33E+00
	443.96	2.83	-4.20E-01		1.23E+00
	488.68	0.42	-8.26E-01		8.32E+00
	563.99	0.49	-1.23E+01		7.44E+00
	586.26	0.46	-3.96E+00		1.15E+01
	678.62	0.47	1.01E+00		8.13E+00
	688.67	0.86	-2.67E-01		5.39E+00
	719.35	0.28	1.07E+00		1.59E+01
	778.90	12.96	-3.26E-03		3.19E-01
	810.45	0.32	-7.45E+00		1.35E+01
	867.37	4.26	-5.85E-01		8.87E-01
	919.33	0.43	5.79E+00		1.17E+01
	964.08	14.65	-5.69E-02		4.27E-01
	1085.87	10.24	-1.43E-01		5.46E-01
	1089.74	1.73	8.79E-01		3.55E+00
	1112.07	13.69	-4.40E-02		3.90E-01
	1212.95	1.43	3.49E+00		5.19E+00
	1249.94	0.19	1.00E+01		3.60E+01
	1299.14	1.63	1.61E+00		3.11E+00
	1408.01	21.07	5.61E-02		2.48E-01
	1457.64	0.50	1.90E+02		4.61E+01
	1528.10	0.28	-5.31E+00		1.32E+01
Eu-154	123.07	40.40	-2.28E-02	7.60E-02	7.60E-02
	247.93	6.89	2.37E-01		4.06E-01
	591.76	4.95	-7.95E-03		6.71E-01
	692.42	1.78	1.76E+00		2.76E+00
	723.30	20.06	8.42E-02		2.49E-01
	756.80	4.52	-5.15E-01		8.82E-01
	873.18	12.08	-6.85E-02		3.88E-01

Analysis Report for 09-Oct-19-10031

L1-12202B-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-8.38E-03	7.60E-02	4.82E-01
	1004.76	18.01	9.48E-02		3.00E-01
	1274.43	34.80	-5.84E-02		1.50E-01
	1596.48	1.80	-1.90E+00		2.02E+00
Eu-155	45.30	1.31	-2.35E+00	1.92E-01	1.16E+01
	60.01	1.22	-1.23E+00		1.29E+01
	86.55	30.70	1.85E-01		1.94E-01
	105.31	21.10	5.40E-02		1.92E-01
Ra-226	186.21	3.64	4.63E-01	8.80E-01	8.80E-01
Pa-231	27.36	10.30	6.90E-01	1.26E+00	1.26E+00
	283.69	1.70	4.16E-01		1.92E+00
	300.07	2.47	-1.05E+00		1.31E+00
	302.65	2.20	1.17E+00		1.38E+00
	330.06	1.40	-3.11E-01		2.24E+00
U-235	143.76	10.96	2.07E-02	5.54E-02	3.01E-01
	163.33	5.08	-2.47E-03		6.19E-01
	185.71	57.20	3.47E-02		5.54E-02
	202.11	1.08	-9.95E-01		2.69E+00
	205.31	5.01	3.11E-01		6.28E-01
Am-241	59.54	35.90	-2.19E-01	4.37E-01	4.37E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10032

L1-12202B-FSGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10032
Sample Description	: L1-12202B-FSGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.517E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:32:00AM
Acquisition Started	: 10/9/2019 11:30:05AM
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	: 9/29/2018
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80366
Fill Height	: 1516.85 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 11:45:09AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 10/9/19 - 1500

T Graham

Analysis Report for 09-Oct-19-10032

L1-12202B-FSGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.72	947 -	963	955.34	1.40E+02	19.24	7.28E+01	0.70
2	351.91	1400 -	1413	1407.64	7.84E+01	12.65	2.96E+01	0.77
3	609.35	2429 -	2444	2436.65	6.24E+01	11.00	1.96E+01	1.03
4	1460.73	5830 -	5855	5843.27	3.90E+02	20.79	9.83E+00	1.87

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.19E+00	5.63E-01
Bi-211	0.89	351.07	*	13.02	5.22E-01	9.42E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.20E-01	3.50E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.72E-01	3.20E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		

Analysis Report for 09-Oct-19-10032

L1-12202B-FSGS-007SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.91E-01	3.44E-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	0.999	8.19E+00	5.63E-01	
?	Bi-211	0.893	5.22E-01	9.42E-02	
	Pb-212	0.999	2.20E-01	3.50E-02	
	Bi-214	1.000	1.72E-01	3.20E-02	
?	Pb-214	1.000	1.91E-01	3.44E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10032

L1-12202B-FSGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 11:45:09AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	2.25E-02	5.37E-02	5.37E-02
	BE-7	477.60		10.44	2.34E-01	4.28E-01	4.28E-01
+	K-40	1460.82	*	10.66	8.19E+00	5.22E-01	5.22E-01
	Mn-54	834.85		99.98	2.88E-02	4.89E-02	4.89E-02
	Co-60	1173.23		99.85	4.86E-02	3.93E-02	6.33E-02
		1332.49		99.98	-3.37E-02		3.93E-02
	Nb-94	702.65		99.81	2.87E-02	4.62E-02	4.98E-02
		871.09		99.89	1.68E-02		4.62E-02
	Ag-108m	79.13		6.60	-4.95E-01	3.92E-02	1.43E+00
		433.94		90.50	4.46E-03		3.92E-02
		614.28		89.80	-2.98E-03		7.04E-02
		722.94		90.80	5.05E-02		5.13E-02
	Sb-125	176.31		6.84	4.33E-02	1.27E-01	5.18E-01
		380.45		1.52	-9.47E-01		2.34E+00
		427.87		29.60	6.16E-02		1.27E-01
		463.36		10.49	6.84E-02		3.60E-01
		600.60		17.65	-8.15E-02		2.42E-01
		606.71		4.98	2.02E+00		1.32E+00
		635.95		11.22	-2.42E-01		3.03E-01

Analysis Report for 09-Oct-19-10032

L1-12202B-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.49E-01	1.27E-01	2.48E+00
Ba-133	79.61	2.65	-6.38E-01	7.85E-02	3.46E+00
	81.00	32.90	-1.23E-01		2.53E-01
	276.40	7.16	2.30E-02		5.00E-01
	302.85	18.34	-1.94E-01		1.73E-01
	356.01	62.05	-6.66E-02		7.85E-02
	383.85	8.94	1.91E-01		4.29E-01
Cs-134	475.36	1.48	2.86E+00	5.47E-02	2.84E+00
	563.25	8.34	-1.72E-01		4.75E-01
	569.33	15.37	5.62E-02		2.62E-01
	604.72	97.62	-2.81E-02		6.16E-02
	795.86	85.46	3.08E-02		5.47E-02
	801.95	8.69	-1.36E-01		5.26E-01
	1038.61	0.99	-3.42E+00		5.40E+00
	1167.97	1.79	1.08E+00		3.98E+00
	1365.19	3.02	1.27E+00		1.64E+00
Cs-137	661.66	85.10	-4.43E-02	5.11E-02	5.11E-02
Eu-152	121.78	28.67	3.16E-02	1.31E-01	1.37E-01
	244.70	7.61	-2.10E-01		5.00E-01
	295.94	0.45	6.45E+00		9.96E+00
	344.28	26.60	-7.90E-02		1.31E-01
	367.79	0.86	-9.29E-01		3.79E+00
	411.12	2.24	5.67E-01		1.74E+00
	443.96	2.83	3.89E-01		1.31E+00
	488.68	0.42	-5.48E+00		7.52E+00
	563.99	0.49	4.38E+00		8.33E+00
	586.26	0.46	1.14E+01		1.20E+01
	678.62	0.47	2.77E+00		8.68E+00
	688.67	0.86	-2.69E+00		4.47E+00
	719.35	0.28	-7.89E+00		1.16E+01
	778.90	12.96	-6.68E-02		3.50E-01
	810.45	0.32	1.69E+01		1.60E+01
	867.37	4.26	-3.55E-01		1.11E+00
	919.33	0.43	-4.80E-01		1.23E+01
	964.08	14.65	1.96E-02		4.18E-01
	1085.87	10.24	-9.43E-02		4.44E-01
	1089.74	1.73	9.99E-01		3.04E+00
	1112.07	13.69	-2.93E-01		4.35E-01
	1212.95	1.43	-1.14E+00		4.83E+00
	1249.94	0.19	-6.63E+00		3.31E+01
	1299.14	1.63	8.19E-01		3.57E+00
	1408.01	21.07	1.24E-01		2.01E-01
	1457.64	0.50	1.82E+02		4.46E+01
	1528.10	0.28	-2.87E+00		1.12E+01
Eu-154	123.07	40.40	-1.00E-03	9.54E-02	9.54E-02
	247.93	6.89	9.34E-02		5.04E-01
	591.76	4.95	4.54E-01		9.06E-01
	692.42	1.78	4.44E-01		2.17E+00
	723.30	20.06	8.96E-02		2.30E-01
	756.80	4.52	2.53E-01		9.60E-01
	873.18	12.08	-1.64E-03		3.71E-01

Analysis Report for 09-Oct-19-10032

L1-12202B-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.61E-01	9.54E-02	4.28E-01
	1004.76	18.01	-6.35E-02		2.90E-01
	1274.43	34.80	6.27E-02		1.65E-01
	1596.48	1.80	-4.28E+00		2.19E+00
Eu-155	45.30	1.31	1.64E+01	1.97E-01	1.99E+01
	60.01	1.22	-1.55E+00		2.28E+01
	86.55	30.70	4.34E-02		2.38E-01
	105.31	21.10	-9.64E-02		1.97E-01
Ra-226	186.21	3.64	8.80E-01	1.04E+00	1.04E+00
Pa-231	27.36	10.30	1.92E+00	1.44E+00	2.26E+00
	283.69	1.70	-6.87E-01		2.06E+00
	300.07	2.47	-1.10E+00		1.57E+00
	302.65	2.20	-2.19E+00		1.44E+00
	330.06	1.40	9.40E-01		2.61E+00
U-235	143.76	10.96	-2.13E-02	6.52E-02	3.20E-01
	163.33	5.08	-1.41E-01		6.83E-01
	185.71	57.20	4.38E-02		6.52E-02
	202.11	1.08	2.27E-01		3.27E+00
	205.31	5.01	-3.51E-01		6.85E-01
Am-241	59.54	35.90	1.01E-01	8.10E-01	8.10E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10033
L1-12202B-FQGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10033
Sample Description	: L1-12202B-FQGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.453E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:32:00AM
Acquisition Started	: 10/9/2019 11:59:34AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80367
Fill Height	: 1452.90 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 12:14:36PM

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

DATA VALIDATED 10/9/19 - 1500
J Graham

Analysis Report for 09-Oct-19-10033

L1-12202B-FQGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.67	948 -	963	955.15	1.31E+02	17.60	5.86E+01	0.87
2	295.49	1177 -	1188	1182.16	3.18E+01	10.89	3.43E+01	0.56
3	338.33	1348 -	1358	1353.37	3.06E+01	8.26	1.54E+01	0.68
4	351.77	1400 -	1413	1407.06	7.68E+01	11.39	1.92E+01	0.87
5	583.06	2324 -	2337	2331.56	3.64E+01	8.90	1.56E+01	0.90
6	609.39	2429 -	2446	2436.81	7.30E+01	10.14	9.00E+00	0.87
7	1460.63	5830 -	5855	5842.89	4.12E+02	21.61	1.29E+01	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	0.99	1460.82	*	10.66	8.75E+00	5.96E-01
Tl-208	0.99	583.19	*	85.00	5.27E-02	1.33E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.08E-01	3.25E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.03E-01	3.08E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 09-Oct-19-10033

L1-12202B-FQGS-007SS

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	1.33E-01	4.70E-02
		351.93	*	35.60	1.89E-01	3.18E-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	2.31E-01	6.52E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 09-Oct-19-10033

L1-12202B-FQGS-007SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.994	8.75E+00	5.96E-01	
	Tl-208	0.997	5.27E-02	1.33E-02	
X	Bi-211	0.926			
	Pb-212	1.000	2.08E-01	3.25E-02	
	Bi-214	1.000	2.03E-01	3.08E-02	
	Pb-214	0.994	1.71E-01	2.63E-02	
	Ac-228	1.000	2.31E-01	6.52E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10033

L1-12202B-FQGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 12:14:36PM
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	3.18E-02	4.92E-02	4.92E-02
	BE-7	477.60		10.44	-2.99E-01	3.36E-01	3.36E-01
+	K-40	1460.82	*	10.66	8.75E+00	5.95E-01	5.95E-01
	Mn-54	834.85		99.98	1.02E-02	4.94E-02	4.94E-02
	Co-60	1173.23		99.85	-3.84E-02	5.15E-02	6.33E-02
		1332.49		99.98	2.61E-02		5.15E-02
	Nb-94	702.65		99.81	7.80E-03	3.72E-02	4.89E-02
		871.09		99.89	-2.21E-02		3.72E-02
	Ag-108m	79.13		6.60	-8.82E-01	3.53E-02	1.43E+00
		433.94		90.50	2.93E-02		3.53E-02
		614.28		89.80	-1.43E-02		6.90E-02
		722.94		90.80	2.26E-02		5.00E-02
	Sb-125	176.31		6.84	7.79E-02	1.16E-01	5.06E-01
		380.45		1.52	8.55E-01		2.38E+00
		427.87		29.60	1.41E-02		1.16E-01
		463.36		10.49	6.38E-03		3.53E-01
		600.60		17.65	1.60E-01		2.44E-01
		606.71		4.98	7.20E-01		1.28E+00
		635.95		11.22	7.85E-02		3.68E-01

Analysis Report for 09-Oct-19-10033

L1-12202B-FQGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	4.20E-01	1.16E-01	2.17E+00
Ba-133	79.61	2.65	-2.23E+00	7.17E-02	3.51E+00
	81.00	32.90	-2.38E-01		2.65E-01
	276.40	7.16	-4.34E-01		4.55E-01
	302.85	18.34	2.81E-02		1.97E-01
	356.01	62.05	-1.97E-02		7.17E-02
	383.85	8.94	1.69E-01		4.10E-01
Cs-134	475.36	1.48	1.51E+00	5.15E-02	2.47E+00
	563.25	8.34	1.01E-01		4.96E-01
	569.33	15.37	-6.42E-02		2.56E-01
	604.72	97.62	-5.90E-02		5.99E-02
	795.86	85.46	1.15E-02		5.15E-02
	801.95	8.69	-6.03E-03		5.02E-01
	1038.61	0.99	-2.47E+00		4.80E+00
	1167.97	1.79	-1.63E+00		3.35E+00
	1365.19	3.02	-3.92E-01		1.58E+00
Cs-137	661.66	85.10	3.53E-02	5.16E-02	5.16E-02
Eu-152	121.78	28.67	-1.97E-02	1.26E-01	1.41E-01
	244.70	7.61	1.58E-02		4.99E-01
	295.94	0.45	7.18E+00		1.01E+01
	344.28	26.60	8.13E-03		1.26E-01
	367.79	0.86	-1.10E+00		3.67E+00
	411.12	2.24	9.37E-02		1.60E+00
	443.96	2.83	6.45E-01		1.22E+00
	488.68	0.42	-3.09E+00		8.45E+00
	563.99	0.49	7.36E-01		8.51E+00
	586.26	0.46	-6.12E+00		1.20E+01
	678.62	0.47	1.80E+00		8.89E+00
	688.67	0.86	-3.64E+00		4.80E+00
	719.35	0.28	4.56E+00		1.62E+01
	778.90	12.96	-3.74E-01		2.86E-01
	810.45	0.32	-5.83E+00		1.23E+01
	867.37	4.26	-1.46E-01		1.02E+00
	919.33	0.43	-1.41E+01		1.10E+01
	964.08	14.65	2.25E-01		4.69E-01
	1085.87	10.24	-1.12E-01		5.35E-01
	1089.74	1.73	1.83E+00		3.08E+00
	1112.07	13.69	-1.81E-01		4.18E-01
	1212.95	1.43	-5.92E-01		4.84E+00
	1249.94	0.19	-5.45E+00		3.08E+01
	1299.14	1.63	8.29E-01		3.56E+00
	1408.01	21.07	3.30E-02		1.97E-01
	1457.64	0.50	1.96E+02		4.63E+01
	1528.10	0.28	2.08E-01		1.22E+01
Eu-154	123.07	40.40	6.43E-02	1.02E-01	1.02E-01
	247.93	6.89	-1.54E-02		5.05E-01
	591.76	4.95	-2.38E-01		8.34E-01
	692.42	1.78	4.96E-01		2.61E+00
	723.30	20.06	9.44E-02		2.24E-01
	756.80	4.52	6.80E-01		9.13E-01
	873.18	12.08	4.17E-02		3.30E-01

Analysis Report for 09-Oct-19-10033

L1-12202B-FQGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.51E-02	1.02E-01	4.41E-01
	1004.76	18.01	1.99E-02		2.94E-01
	1274.43	34.80	1.57E-02		1.47E-01
	1596.48	1.80	-1.75E+00		1.51E+00
Eu-155	45.30	1.31	2.17E+00	2.15E-01	1.93E+01
	60.01	1.22	-1.17E+01		2.16E+01
	86.55	30.70	-1.36E-01		2.29E-01
	105.31	21.10	-6.14E-02		2.15E-01
Ra-226	186.21	3.64	-3.23E-01	9.96E-01	9.96E-01
Pa-231	27.36	10.30	1.74E+00	1.60E+00	2.44E+00
	283.69	1.70	-1.32E+00		1.98E+00
	300.07	2.47	6.25E-01		1.60E+00
	302.65	2.20	-2.43E-01		1.63E+00
	330.06	1.40	3.60E-01		2.50E+00
U-235	143.76	10.96	1.15E-01	6.22E-02	3.33E-01
	163.33	5.08	1.59E-01		7.42E-01
	185.71	57.20	-1.94E-02		6.22E-02
	202.11	1.08	6.31E-02		3.19E+00
	205.31	5.01	-2.18E-01		6.98E-01
Am-241	59.54	35.90	-4.91E-01	7.68E-01	7.68E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10034

L1-12202B-FSGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10034
Sample Description	: L1-12202B-FSGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.691E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:34:00AM
Acquisition Started	: 10/9/2019 11:59:40AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80368
Fill Height	: 1690.88 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 12:14:42PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated 10/9/19 - 1500

J Graham

Analysis Report for 09-Oct-19-10034

L1-12202B-FSGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.64	473 -	481	477.46	1.47E+02	19.34	1.05E+02	1.10
2	351.93	698 -	708	703.81	1.08E+02	13.78	3.43E+01	1.49
3	477.51	952 -	960	954.76	3.38E+01	8.68	1.92E+01	1.26
4	583.28	1162 -	1171	1166.15	5.10E+01	9.22	1.50E+01	1.20
5	609.20	1213 -	1223	1217.98	5.39E+01	10.32	2.21E+01	0.96
6	1460.62	2915 -	2928	2921.30	4.38E+02	21.15	3.50E+00	1.97

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	3.11E-01	8.27E-02
K-40	0.99	1460.82	*	10.66	8.01E+00	5.21E-01
Tl-208	0.99	583.19	*	85.00	6.44E-02	1.23E-02
Bi-211	0.88	351.07	*	13.02	6.34E-01	9.58E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.03E-01	3.13E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.31E-01	2.63E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 09-Oct-19-10034

L1-12202B-FSGS-008SS

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	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.32E-01	3.50E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.999	3.11E-01	8.27E-02	
	K-40	0.994	8.01E+00	5.21E-01	
	Tl-208	0.999	6.44E-02	1.23E-02	
?	Bi-211	0.887	6.34E-01	9.58E-02	
	Pb-212	1.000	2.03E-01	3.13E-02	
	Bi-214	0.999	1.31E-01	2.63E-02	
?	Pb-214	0.514	2.32E-01	3.50E-02	

Analysis Report for 09-Oct-19-10034

L1-12202B-FSGS-008SS

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10034
L1-12202B-FSGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 12:14:42PM
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	5.94E-02	4.97E-02	4.97E-02
+	BE-7	477.60	*	10.44	3.11E-01	2.27E-01	2.27E-01
+	K-40	1460.82	*	10.66	8.01E+00	2.46E-01	2.46E-01
	Mn-54	834.85		99.98	-8.90E-03	4.19E-02	4.19E-02
	Co-60	1173.23		99.85	2.61E-02	4.99E-02	5.85E-02
		1332.49		99.98	6.92E-03		4.99E-02
	Nb-94	702.65		99.81	-1.38E-02	3.99E-02	3.99E-02
		871.09		99.89	2.09E-03		4.06E-02
	Ag-108m	79.13		6.60	2.61E-01	3.09E-02	1.14E+00
		433.94		90.50	2.99E-04		3.09E-02
		614.28		89.80	-9.81E-03		4.95E-02
		722.94		90.80	-2.03E-03		4.72E-02
	Sb-125	176.31		6.84	1.55E-01	9.26E-02	5.02E-01
		380.45		1.52	2.62E-01		2.03E+00
		427.87		29.60	-1.86E-02		9.26E-02
		463.36		10.49	1.76E-02		3.33E-01
		600.60		17.65	6.76E-02		2.11E-01
		606.71		4.98	-3.37E-01		1.03E+00
		635.95		11.22	-2.35E-02		3.08E-01

Analysis Report for 09-Oct-19-10034

L1-12202B-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.58E-01	9.26E-02	2.21E+00
Ba-133	79.61	2.65	-3.37E-01	6.65E-02	2.68E+00
	81.00	32.90	-1.32E-01		1.90E-01
	276.40	7.16	1.00E-01		4.43E-01
	302.85	18.34	-2.34E-02		1.75E-01
	356.01	62.05	-4.30E-02		6.65E-02
	383.85	8.94	-1.14E-01		3.50E-01
Cs-134	475.36	1.48	-1.82E+00	4.65E-02	2.69E+00
	563.25	8.34	-6.68E-02		4.14E-01
	569.33	15.37	1.48E-01		2.49E-01
	604.72	97.62	-2.70E-02		4.65E-02
	795.86	85.46	2.75E-02		5.22E-02
	801.95	8.69	-3.44E-01		4.30E-01
	1038.61	0.99	-1.96E+00		4.53E+00
	1167.97	1.79	-5.61E-01		3.04E+00
	1365.19	3.02	-6.80E-01		9.60E-01
Cs-137	661.66	85.10	2.67E-02	4.50E-02	4.50E-02
Eu-152	121.78	28.67	-6.83E-03	1.08E-01	1.08E-01
	244.70	7.61	-1.92E-01		4.52E-01
	295.94	0.45	6.30E+00		8.87E+00
	344.28	26.60	-5.58E-02		1.27E-01
	367.79	0.86	5.07E-01		3.78E+00
	411.12	2.24	1.60E+00		1.69E+00
	443.96	2.83	-5.18E-01		1.18E+00
	488.68	0.42	-9.28E-03		7.83E+00
	563.99	0.49	-3.93E-01		7.11E+00
	586.26	0.46	-2.61E+00		1.11E+01
	678.62	0.47	4.39E+00		7.85E+00
	688.67	0.86	6.70E-01		4.06E+00
	719.35	0.28	-2.13E+00		1.32E+01
	778.90	12.96	1.39E-01		3.39E-01
	810.45	0.32	2.28E+00		1.22E+01
	867.37	4.26	-8.38E-01		8.91E-01
	919.33	0.43	-1.23E+00		8.73E+00
	964.08	14.65	-5.55E-02		3.63E-01
	1085.87	10.24	6.65E-02		4.96E-01
	1089.74	1.73	1.06E+00		3.05E+00
	1112.07	13.69	-3.40E-01		3.90E-01
	1212.95	1.43	-1.23E+00		4.43E+00
	1249.94	0.19	-2.58E+00		2.66E+01
	1299.14	1.63	-4.42E-01		2.75E+00
	1408.01	21.07	1.03E-03		1.69E-01
	1457.64	0.50	-9.21E+00		4.03E+01
	1528.10	0.28	-1.61E+00		8.93E+00
Eu-154	123.07	40.40	1.63E-02	7.82E-02	7.82E-02
	247.93	6.89	1.68E-01		5.07E-01
	591.76	4.95	1.41E-01		7.52E-01
	692.42	1.78	3.45E-01		2.11E+00
	723.30	20.06	-5.42E-03		2.18E-01
	756.80	4.52	5.72E-01		8.08E-01
	873.18	12.08	-1.82E-01		3.21E-01

Analysis Report for 09-Oct-19-10034

L1-12202B-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.53E-01	7.82E-02	3.90E-01
	1004.76	18.01	1.44E-02		2.06E-01
	1274.43	34.80	2.51E-02		1.55E-01
	1596.48	1.80	-7.55E-01		1.70E+00
Eu-155	45.30	1.31	-3.28E+00	1.73E-01	9.96E+00
	60.01	1.22	-7.74E+00		1.13E+01
	86.55	30.70	-7.28E-02		1.73E-01
	105.31	21.10	7.81E-03		1.88E-01
Ra-226	186.21	3.64	5.48E-01	1.00E+00	1.00E+00
Pa-231	27.36	10.30	9.42E-01	1.17E+00	1.17E+00
	283.69	1.70	-2.86E-01		1.65E+00
	300.07	2.47	-2.19E+00		1.28E+00
	302.65	2.20	-1.95E-01		1.46E+00
	330.06	1.40	1.01E+00		2.37E+00
U-235	143.76	10.96	8.59E-02	6.34E-02	3.07E-01
	163.33	5.08	2.31E-01		6.91E-01
	185.71	57.20	3.15E-02		6.34E-02
	202.11	1.08	-1.94E-01		3.18E+00
	205.31	5.01	-2.72E-01		6.82E-01
Am-241	59.54	35.90	-2.17E-01	3.95E-01	3.95E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10035

L1-12202B-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10035
Sample Description	: L1-12202B-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.548E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:36:00AM
Acquisition Started	: 10/9/2019 11:59:46AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.15 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80369
Fill Height	: 1548.25 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 12:15:06PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/9/19 - 1500

J Graham

Analysis Report for 09-Oct-19-10035

L1-12202B-FSGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.15	305 -	315	309.34	2.06E+01	13.10	6.24E+01	0.62
2	238.68	951 -	961	954.83	9.86E+01	15.19	5.44E+01	0.86
3	352.11	1399 -	1416	1408.16	8.81E+01	11.87	1.59E+01	1.45
4	583.44	2326 -	2340	2332.99	5.21E+01	8.35	5.88E+00	0.41
5	609.30	2430 -	2443	2436.37	3.48E+01	9.06	1.72E+01	0.56
6	911.20	3637 -	3650	3643.78	3.40E+01	7.30	7.00E+00	1.27
7	1460.82	5832 -	5854	5843.12	3.75E+02	20.88	1.63E+01	1.57

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	9.31E+00	6.58E-01
Tl-208	0.98	583.19	*	85.00	8.68E-02	1.49E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.76E-01	3.06E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	2.51E-01	1.62E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	1.11E-01	2.98E-02

Analysis Report for 09-Oct-19-10035

L1-12202B-FSGS-009SS

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		
		351.93	*	35.60	2.46E-01	3.86E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	4.42E-01	2.86E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.53E-01	5.53E-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 09-Oct-19-10035

L1-12202B-FSGS-009SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	9.31E+00	6.58E-01	
	Tl-208	0.989	8.68E-02	1.49E-02	
	Pb-212	1.000	1.76E-01	3.06E-02	
?	Pb212-XR	1.000	2.51E-01	1.62E-01	
	Bi-214	1.000	1.11E-01	2.98E-02	
	Pb-214	0.997	2.46E-01	3.86E-02	
?	Pb214-XR	1.000	4.42E-01	2.86E-01	
	Ac-228	1.000	2.53E-01	5.53E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10035

L1-12202B-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 12:15:06PM
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	6.64E-02	6.34E-02	6.34E-02
	BE-7	477.60		10.44	-5.13E-02	4.29E-01	4.29E-01
+	K-40	1460.82	*	10.66	9.31E+00	7.31E-01	7.31E-01
	Mn-54	834.85		99.98	-1.79E-02	4.94E-02	4.94E-02
	Co-60	1173.23		99.85	-2.11E-02	6.39E-02	6.91E-02
		1332.49		99.98	-6.17E-03		6.39E-02
	Nb-94	702.65		99.81	2.68E-02	4.83E-02	4.83E-02
		871.09		99.89	2.46E-02		5.41E-02
	Ag-108m	79.13		6.60	-1.69E-01	3.71E-02	1.67E+00
		433.94		90.50	-2.34E-02		3.71E-02
		614.28		89.80	0.00E+00		6.33E-02
		722.94		90.80	-2.05E-02		6.38E-02
	Sb-125	176.31		6.84	-6.21E-02	1.27E-01	5.91E-01
		380.45		1.52	-1.07E+00		2.67E+00
		427.87		29.60	2.97E-02		1.27E-01
		463.36		10.49	1.33E-01		3.73E-01
		600.60		17.65	5.52E-02		2.59E-01
		606.71		4.98	1.41E+00		1.30E+00
		635.95		11.22	3.79E-02		4.07E-01

Analysis Report for 09-Oct-19-10035

L1-12202B-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.16E+00	1.27E-01	2.86E+00
Ba-133	79.61	2.65	6.38E-02	8.18E-02	3.99E+00
	81.00	32.90	-1.30E-01		2.82E-01
	276.40	7.16	2.73E-01		6.03E-01
	302.85	18.34	-4.10E-03		2.20E-01
	356.01	62.05	1.08E-02		8.18E-02
	383.85	8.94	1.04E-01		4.48E-01
Cs-134	475.36	1.48	3.67E-01	6.13E-02	2.92E+00
	563.25	8.34	2.24E-01		4.98E-01
	569.33	15.37	4.13E-02		2.90E-01
	604.72	97.62	-2.31E-02		6.13E-02
	795.86	85.46	6.65E-03		6.31E-02
	801.95	8.69	-7.26E-02		6.15E-01
	1038.61	0.99	3.31E+00		6.44E+00
	1167.97	1.79	-1.64E+00		4.00E+00
	1365.19	3.02	-6.26E-02		1.63E+00
Cs-137	661.66	85.10	-3.94E-03	4.96E-02	4.96E-02
Eu-152	121.78	28.67	2.11E-02	1.32E-01	1.61E-01
	244.70	7.61	3.54E-01		5.82E-01
	295.94	0.45	2.61E-01		1.05E+01
	344.28	26.60	-9.60E-02		1.32E-01
	367.79	0.86	6.31E-01		3.86E+00
	411.12	2.24	-1.03E+00		1.83E+00
	443.96	2.83	-1.30E-01		1.47E+00
	488.68	0.42	1.85E+00		9.56E+00
	563.99	0.49	4.08E+00		8.57E+00
	586.26	0.46	-7.00E-01		1.35E+01
	678.62	0.47	2.49E+00		9.24E+00
	688.67	0.86	1.47E+00		5.54E+00
	719.35	0.28	-5.36E+00		1.87E+01
	778.90	12.96	2.51E-01		3.81E-01
	810.45	0.32	9.53E+00		1.68E+01
	867.37	4.26	-8.32E-01		1.30E+00
	919.33	0.43	5.86E+00		1.31E+01
	964.08	14.65	4.20E-01		5.18E-01
	1085.87	10.24	2.68E-01		5.75E-01
	1089.74	1.73	-5.58E-01		3.35E+00
	1112.07	13.69	1.99E-01		5.06E-01
	1212.95	1.43	3.35E+00		5.08E+00
	1249.94	0.19	2.94E+01		3.65E+01
	1299.14	1.63	-7.79E-01		3.11E+00
	1408.01	21.07	2.14E-02		2.21E-01
	1457.64	0.50	2.12E+02		5.22E+01
	1528.10	0.28	5.84E+00		1.42E+01
Eu-154	123.07	40.40	2.92E-02	1.15E-01	1.15E-01
	247.93	6.89	3.44E-01		5.63E-01
	591.76	4.95	1.55E-01		8.42E-01
	692.42	1.78	1.27E+00		2.61E+00
	723.30	20.06	9.02E-02		3.00E-01
	756.80	4.52	2.43E-01		1.04E+00
	873.18	12.08	2.98E-01		4.42E-01

Analysis Report for 09-Oct-19-10035

L1-12202B-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.01E-01	1.15E-01	5.49E-01
	1004.76	18.01	3.78E-02		3.32E-01
	1274.43	34.80	1.20E-01		1.78E-01
	1596.48	1.80	-1.40E+00		1.77E+00
Eu-155	45.30	1.31	4.83E+00	2.77E-01	3.12E+01
	60.01	1.22	-8.85E+00		3.00E+01
	86.55	30.70	1.13E-01		2.79E-01
	105.31	21.10	1.70E-02		2.77E-01
Ra-226	186.21	3.64	9.65E-01	1.18E+00	1.18E+00
Pa-231	27.36	10.30	4.44E+00	1.62E+00	3.90E+00
	283.69	1.70	-2.42E-01		2.27E+00
	300.07	2.47	-1.87E+00		1.62E+00
	302.65	2.20	7.59E-01		1.85E+00
	330.06	1.40	-1.78E+00		2.62E+00
U-235	143.76	10.96	-1.46E-01	7.48E-02	3.90E-01
	163.33	5.08	1.34E-01		8.29E-01
	185.71	57.20	6.66E-02		7.48E-02
	202.11	1.08	-2.27E+00		3.23E+00
	205.31	5.01	-2.30E-01		7.51E-01
Am-241	59.54	35.90	5.22E-01	1.12E+00	1.12E+00

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

Apex-Gamma

Analysis Report for 09-Oct-19-10036

L1-12202B-FSGS-010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10036
Sample Description	: L1-12202B-FSGS-010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.573E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:38:00AM
Acquisition Started	: 10/9/2019 11:59:53AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80370
Fill Height	: 1573.38 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 12:14:58PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/9/19 - 1500

J Graham

Analysis Report for 09-Oct-19-10036

L1-12202B-FSGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.78	948 -	960	954.69	1.13E+02	16.80	6.44E+01	1.20
2	338.43	1349 -	1358	1352.81	3.05E+01	8.54	1.85E+01	0.82
3	352.11	1399 -	1414	1407.47	9.42E+01	12.39	1.98E+01	0.58
4	582.98	2323 -	2337	2330.06	4.38E+01	9.51	1.62E+01	0.54
5	609.16	2428 -	2441	2434.67	4.09E+01	8.96	1.41E+01	0.72
6	1460.12	5826 -	5851	5838.41	4.00E+02	20.92	9.22E+00	1.62

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.92	1460.82	*	10.66	8.90E+00	6.05E-01
Tl-208	0.99	583.19	*	85.00	6.54E-02	1.47E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.78E-01	3.02E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.18E-01	2.67E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 09-Oct-19-10036

L1-12202B-FSGS-010SS

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	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.36E-01	3.63E-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	2.34E-01	6.83E-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 09-Oct-19-10036

L1-12202B-FSGS-010SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.924	8.90E+00	6.05E-01	
Tl-208	0.993	6.54E-02	1.47E-02	
Pb-212	0.997	1.78E-01	3.02E-02	
Bi-214	0.998	1.18E-01	2.67E-02	
Pb-214	0.510	2.36E-01	3.63E-02	
Ac-228	1.000	2.34E-01	6.83E-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 09-Oct-19-10036

L1-12202B-FSGS-010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 12:14:58PM
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	6.02E-02	5.45E-02	5.45E-02
	BE-7	477.60		10.44	3.12E-01	4.44E-01	4.44E-01
+	K-40	1460.82	*	10.66	8.90E+00	5.28E-01	5.28E-01
	Mn-54	834.85		99.98	2.07E-02	5.27E-02	5.27E-02
	Co-60	1173.23		99.85	4.13E-02	4.31E-02	6.12E-02
		1332.49		99.98	-1.65E-02		4.31E-02
	Nb-94	702.65		99.81	-1.08E-02	4.21E-02	4.21E-02
		871.09		99.89	-1.69E-02		4.23E-02
	Ag-108m	79.13		6.60	6.47E-01	3.97E-02	1.14E+00
		433.94		90.50	4.75E-03		3.97E-02
		614.28		89.80	-2.45E-02		5.14E-02
		722.94		90.80	-1.25E-02		4.65E-02
	Sb-125	176.31		6.84	1.08E-01	1.14E-01	4.33E-01
		380.45		1.52	-7.40E-01		2.11E+00
		427.87		29.60	-1.71E-03		1.14E-01
		463.36		10.49	4.56E-02		3.47E-01
		600.60		17.65	1.14E-01		2.55E-01
		606.71		4.98	7.73E-01		1.22E+00
		635.95		11.22	1.40E-02		3.56E-01

Analysis Report for 09-Oct-19-10036

L1-12202B-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.27E-01	1.14E-01	2.28E+00
Ba-133	79.61	2.65	1.09E+00	6.59E-02	2.72E+00
	81.00	32.90	-2.78E-01		1.86E-01
	276.40	7.16	-7.72E-02		4.85E-01
	302.85	18.34	-9.00E-02		1.77E-01
	356.01	62.05	-3.01E-02		6.59E-02
	383.85	8.94	-2.23E-02		3.65E-01
Cs-134	475.36	1.48	2.97E+00	4.94E-02	3.13E+00
	563.25	8.34	-1.86E-01		4.66E-01
	569.33	15.37	-6.51E-02		2.34E-01
	604.72	97.62	-1.20E-02		6.04E-02
	795.86	85.46	-5.70E-04		4.94E-02
	801.95	8.69	3.48E-01		5.82E-01
	1038.61	0.99	5.64E+00		6.01E+00
	1167.97	1.79	5.67E-02		2.99E+00
	1365.19	3.02	8.19E-01		1.69E+00
Cs-137	661.66	85.10	2.16E-02	5.53E-02	5.53E-02
Eu-152	121.78	28.67	-3.15E-02	1.11E-01	1.11E-01
	244.70	7.61	-3.29E-02		4.72E-01
	295.94	0.45	5.61E+00		9.65E+00
	344.28	26.60	-5.01E-02		1.13E-01
	367.79	0.86	5.14E-01		4.04E+00
	411.12	2.24	-2.06E-01		1.53E+00
	443.96	2.83	3.13E-01		1.21E+00
	488.68	0.42	-7.55E+00		8.15E+00
	563.99	0.49	-5.15E+00		7.70E+00
	586.26	0.46	-1.74E+00		1.28E+01
	678.62	0.47	-5.85E+00		7.88E+00
	688.67	0.86	-2.72E+00		4.61E+00
	719.35	0.28	3.42E+00		1.46E+01
	778.90	12.96	1.76E-02		3.32E-01
	810.45	0.32	-7.07E+00		1.33E+01
	867.37	4.26	-3.87E-02		1.08E+00
	919.33	0.43	-1.65E-01		1.13E+01
	964.08	14.65	1.69E-01		4.19E-01
	1085.87	10.24	-1.30E-01		4.79E-01
	1089.74	1.73	5.20E-01		2.84E+00
	1112.07	13.69	-5.80E-01		4.18E-01
	1212.95	1.43	-1.15E+00		4.25E+00
	1249.94	0.19	-4.80E+00		3.22E+01
	1299.14	1.63	-8.70E-01		3.18E+00
	1408.01	21.07	5.88E-02		2.35E-01
	1457.64	0.50	1.96E+02		4.75E+01
	1528.10	0.28	-6.32E+00		1.27E+01
Eu-154	123.07	40.40	1.82E-02	8.22E-02	8.22E-02
	247.93	6.89	-3.28E-02		4.50E-01
	591.76	4.95	-4.05E-01		7.09E-01
	692.42	1.78	8.28E-01		2.34E+00
	723.30	20.06	7.14E-02		2.11E-01
	756.80	4.52	6.29E-01		9.63E-01
	873.18	12.08	-2.70E-02		3.84E-01

Analysis Report for 09-Oct-19-10036

L1-12202B-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.58E-01	8.22E-02	5.09E-01
	1004.76	18.01	9.39E-02		3.27E-01
	1274.43	34.80	-3.13E-02		2.03E-01
	1596.48	1.80	1.41E+00		2.55E+00
Eu-155	45.30	1.31	4.63E+00	1.89E-01	1.18E+01
	60.01	1.22	-2.49E-02		1.21E+01
	86.55	30.70	-1.79E-02		1.89E-01
	105.31	21.10	1.44E-02		1.93E-01
Ra-226	186.21	3.64	3.56E-01	9.50E-01	9.50E-01
Pa-231	27.36	10.30	1.13E+00	1.37E+00	1.37E+00
	283.69	1.70	-2.10E+00		1.68E+00
	300.07	2.47	-1.02E+00		1.41E+00
	302.65	2.20	-3.11E-01		1.51E+00
	330.06	1.40	1.31E+00		2.80E+00
U-235	143.76	10.96	1.29E-01	6.01E-02	3.16E-01
	163.33	5.08	2.59E-01		6.11E-01
	185.71	57.20	-1.35E-03		6.01E-02
	202.11	1.08	-3.98E-01		2.78E+00
	205.31	5.01	-2.31E-01		6.08E-01
Am-241	59.54	35.90	1.65E-02	4.21E-01	4.21E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10037

L1-12202B-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10037
Sample Description	: L1-12202B-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.717E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:40:00AM
Acquisition Started	: 10/9/2019 12:18:26PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80371
Fill Height	: 1717.25 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 12:33:28PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 10/9/19 - 1500

J Graham

Analysis Report for 09-Oct-19-10037

L1-12202B-FSGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.58	473 -	481	477.34	1.13E+02	18.40	1.02E+02	1.09
2	295.26	586 -	595	590.57	4.00E+01	13.96	6.80E+01	0.98
3	338.46	674 -	681	676.89	4.52E+01	10.71	3.38E+01	1.38
4	351.78	701 -	708	703.51	1.10E+02	12.94	2.83E+01	1.20
5	583.10	1162 -	1171	1165.81	3.94E+01	9.88	2.46E+01	1.51
6	609.33	1212 -	1223	1218.23	8.80E+01	11.20	1.50E+01	1.14
7	911.29	1816 -	1827	1822.03	6.02E+01	9.86	1.48E+01	1.48
8	1460.62	2914 -	2928	2921.29	4.62E+02	21.97	7.41E+00	2.15

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.42E+00	5.43E-01
Tl-208	0.99	583.19	*	85.00	4.96E-02	1.28E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.56E-01	2.83E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.13E-01	3.00E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 09-Oct-19-10037

L1-12202B-FSGS-011SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.47E-01	5.26E-02
		351.93	*	35.60	2.35E-01	3.36E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.98E-01	7.48E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.34E-01	5.65E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 09-Oct-19-10037

L1-12202B-FSGS-011SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.993	8.42E+00	5.43E-01	
	Tl-208	0.999	4.96E-02	1.28E-02	
X	Bi-211	0.922			
	Pb-212	1.000	1.56E-01	2.83E-02	
	Bi-214	1.000	2.13E-01	3.00E-02	
	Pb-214	0.998	2.10E-01	2.83E-02	
	Ac-228	0.999	3.21E-01	4.51E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10037

L1-12202B-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 12:33:28PM
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	6.44E-02	5.41E-02	5.41E-02
	BE-7	477.60		10.44	-3.24E-02	3.51E-01	3.51E-01
+	K-40	1460.82	*	10.66	8.42E+00	3.37E-01	3.37E-01
	Mn-54	834.85		99.98	-1.47E-03	3.83E-02	3.83E-02
	Co-60	1173.23		99.85	7.65E-03	4.62E-02	5.45E-02
		1332.49		99.98	3.35E-03		4.62E-02
	Nb-94	702.65		99.81	2.39E-02	4.07E-02	4.07E-02
		871.09		99.89	1.15E-02		4.17E-02
	Ag-108m	79.13		6.60	7.71E-02	3.80E-02	1.12E+00
		433.94		90.50	1.90E-02		3.80E-02
		614.28		89.80	-2.22E-02		5.20E-02
		722.94		90.80	6.04E-03		4.89E-02
	Sb-125	176.31		6.84	-2.06E-01	1.11E-01	5.16E-01
		380.45		1.52	-3.06E-01		2.10E+00
		427.87		29.60	-1.13E-03		1.11E-01
		463.36		10.49	2.99E-02		2.88E-01
		600.60		17.65	6.14E-02		2.17E-01
		606.71		4.98	-1.93E-01		1.19E+00
		635.95		11.22	4.04E-02		3.43E-01

Analysis Report for 09-Oct-19-10037

L1-12202B-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-6.90E-01	1.11E-01	1.82E+00
Ba-133	79.61	2.65	2.27E-01	6.61E-02	2.62E+00
	81.00	32.90	-1.62E-01		1.82E-01
	276.40	7.16	5.07E-02		4.45E-01
	302.85	18.34	3.37E-02		1.73E-01
	356.01	62.05	-2.21E-02		6.61E-02
	383.85	8.94	7.12E-02		3.80E-01
Cs-134	475.36	1.48	8.89E-01	5.21E-02	2.56E+00
	563.25	8.34	9.19E-03		4.22E-01
	569.33	15.37	-1.29E-02		2.20E-01
	604.72	97.62	4.92E-04		5.38E-02
	795.86	85.46	2.07E-02		5.21E-02
	801.95	8.69	-1.97E-01		3.85E-01
	1038.61	0.99	7.07E-01		5.16E+00
	1167.97	1.79	1.77E+00		3.34E+00
	1365.19	3.02	3.95E-02		1.28E+00
Cs-137	661.66	85.10	-3.41E-04	4.43E-02	4.43E-02
Eu-152	121.78	28.67	-5.85E-02	1.11E-01	1.11E-01
	244.70	7.61	3.69E-02		4.66E-01
	295.94	0.45	7.08E+00		8.71E+00
	344.28	26.60	-5.21E-02		1.23E-01
	367.79	0.86	2.71E+00		4.09E+00
	411.12	2.24	7.10E-01		1.53E+00
	443.96	2.83	2.76E-01		1.10E+00
	488.68	0.42	4.92E+00		8.03E+00
	563.99	0.49	8.86E-01		7.24E+00
	586.26	0.46	9.78E-01		1.11E+01
	678.62	0.47	1.25E+00		7.41E+00
	688.67	0.86	6.38E-01		4.51E+00
	719.35	0.28	3.73E+00		1.37E+01
	778.90	12.96	-1.95E-01		2.68E-01
	810.45	0.32	2.89E+00		1.13E+01
	867.37	4.26	2.11E-01		1.02E+00
	919.33	0.43	-4.33E+00		1.05E+01
	964.08	14.65	-1.74E-01		3.62E-01
	1085.87	10.24	-5.27E-02		3.96E-01
	1089.74	1.73	4.92E-01		2.78E+00
	1112.07	13.69	-2.74E-01		3.50E-01
	1212.95	1.43	-2.06E+00		3.99E+00
	1249.94	0.19	1.07E+00		2.81E+01
	1299.14	1.63	-9.88E-01		3.06E+00
	1408.01	21.07	-6.97E-02		1.69E-01
	1457.64	0.50	-1.76E+00		4.16E+01
	1528.10	0.28	-3.70E+00		8.90E+00
Eu-154	123.07	40.40	-2.01E-02	8.01E-02	8.01E-02
	247.93	6.89	6.26E-02		4.46E-01
	591.76	4.95	1.34E-01		7.58E-01
	692.42	1.78	7.51E-01		2.24E+00
	723.30	20.06	1.52E-01		2.34E-01
	756.80	4.52	4.01E-01		8.05E-01
	873.18	12.08	-5.87E-02		3.09E-01

Analysis Report for 09-Oct-19-10037

L1-12202B-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.22E-01	8.01E-02	3.88E-01
	1004.76	18.01	4.80E-02		2.71E-01
	1274.43	34.80	-5.54E-02		1.48E-01
	1596.48	1.80	-2.31E-01		1.80E+00
Eu-155	45.30	1.31	-2.19E+00	1.76E-01	1.06E+01
	60.01	1.22	-1.26E+00		1.21E+01
	86.55	30.70	3.22E-02		1.76E-01
	105.31	21.10	-8.84E-03		1.82E-01
Ra-226	186.21	3.64	-1.23E-02	1.00E+00	1.00E+00
Pa-231	27.36	10.30	3.14E-01	1.06E+00	1.06E+00
	283.69	1.70	1.19E+00		1.92E+00
	300.07	2.47	-1.88E-01		1.28E+00
	302.65	2.20	2.81E-01		1.44E+00
	330.06	1.40	-1.20E+00		2.18E+00
U-235	143.76	10.96	-1.92E-02	6.44E-02	2.79E-01
	163.33	5.08	5.08E-02		7.04E-01
	185.71	57.20	2.66E-02		6.44E-02
	202.11	1.08	4.24E-01		2.98E+00
	205.31	5.01	3.17E-02		6.61E-01
Am-241	59.54	35.90	-2.84E-02	4.28E-01	4.28E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10038
L1-12202B-FSGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10038
Sample Description	: L1-12202B-FSGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.500E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:42:00AM
Acquisition Started	: 10/9/2019 12:18:36PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.15 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80372
Fill Height	: 1500.06 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 12:33:39PM

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

DATA VALIDATED 10/9/19 - 1500
J Graham

Analysis Report for 09-Oct-19-10038

L1-12202B-FSGS-012SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.31	739 -	750	745.52	3.53E+01	12.06	4.37E+01	0.54
2	238.75	949 -	960	955.08	6.81E+01	15.26	6.49E+01	0.46
3	295.18	1175 -	1185	1180.62	2.44E+01	10.79	3.76E+01	0.78
4	351.86	1401 -	1412	1407.17	7.30E+01	12.18	3.00E+01	0.43
5	609.36	2430 -	2443	2436.61	4.56E+01	8.62	1.04E+01	1.19
6	1460.86	5831 -	5854	5843.28	3.92E+02	20.39	5.93E+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	1.00	1460.82	*	10.66	9.83E+00	6.66E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.22E-01	2.91E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.47E-01	2.92E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		

Analysis Report for 09-Oct-19-10038

L1-12202B-FSGS-012SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.17E-01	5.25E-02
		351.93	*	35.60	2.05E-01	3.80E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	6.77E-01	2.38E-01
U-235	0.96	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.31E-02	1.51E-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	1.000	9.83E+00	6.66E-01	
X	Bi-211	0.905			
	Pb-212	0.998	1.22E-01	2.91E-02	
	Bi-214	1.000	1.47E-01	2.92E-02	
	Pb-214	0.999	1.75E-01	3.08E-02	
?	Ra-226	0.998	6.77E-01	2.38E-01	

Analysis Report for 09-Oct-19-10038

L1-12202B-FSGS-012SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
?	U-235	0.960	4.31E-02	1.51E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10038

L1-12202B-FSGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 12:33:39PM
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	7.00E-02	6.33E-02	6.33E-02
	BE-7	477.60		10.44	4.01E-01	4.98E-01	4.98E-01
+	K-40	1460.82	*	10.66	9.83E+00	4.85E-01	4.85E-01
	Mn-54	834.85		99.98	-8.07E-02	4.81E-02	4.81E-02
	Co-60	1173.23		99.85	2.41E-02	4.68E-02	7.70E-02
		1332.49		99.98	2.74E-02		4.68E-02
	Nb-94	702.65		99.81	9.85E-03	4.58E-02	4.58E-02
		871.09		99.89	-3.05E-02		5.46E-02
	Ag-108m	79.13		6.60	8.58E-01	4.45E-02	2.02E+00
		433.94		90.50	-2.69E-02		4.45E-02
		614.28		89.80	-5.30E-02		6.16E-02
		722.94		90.80	2.21E-03		5.30E-02
	Sb-125	176.31		6.84	-4.17E-02	1.57E-01	5.96E-01
		380.45		1.52	8.77E-02		2.50E+00
		427.87		29.60	1.05E-01		1.57E-01
		463.36		10.49	5.88E-02		4.15E-01
		600.60		17.65	-1.80E-02		2.48E-01
		606.71		4.98	1.81E+00		1.34E+00
		635.95		11.22	1.94E-01		4.05E-01

Analysis Report for 09-Oct-19-10038

L1-12202B-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.27E+00	1.57E-01	2.40E+00
Ba-133	79.61	2.65	1.12E+00	7.18E-02	4.81E+00
	81.00	32.90	-4.70E-01		3.22E-01
	276.40	7.16	-2.94E-01		5.40E-01
	302.85	18.34	4.43E-02		2.09E-01
	356.01	62.05	-5.65E-02		7.18E-02
	383.85	8.94	1.62E-01		4.51E-01
Cs-134	475.36	1.48	1.25E+00	6.09E-02	3.17E+00
	563.25	8.34	3.37E-02		5.02E-01
	569.33	15.37	5.31E-02		2.58E-01
	604.72	97.62	1.67E-02		6.09E-02
	795.86	85.46	-3.97E-02		6.19E-02
	801.95	8.69	1.96E-02		5.57E-01
	1038.61	0.99	1.39E+00		6.22E+00
	1167.97	1.79	1.59E+00		4.38E+00
	1365.19	3.02	-5.42E-01		1.64E+00
Cs-137	661.66	85.10	-1.77E-02	5.78E-02	5.78E-02
Eu-152	121.78	28.67	5.93E-02	1.48E-01	1.77E-01
	244.70	7.61	-1.28E-02		5.55E-01
	295.94	0.45	6.22E+00		1.06E+01
	344.28	26.60	8.11E-02		1.48E-01
	367.79	0.86	1.61E+00		4.49E+00
	411.12	2.24	-2.16E-01		1.68E+00
	443.96	2.83	-1.05E+00		1.34E+00
	488.68	0.42	-5.86E+00		9.14E+00
	563.99	0.49	1.76E+00		8.52E+00
	586.26	0.46	8.42E+00		1.31E+01
	678.62	0.47	5.50E+00		9.77E+00
	688.67	0.86	-4.61E-01		4.72E+00
	719.35	0.28	-1.46E+01		1.40E+01
	778.90	12.96	7.44E-02		3.33E-01
	810.45	0.32	-1.70E+00		1.54E+01
	867.37	4.26	-4.54E-01		1.28E+00
	919.33	0.43	-2.19E+00		1.18E+01
	964.08	14.65	2.46E-01		4.50E-01
	1085.87	10.24	-3.48E-03		6.10E-01
	1089.74	1.73	-7.22E-01		3.32E+00
	1112.07	13.69	-2.33E-02		4.49E-01
	1212.95	1.43	-5.78E+00		5.39E+00
	1249.94	0.19	6.32E-02		3.07E+01
	1299.14	1.63	-1.29E+00		3.33E+00
	1408.01	21.07	7.45E-02		2.40E-01
	1457.64	0.50	2.06E+02		5.29E+01
	1528.10	0.28	-7.43E+00		1.61E+01
Eu-154	123.07	40.40	3.31E-02	1.22E-01	1.22E-01
	247.93	6.89	-2.37E-01		5.49E-01
	591.76	4.95	-1.16E-01		9.10E-01
	692.42	1.78	1.22E+00		2.55E+00
	723.30	20.06	1.30E-02		2.40E-01
	756.80	4.52	-2.61E-01		9.56E-01
	873.18	12.08	3.37E-01		4.72E-01

Analysis Report for 09-Oct-19-10038

L1-12202B-FSGS-012SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	2.42E-01	1.22E-01	5.54E-01
		1004.76		18.01	-2.17E-01		2.60E-01
		1274.43		34.80	7.82E-02		1.83E-01
		1596.48		1.80	-1.18E+00		1.54E+00
	Eu-155	45.30		1.31	3.13E+00	2.71E-01	3.05E+01
		60.01		1.22	-1.06E+01		3.03E+01
		86.55		30.70	7.62E-02		2.86E-01
		105.31		21.10	-1.84E-01		2.71E-01
+	Ra-226	186.21	*	3.64	6.77E-01	7.38E-01	7.38E-01
	Pa-231	27.36		10.30	4.19E+00	1.66E+00	3.65E+00
		283.69		1.70	1.06E+00		2.28E+00
		300.07		2.47	2.03E-01		1.66E+00
		302.65		2.20	8.09E-01		1.78E+00
		330.06		1.40	1.19E+00		3.12E+00
+	U-235	143.76		10.96	1.02E-01	4.70E-02	4.13E-01
		163.33		5.08	-4.99E-01		7.85E-01
		185.71	*	57.20	4.31E-02		4.70E-02
		202.11		1.08	2.62E-03		3.56E+00
		205.31		5.01	5.18E-01		7.98E-01
	Am-241	59.54		35.90	3.40E-01	1.13E+00	1.13E+00

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

Apex-Gamma

Analysis Report for 09-Oct-19-10039

L1-12202B-FSGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10039
Sample Description	: L1-12202B-FSGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.596E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:44:00AM
Acquisition Started	: 10/9/2019 12:18:43PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80373
Fill Height	: 1595.71 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 12:33:53PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/9/19 - 1500

J Graham

Analysis Report for 09-Oct-19-10039

L1-12202B-FSGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.37	305 -	316	310.00	5.31E+01	15.70	7.69E+01	0.85
2	238.73	947 -	961	954.51	9.41E+01	17.72	7.49E+01	0.93
3	295.50	1175 -	1187	1181.30	4.04E+01	10.38	2.56E+01	0.47
4	338.38	1348 -	1358	1352.58	1.94E+01	8.83	2.46E+01	0.94
5	352.03	1401 -	1414	1407.12	6.13E+01	12.07	3.07E+01	0.61
6	583.12	2324 -	2336	2330.60	3.38E+01	7.95	1.12E+01	1.32
7	609.23	2427 -	2440	2434.95	6.08E+01	9.71	1.22E+01	0.90
8	1460.13	5826 -	5850	5838.45	4.15E+02	20.67	3.06E+00	1.65

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.92	1460.82	*	10.66	9.20E+00	6.08E-01
Tl-208	0.99	583.19	*	85.00	5.03E-02	1.22E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.48E-01	3.04E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.71E-01	1.16E-01
		87.35		3.97		
		89.78		1.46		

Analysis Report for 09-Oct-19-10039

L1-12202B-FSGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	609.32	*	45.49	1.75E-01	2.98E-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	1.71E-01	4.61E-02
		351.93	*	35.60	1.53E-01	3.25E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	6.55E-01	2.07E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.48E-01	6.87E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

Analysis Report for 09-Oct-19-10039

L1-12202B-FSGS-013SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.926	9.20E+00	6.08E-01	
	Tl-208	0.999	5.03E-02	1.22E-02	
X	Bi-211	0.863			
	Pb-212	0.998	1.48E-01	3.04E-02	
?	Pb212-XR	0.994	3.71E-01	1.16E-01	
	Bi-214	0.999	1.75E-01	2.98E-02	
	Pb-214	0.995	1.59E-01	2.66E-02	
?	Pb214-XR	0.994	6.55E-01	2.07E-01	
	Ac-228	1.000	1.48E-01	6.87E-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 09-Oct-19-10039

L1-12202B-FSGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 12:33:53PM
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	4.32E-02	5.25E-02	5.25E-02
	BE-7	477.60		10.44	1.90E-01	3.68E-01	3.68E-01
+	K-40	1460.82	*	10.66	9.20E+00	3.29E-01	3.29E-01
	Mn-54	834.85		99.98	1.50E-02	4.35E-02	4.35E-02
	Co-60	1173.23		99.85	3.55E-02	5.12E-02	6.82E-02
		1332.49		99.98	-4.78E-03		5.12E-02
	Nb-94	702.65		99.81	9.56E-03	4.32E-02	4.32E-02
		871.09		99.89	2.56E-02		4.85E-02
	Ag-108m	79.13		6.60	-3.11E-01	3.61E-02	1.14E+00
		433.94		90.50	-3.17E-04		3.61E-02
		614.28		89.80	-7.55E-02		5.52E-02
		722.94		90.80	1.48E-02		5.60E-02
	Sb-125	176.31		6.84	-1.64E-01	1.15E-01	4.25E-01
		380.45		1.52	-1.92E+00		2.06E+00
		427.87		29.60	4.10E-04		1.15E-01
		463.36		10.49	4.53E-02		3.57E-01
		600.60		17.65	1.76E-01		2.54E-01
		606.71		4.98	1.30E+00		1.30E+00
		635.95		11.22	-1.73E-01		3.49E-01

Analysis Report for 09-Oct-19-10039

L1-12202B-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.69E+00	1.15E-01	1.98E+00
Ba-133	79.61	2.65	-8.38E-01	6.61E-02	2.78E+00
	81.00	32.90	-2.05E-01		1.78E-01
	276.40	7.16	-5.82E-01		4.10E-01
	302.85	18.34	3.19E-02		1.65E-01
	356.01	62.05	2.32E-02		6.61E-02
	383.85	8.94	-1.96E-01		3.67E-01
Cs-134	475.36	1.48	6.51E-01	5.17E-02	2.45E+00
	563.25	8.34	-4.87E-01		4.93E-01
	569.33	15.37	-8.95E-02		2.54E-01
	604.72	97.62	-2.13E-02		5.80E-02
	795.86	85.46	-1.36E-02		5.17E-02
	801.95	8.69	3.21E-01		5.12E-01
	1038.61	0.99	3.50E+00		6.36E+00
	1167.97	1.79	9.64E-01		3.88E+00
	1365.19	3.02	2.33E-01		1.64E+00
Cs-137	661.66	85.10	3.85E-03	4.51E-02	4.51E-02
Eu-152	121.78	28.67	-1.10E-01	1.04E-01	1.04E-01
	244.70	7.61	3.39E-01		5.04E-01
	295.94	0.45	-5.96E-01		8.62E+00
	344.28	26.60	5.74E-03		1.23E-01
	367.79	0.86	-2.54E-01		3.69E+00
	411.12	2.24	6.27E-02		1.65E+00
	443.96	2.83	-1.78E-01		1.20E+00
	488.68	0.42	2.80E+00		7.54E+00
	563.99	0.49	-8.49E+00		7.98E+00
	586.26	0.46	-2.32E+00		1.17E+01
	678.62	0.47	2.87E+00		9.18E+00
	688.67	0.86	2.96E+00		4.59E+00
	719.35	0.28	1.40E-01		1.53E+01
	778.90	12.96	-1.21E-01		3.41E-01
	810.45	0.32	4.25E+00		1.39E+01
	867.37	4.26	-9.49E-02		1.20E+00
	919.33	0.43	2.82E+00		1.04E+01
	964.08	14.65	2.13E-01		4.60E-01
	1085.87	10.24	3.73E-01		6.03E-01
	1089.74	1.73	-1.45E+00		3.44E+00
	1112.07	13.69	-2.38E-02		4.41E-01
	1212.95	1.43	-4.55E+00		5.04E+00
	1249.94	0.19	6.52E+00		3.36E+01
	1299.14	1.63	2.53E+00		3.17E+00
	1408.01	21.07	-1.28E-01		1.79E-01
	1457.64	0.50	1.92E+02		4.78E+01
	1528.10	0.28	-8.90E+00		9.71E+00
Eu-154	123.07	40.40	1.24E-02	8.24E-02	8.24E-02
	247.93	6.89	9.76E-02		4.42E-01
	591.76	4.95	-1.97E-01		7.98E-01
	692.42	1.78	-1.79E+00		1.99E+00
	723.30	20.06	7.65E-02		2.54E-01
	756.80	4.52	3.22E-04		9.14E-01
	873.18	12.08	-4.06E-01		3.77E-01

Analysis Report for 09-Oct-19-10039

L1-12202B-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.48E-01	8.24E-02	5.36E-01
	1004.76	18.01	8.47E-02		3.05E-01
	1274.43	34.80	-5.23E-02		1.95E-01
	1596.48	1.80	-1.14E+00		2.06E+00
Eu-155	45.30	1.31	-4.41E+00	1.79E-01	1.12E+01
	60.01	1.22	-1.43E+00		1.13E+01
	86.55	30.70	6.36E-02		1.88E-01
	105.31	21.10	3.71E-04		1.79E-01
Ra-226	186.21	3.64	3.79E-01	9.30E-01	9.30E-01
Pa-231	27.36	10.30	1.10E+00	1.24E+00	1.24E+00
	283.69	1.70	-8.63E-02		2.08E+00
	300.07	2.47	5.50E-01		1.27E+00
	302.65	2.20	2.28E-01		1.37E+00
	330.06	1.40	1.12E+00		2.52E+00
U-235	143.76	10.96	-9.45E-02	5.86E-02	3.12E-01
	163.33	5.08	7.77E-02		5.85E-01
	185.71	57.20	1.81E-02		5.86E-02
	202.11	1.08	1.57E-01		3.08E+00
	205.31	5.01	-5.77E-01		6.20E-01
Am-241	59.54	35.90	3.16E-02	3.94E-01	3.94E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10040

L1-12202B-FSGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10040
Sample Description	: L1-12202B-FSGS-014SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.584E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:46:00AM
Acquisition Started	: 10/9/2019 12:18:52PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80374
Fill Height	: 1583.94 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 12:33:57PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 10/9/19 - 1500

T Graham

Analysis Report for 09-Oct-19-10040

L1-12202B-FSGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.56	949 -	962	954.73	9.31E+01	16.31	6.09E+01	1.10
2	295.18	1171 -	1187	1180.95	5.00E+01	12.51	3.40E+01	1.11
3	351.84	1400 -	1414	1407.36	8.51E+01	11.57	1.69E+01	0.37
4	583.37	2326 -	2339	2332.80	4.29E+01	8.40	1.01E+01	1.20
5	609.31	2430 -	2443	2436.49	5.35E+01	8.60	7.46E+00	0.39
6	1460.57	5830 -	5855	5842.67	4.42E+02	21.66	6.50E+00	1.70

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.15E+00	6.00E-01
Tl-208	0.99	583.19	*	85.00	6.09E-02	1.25E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.45E-01	2.79E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.46E-01	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 09-Oct-19-10040

L1-12202B-FSGS-014SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.07E-01	5.43E-02
		351.93	*	35.60	2.06E-01	3.25E-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	9.15E+00	6.00E-01	
	Tl-208	0.995	6.09E-02	1.25E-02	
X	Bi-211	0.909			
	Pb-212	0.999	1.45E-01	2.79E-02	
	Bi-214	1.000	1.46E-01	2.51E-02	
	Pb-214	0.999	2.06E-01	2.79E-02	

Analysis Report for 09-Oct-19-10040

L1-12202B-FSGS-014SS

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10040

L1-12202B-FSGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 12:33:57PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	2.46E-02	5.08E-02	5.08E-02
	BE-7	477.60		10.44	1.84E-01	4.24E-01	4.24E-01
+	K-40	1460.82	*	10.66	9.15E+00	4.29E-01	4.29E-01
	Mn-54	834.85		99.98	4.32E-02	5.08E-02	5.08E-02
	Co-60	1173.23		99.85	2.00E-02	4.17E-02	6.18E-02
		1332.49		99.98	-4.85E-03		4.17E-02
	Nb-94	702.65		99.81	-2.93E-03	4.32E-02	4.32E-02
		871.09		99.89	1.47E-02		4.43E-02
	Ag-108m	79.13		6.60	-4.44E-01	3.84E-02	1.44E+00
		433.94		90.50	2.69E-02		3.84E-02
		614.28		89.80	-2.84E-02		6.17E-02
		722.94		90.80	2.81E-02		5.78E-02
	Sb-125	176.31		6.84	2.47E-01	1.13E-01	4.47E-01
		380.45		1.52	7.64E-01		2.38E+00
		427.87		29.60	3.62E-02		1.13E-01
		463.36		10.49	-1.65E-01		3.36E-01
		600.60		17.65	2.12E-03		2.24E-01
		606.71		4.98	1.08E+00		1.17E+00
		635.95		11.22	1.35E-01		3.78E-01

Analysis Report for 09-Oct-19-10040

L1-12202B-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.25E+00	1.13E-01	2.40E+00
Ba-133	79.61	2.65	9.26E-01	7.24E-02	3.54E+00
	81.00	32.90	-1.56E-01		2.54E-01
	276.40	7.16	9.23E-03		5.02E-01
	302.85	18.34	-3.36E-02		1.94E-01
	356.01	62.05	-2.59E-02		7.24E-02
	383.85	8.94	-7.25E-02		4.03E-01
Cs-134	475.36	1.48	2.01E+00	5.05E-02	2.92E+00
	563.25	8.34	-7.26E-02		3.94E-01
	569.33	15.37	1.16E-02		1.96E-01
	604.72	97.62	-4.47E-02		5.70E-02
	795.86	85.46	-3.79E-02		5.05E-02
	801.95	8.69	-1.44E-01		4.91E-01
	1038.61	0.99	1.78E+00		5.49E+00
	1167.97	1.79	2.30E+00		3.60E+00
	1365.19	3.02	-6.18E-01		1.36E+00
Cs-137	661.66	85.10	4.24E-02	5.97E-02	5.97E-02
Eu-152	121.78	28.67	1.69E-02	1.26E-01	1.41E-01
	244.70	7.61	-4.72E-01		4.68E-01
	295.94	0.45	6.01E+00		9.73E+00
	344.28	26.60	-2.10E-02		1.26E-01
	367.79	0.86	-2.02E-01		3.57E+00
	411.12	2.24	4.08E-01		1.62E+00
	443.96	2.83	-2.31E-01		1.33E+00
	488.68	0.42	1.09E+00		8.59E+00
	563.99	0.49	3.15E+00		6.79E+00
	586.26	0.46	8.30E+00		1.20E+01
	678.62	0.47	-9.54E-03		9.05E+00
	688.67	0.86	3.92E-02		4.83E+00
	719.35	0.28	9.90E-01		1.77E+01
	778.90	12.96	-3.01E-01		3.38E-01
	810.45	0.32	1.63E+00		1.42E+01
	867.37	4.26	-1.98E-01		1.00E+00
	919.33	0.43	-1.44E+01		1.17E+01
	964.08	14.65	3.78E-01		4.51E-01
	1085.87	10.24	-7.03E-01		5.15E-01
	1089.74	1.73	4.37E-01		3.36E+00
	1112.07	13.69	-4.56E-01		4.14E-01
	1212.95	1.43	1.78E+00		5.50E+00
	1249.94	0.19	1.94E+01		3.71E+01
	1299.14	1.63	1.39E+00		3.70E+00
	1408.01	21.07	-2.30E-02		1.99E-01
	1457.64	0.50	1.96E+02		4.63E+01
	1528.10	0.28	4.05E+00		1.10E+01
Eu-154	123.07	40.40	-4.58E-02	9.92E-02	9.92E-02
	247.93	6.89	-4.05E-01		4.71E-01
	591.76	4.95	6.52E-01		8.80E-01
	692.42	1.78	-3.27E-01		2.38E+00
	723.30	20.06	1.13E-01		2.59E-01
	756.80	4.52	2.06E-01		9.23E-01
	873.18	12.08	2.00E-01		3.73E-01

Analysis Report for 09-Oct-19-10040

L1-12202B-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.82E-02	9.92E-02	5.05E-01
	1004.76	18.01	1.75E-01		2.83E-01
	1274.43	34.80	-6.78E-03		1.40E-01
	1596.48	1.80	5.33E-01		2.37E+00
Eu-155	45.30	1.31	9.20E+00	2.34E-01	2.25E+01
	60.01	1.22	-1.76E+00		2.06E+01
	86.55	30.70	5.82E-02		2.44E-01
	105.31	21.10	1.39E-01		2.34E-01
Ra-226	186.21	3.64	-1.19E-01	9.58E-01	9.58E-01
Pa-231	27.36	10.30	1.03E+00	1.50E+00	2.06E+00
	283.69	1.70	6.80E-01		2.08E+00
	300.07	2.47	6.89E-02		1.50E+00
	302.65	2.20	-7.35E-01		1.57E+00
	330.06	1.40	6.82E-01		2.41E+00
U-235	143.76	10.96	-2.90E-02	6.11E-02	3.33E-01
	163.33	5.08	1.50E-01		7.29E-01
	185.71	57.20	3.06E-02		6.11E-02
	202.11	1.08	1.91E-01		3.31E+00
	205.31	5.01	-2.70E-01		6.74E-01
Am-241	59.54	35.90	-2.52E-01	7.18E-01	7.18E-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 09-Oct-19-10041

L1-12202B-FSGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10041
Sample Description	: L1-12202B-FSGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.568E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:48:00AM
Acquisition Started	: 10/9/2019 12:38:53PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80375
Fill Height	: 1567.76 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 12:53:55PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 10/9/19 - 1500

J Graham

Analysis Report for 09-Oct-19-10041

L1-12202B-FSGS-015SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.70	473 -	482	477.58	1.01E+02	18.92	1.12E+02	1.06
2	351.88	698 -	708	703.70	8.10E+01	14.55	5.50E+01	1.34
3	609.16	1212 -	1223	1217.89	6.40E+01	11.79	3.00E+01	1.17
4	910.99	1817 -	1827	1821.43	4.22E+01	8.80	1.48E+01	1.34
5	1460.59	2914 -	2928	2921.24	4.29E+02	21.58	1.29E+01	1.78

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.01E+00	5.32E-01
Bi-211	0.90	351.07	*	13.02	4.83E-01	9.51E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.42E-01	2.88E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.58E-01	3.06E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		

Analysis Report for 09-Oct-19-10041

L1-12202B-FSGS-015SS

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	1.77E-01	3.47E-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	2.39E-01	5.09E-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 09-Oct-19-10041

L1-12202B-FSGS-015SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.992	8.01E+00	5.32E-01	
?	Bi-211	0.901	4.83E-01	9.51E-02	
	Pb-212	0.999	1.42E-01	2.88E-02	
	Bi-214	0.998	1.58E-01	3.06E-02	
?	Pb-214	1.000	1.77E-01	3.47E-02	
	Ac-228	0.998	2.39E-01	5.09E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10041

L1-12202B-FSGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 12:53:55PM
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	7.17E-02	5.08E-02	5.08E-02
	BE-7	477.60		10.44	3.09E-01	3.91E-01	3.91E-01
+	K-40	1460.82	*	10.66	8.01E+00	4.38E-01	4.38E-01
	Mn-54	834.85		99.98	-1.04E-02	3.90E-02	3.90E-02
	Co-60	1173.23		99.85	-7.56E-03	4.22E-02	5.77E-02
		1332.49		99.98	1.49E-02		4.22E-02
	Nb-94	702.65		99.81	1.77E-02	3.65E-02	3.65E-02
		871.09		99.89	-1.24E-02		3.81E-02
	Ag-108m	79.13		6.60	3.53E-01	3.09E-02	1.13E+00
		433.94		90.50	-1.61E-02		3.09E-02
		614.28		89.80	-1.56E-02		4.99E-02
		722.94		90.80	6.34E-03		4.59E-02
	Sb-125	176.31		6.84	-1.01E-01	1.02E-01	4.96E-01
		380.45		1.52	-8.22E-02		1.97E+00
		427.87		29.60	1.39E-02		1.02E-01
		463.36		10.49	1.31E-01		3.28E-01
		600.60		17.65	-5.32E-02		2.02E-01
		606.71		4.98	1.94E-02		1.20E+00
		635.95		11.22	1.31E-01		3.38E-01

Analysis Report for 09-Oct-19-10041

L1-12202B-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.18E+00	1.02E-01	2.01E+00
Ba-133	79.61	2.65	-2.13E-01	6.74E-02	2.61E+00
	81.00	32.90	-1.78E-01		1.80E-01
	276.40	7.16	3.50E-02		4.39E-01
	302.85	18.34	7.01E-02		1.86E-01
	356.01	62.05	-3.71E-02		6.74E-02
	383.85	8.94	6.71E-03		3.55E-01
Cs-134	475.36	1.48	2.92E-01	5.01E-02	2.74E+00
	563.25	8.34	1.50E-02		3.89E-01
	569.33	15.37	3.03E-02		2.21E-01
	604.72	97.62	6.72E-03		5.54E-02
	795.86	85.46	9.38E-03		5.01E-02
	801.95	8.69	-3.72E-01		3.84E-01
	1038.61	0.99	-5.39E-01		5.08E+00
	1167.97	1.79	-1.69E+00		2.83E+00
	1365.19	3.02	-2.68E-01		1.18E+00
Cs-137	661.66	85.10	4.52E-03	4.93E-02	4.93E-02
Eu-152	121.78	28.67	2.86E-03	1.10E-01	1.10E-01
	244.70	7.61	-2.25E-01		4.17E-01
	295.94	0.45	6.07E+00		8.92E+00
	344.28	26.60	-4.60E-02		1.29E-01
	367.79	0.86	3.37E-01		3.60E+00
	411.12	2.24	-3.11E-01		1.35E+00
	443.96	2.83	-6.97E-02		1.20E+00
	488.68	0.42	1.77E+00		8.41E+00
	563.99	0.49	1.19E+00		6.42E+00
	586.26	0.46	1.10E+01		1.08E+01
	678.62	0.47	-1.83E+00		7.97E+00
	688.67	0.86	1.45E+00		4.75E+00
	719.35	0.28	9.43E-01		1.33E+01
	778.90	12.96	-3.33E-01		2.68E-01
	810.45	0.32	8.60E+00		1.28E+01
	867.37	4.26	-1.85E-01		8.74E-01
	919.33	0.43	-5.35E+00		9.22E+00
	964.08	14.65	-1.57E-02		3.84E-01
	1085.87	10.24	-2.35E-02		5.11E-01
	1089.74	1.73	-8.54E-01		2.92E+00
	1112.07	13.69	-7.74E-04		4.16E-01
	1212.95	1.43	-2.30E+00		3.68E+00
	1249.94	0.19	8.68E+00		3.03E+01
	1299.14	1.63	3.50E-01		3.18E+00
	1408.01	21.07	-6.21E-02		1.51E-01
	1457.64	0.50	-6.92E-01		4.14E+01
	1528.10	0.28	1.04E+00		1.14E+01
Eu-154	123.07	40.40	-2.29E-02	7.67E-02	7.67E-02
	247.93	6.89	2.25E-01		4.62E-01
	591.76	4.95	9.70E-02		7.39E-01
	692.42	1.78	2.81E-01		2.20E+00
	723.30	20.06	5.20E-02		2.12E-01
	756.80	4.52	2.80E-02		7.40E-01
	873.18	12.08	1.07E-01		3.32E-01

Analysis Report for 09-Oct-19-10041

L1-12202B-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	7.38E-02	7.67E-02	4.03E-01
	1004.76	18.01	-5.61E-02		2.32E-01
	1274.43	34.80	-9.67E-03		1.64E-01
	1596.48	1.80	4.44E-01		2.14E+00
Eu-155	45.30	1.31	-3.71E+00	1.70E-01	1.03E+01
	60.01	1.22	6.95E-01		1.28E+01
	86.55	30.70	-6.13E-03		1.70E-01
	105.31	21.10	2.42E-02		1.84E-01
Ra-226	186.21	3.64	4.75E-01	1.04E+00	1.04E+00
Pa-231	27.36	10.30	8.78E-01	1.22E+00	1.22E+00
	283.69	1.70	9.00E-01		1.97E+00
	300.07	2.47	-9.51E-01		1.41E+00
	302.65	2.20	5.84E-01		1.55E+00
	330.06	1.40	1.05E+00		2.50E+00
U-235	143.76	10.96	-5.37E-02	6.69E-02	2.80E-01
	163.33	5.08	-3.48E-01		6.44E-01
	185.71	57.20	4.80E-02		6.69E-02
	202.11	1.08	5.41E-01		2.92E+00
	205.31	5.01	-4.87E-01		6.14E-01
Am-241	59.54	35.90	1.24E-02	4.44E-01	4.44E-01

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

Apex-Gamma

Analysis Report for 09-Oct-19-10042
L1-12202B-FSGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10042
Sample Description	: L1-12202B-FSGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.644E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:50:00AM
Acquisition Started	: 10/9/2019 12:39:03PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.15 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80376
Fill Height	: 1644.08 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 12:54:09PM

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

DATA VALIDATED 10/9/19 - 1500
J Graham

Analysis Report for 09-Oct-19-10042

L1-12202B-FSGS-016SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.62	947 -	958	954.56	1.08E+02	15.49	5.29E+01	0.86
2	294.96	1175 -	1186	1179.75	2.41E+01	10.61	3.49E+01	0.33
3	351.93	1400 -	1414	1407.44	7.05E+01	13.14	3.55E+01	0.39
4	583.13	2326 -	2339	2331.73	3.85E+01	7.87	8.55E+00	0.85
5	609.19	2431 -	2442	2435.92	4.57E+01	8.89	1.33E+01	1.03
6	910.98	3637 -	3648	3642.90	3.10E+01	6.78	6.00E+00	0.64
7	1460.69	5832 -	5854	5842.60	4.02E+02	21.02	1.07E+01	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	9.83E+00	6.68E-01
Tl-208	0.99	583.19	*	85.00	6.32E-02	1.35E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.91E-01	3.14E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.45E-01	2.94E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 09-Oct-19-10042

L1-12202B-FSGS-016SS

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	1.13E-01	5.07E-02
		351.93	*	35.60	1.95E-01	3.95E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.27E-01	5.06E-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 09-Oct-19-10042

L1-12202B-FSGS-016SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	9.83E+00	6.68E-01	
	Tl-208	0.999	6.32E-02	1.35E-02	
X	Bi-211	0.889			
	Pb-212	1.000	1.91E-01	3.14E-02	
	Bi-214	0.999	1.45E-01	2.94E-02	
	Pb-214	0.997	1.64E-01	3.11E-02	
	Ac-228	0.998	2.27E-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 09-Oct-19-10042

L1-12202B-FSGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 12:54:09PM
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	6.55E-02	6.26E-02	6.26E-02
	BE-7	477.60		10.44	3.64E-01	4.63E-01	4.63E-01
+	K-40	1460.82	*	10.66	9.83E+00	5.93E-01	5.93E-01
	Mn-54	834.85		99.98	4.70E-02	5.27E-02	5.27E-02
	Co-60	1173.23		99.85	2.49E-02	5.78E-02	7.26E-02
		1332.49		99.98	1.52E-02		5.78E-02
	Nb-94	702.65		99.81	-8.17E-03	4.41E-02	4.41E-02
		871.09		99.89	4.57E-03		4.92E-02
	Ag-108m	79.13		6.60	1.48E+00	4.23E-02	1.95E+00
		433.94		90.50	3.57E-02		4.23E-02
		614.28		89.80	-4.76E-02		5.87E-02
		722.94		90.80	-1.06E-02		5.18E-02
	Sb-125	176.31		6.84	3.87E-01	1.34E-01	5.84E-01
		380.45		1.52	-2.43E-01		2.55E+00
		427.87		29.60	-8.04E-02		1.34E-01
		463.36		10.49	3.63E-01		4.30E-01
		600.60		17.65	4.59E-03		2.05E-01
		606.71		4.98	1.24E+00		1.29E+00
		635.95		11.22	1.13E-01		4.18E-01

Analysis Report for 09-Oct-19-10042

L1-12202B-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	5.43E-01	1.34E-01	2.54E+00
Ba-133	79.61	2.65	6.56E-01	7.81E-02	4.51E+00
	81.00	32.90	-4.68E-01		2.95E-01
	276.40	7.16	2.12E-01		5.67E-01
	302.85	18.34	1.12E-01		2.14E-01
	356.01	62.05	-3.96E-02		7.81E-02
	383.85	8.94	-7.90E-02		4.34E-01
Cs-134	475.36	1.48	1.17E+00	6.01E-02	3.11E+00
	563.25	8.34	2.03E-01		4.77E-01
	569.33	15.37	1.84E-01		3.07E-01
	604.72	97.62	-6.95E-02		6.01E-02
	795.86	85.46	1.34E-02		6.05E-02
	801.95	8.69	-6.20E-01		6.31E-01
	1038.61	0.99	-1.66E+00		4.84E+00
	1167.97	1.79	-1.47E+00		4.27E+00
	1365.19	3.02	1.56E-01		1.76E+00
Cs-137	661.66	85.10	1.17E-02	5.21E-02	5.21E-02
Eu-152	121.78	28.67	5.25E-02	1.47E-01	1.66E-01
	244.70	7.61	-1.63E-01		5.43E-01
	295.94	0.45	3.48E-01		9.66E+00
	344.28	26.60	2.59E-02		1.47E-01
	367.79	0.86	-1.94E+00		4.17E+00
	411.12	2.24	-3.23E-01		1.82E+00
	443.96	2.83	3.42E-02		1.23E+00
	488.68	0.42	-3.57E+00		8.96E+00
	563.99	0.49	5.41E+00		8.46E+00
	586.26	0.46	-7.32E+00		1.23E+01
	678.62	0.47	2.52E-01		8.81E+00
	688.67	0.86	-2.82E+00		5.61E+00
	719.35	0.28	1.25E+01		1.73E+01
	778.90	12.96	-3.31E-01		3.58E-01
	810.45	0.32	2.75E+00		1.58E+01
	867.37	4.26	-3.02E-01		1.06E+00
	919.33	0.43	6.90E+00		1.31E+01
	964.08	14.65	2.48E-02		4.69E-01
	1085.87	10.24	-5.77E-01		5.67E-01
	1089.74	1.73	-1.22E+00		3.58E+00
	1112.07	13.69	9.50E-02		4.08E-01
	1212.95	1.43	6.97E-01		5.72E+00
	1249.94	0.19	-7.04E+00		3.75E+01
	1299.14	1.63	3.74E+00		4.41E+00
	1408.01	21.07	4.81E-02		2.34E-01
	1457.64	0.50	2.13E+02		5.24E+01
	1528.10	0.28	1.91E+00		9.24E+00
Eu-154	123.07	40.40	3.82E-03	1.14E-01	1.14E-01
	247.93	6.89	-1.34E-01		5.23E-01
	591.76	4.95	2.39E-01		8.05E-01
	692.42	1.78	3.92E-01		2.72E+00
	723.30	20.06	-6.04E-03		2.35E-01
	756.80	4.52	1.29E-01		9.71E-01
	873.18	12.08	2.69E-01		3.92E-01

Analysis Report for 09-Oct-19-10042

L1-12202B-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.06E-01	1.14E-01	5.32E-01
	1004.76	18.01	4.31E-02		3.41E-01
	1274.43	34.80	1.34E-01		2.03E-01
	1596.48	1.80	1.40E+00		2.68E+00
Eu-155	45.30	1.31	5.21E+00	2.68E-01	3.22E+01
	60.01	1.22	-6.83E+00		2.92E+01
	86.55	30.70	4.18E-03		2.68E-01
	105.31	21.10	-7.25E-02		2.82E-01
Ra-226	186.21	3.64	1.39E-01	1.12E+00	1.12E+00
Pa-231	27.36	10.30	9.29E-01	1.56E+00	3.20E+00
	283.69	1.70	1.06E-01		2.20E+00
	300.07	2.47	-3.72E-01		1.56E+00
	302.65	2.20	1.03E+00		1.77E+00
	330.06	1.40	2.65E-01		2.81E+00
U-235	143.76	10.96	9.98E-02	7.34E-02	4.05E-01
	163.33	5.08	-1.17E-02		8.11E-01
	185.71	57.20	4.91E-02		7.34E-02
	202.11	1.08	2.57E+00		3.72E+00
	205.31	5.01	-2.27E-01		7.77E-01
Am-241	59.54	35.90	-7.01E-01	1.01E+00	1.01E+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 09-Oct-19-10043
L1-12202B-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Oct-19-10043
Sample Description	: L1-12202B-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.652E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 7:50:00AM
Acquisition Started	: 10/9/2019 12:39:14PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 10/9/2019
Efficiency Calibration Description	:
Sample Number	: 80377
Fill Height	: 1652.01 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/9/2019 12:54:27PM

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

DATA VALIDATED 10/9/19 - 1500
J Graham

Analysis Report for 09-Oct-19-10043

L1-12202B-FSGS-017SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.75	949 -	960	954.58	8.61E+01	15.60	6.09E+01	1.06
2	295.29	1177 -	1187	1180.43	3.77E+01	9.32	2.03E+01	0.52
3	351.94	1400 -	1414	1406.77	7.86E+01	10.87	1.34E+01	0.78
4	583.19	2324 -	2337	2330.87	5.15E+01	7.82	3.50E+00	0.77
5	609.21	2428 -	2440	2434.87	5.79E+01	10.01	1.61E+01	0.81
6	1460.11	5825 -	5852	5838.37	4.45E+02	21.43	3.32E+00	2.14

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.92	1460.82	*	10.66	9.77E+00	6.33E-01
Tl-208	1.00	583.19	*	85.00	7.62E-02	1.24E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.35E-01	2.68E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.65E-01	3.02E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 09-Oct-19-10043

L1-12202B-FSGS-017SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.59E-01	4.13E-02
		351.93	*	35.60	1.95E-01	3.11E-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	0.922	9.77E+00	6.33E-01	
	Tl-208	1.000	7.62E-02	1.24E-02	
X	Bi-211	0.886			
	Pb-212	0.998	1.35E-01	2.68E-02	
	Bi-214	0.999	1.65E-01	3.02E-02	
	Pb-214	1.000	1.82E-01	2.49E-02	

Analysis Report for 09-Oct-19-10043

L1-12202B-FSGS-017SS

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

Errors quoted at 1.000sigma

Analysis Report for 09-Oct-19-10043

L1-12202B-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/9/2019 12:54:27PM
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	7.58E-02	5.55E-02	5.55E-02
	BE-7	477.60		10.44	9.31E-02	4.16E-01	4.16E-01
+	K-40	1460.82	*	10.66	9.77E+00	3.45E-01	3.45E-01
	Mn-54	834.85		99.98	1.42E-02	5.02E-02	5.02E-02
	Co-60	1173.23		99.85	-2.16E-02	4.10E-02	6.45E-02
		1332.49		99.98	-6.95E-04		4.10E-02
	Nb-94	702.65		99.81	6.20E-03	4.58E-02	4.64E-02
		871.09		99.89	-2.19E-02		4.58E-02
	Ag-108m	79.13		6.60	1.17E+00	3.58E-02	1.20E+00
		433.94		90.50	-1.87E-02		3.58E-02
		614.28		89.80	-5.97E-02		5.44E-02
		722.94		90.80	-5.14E-02		4.81E-02
	Sb-125	176.31		6.84	9.55E-03	1.06E-01	4.38E-01
		380.45		1.52	1.20E-01		2.20E+00
		427.87		29.60	-7.52E-03		1.06E-01
		463.36		10.49	-1.97E-02		3.32E-01
		600.60		17.65	-2.66E-01		2.02E-01
		606.71		4.98	2.28E+00		1.33E+00
		635.95		11.22	1.05E-01		3.36E-01

Analysis Report for 09-Oct-19-10043

L1-12202B-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.16E+00	1.06E-01	2.22E+00
Ba-133	79.61	2.65	2.40E+00	6.17E-02	2.92E+00
	81.00	32.90	-2.38E-01		1.92E-01
	276.40	7.16	2.52E-01		4.54E-01
	302.85	18.34	-3.37E-02		1.63E-01
	356.01	62.05	-2.07E-02		6.17E-02
	383.85	8.94	-2.08E-01		3.61E-01
Cs-134	475.36	1.48	9.20E-01	5.60E-02	2.96E+00
	563.25	8.34	-4.07E-01		5.11E-01
	569.33	15.37	1.36E-02		2.48E-01
	604.72	97.62	-1.83E-02		5.91E-02
	795.86	85.46	1.97E-02		5.60E-02
	801.95	8.69	-2.32E-01		4.65E-01
	1038.61	0.99	-4.15E+00		5.47E+00
	1167.97	1.79	5.50E-01		3.72E+00
	1365.19	3.02	-2.03E-01		1.33E+00
Cs-137	661.66	85.10	6.62E-03	4.83E-02	4.83E-02
Eu-152	121.78	28.67	8.94E-03	1.20E-01	1.20E-01
	244.70	7.61	2.82E-01		4.97E-01
	295.94	0.45	3.94E+00		8.48E+00
	344.28	26.60	3.30E-03		1.39E-01
	367.79	0.86	-4.90E-01		3.75E+00
	411.12	2.24	-1.45E+00		1.51E+00
	443.96	2.83	-3.59E-01		1.13E+00
	488.68	0.42	-2.78E+00		9.00E+00
	563.99	0.49	-1.39E+01		7.62E+00
	586.26	0.46	-3.60E+00		1.17E+01
	678.62	0.47	-3.91E+00		6.52E+00
	688.67	0.86	-1.21E+00		4.07E+00
	719.35	0.28	-1.07E+00		1.40E+01
	778.90	12.96	-2.74E-02		3.11E-01
	810.45	0.32	-1.47E+00		1.24E+01
	867.37	4.26	-6.75E-01		1.11E+00
	919.33	0.43	1.00E+00		1.07E+01
	964.08	14.65	2.85E-01		4.44E-01
	1085.87	10.24	-2.53E-02		5.68E-01
	1089.74	1.73	2.57E+00		3.46E+00
	1112.07	13.69	-1.73E-01		4.01E-01
	1212.95	1.43	-4.32E-01		5.10E+00
	1249.94	0.19	-1.90E+01		3.33E+01
	1299.14	1.63	-4.23E+00		3.14E+00
	1408.01	21.07	-4.54E-02		2.03E-01
	1457.64	0.50	2.11E+02		4.89E+01
	1528.10	0.28	-2.01E+00		1.26E+01
Eu-154	123.07	40.40	-6.50E-03	8.27E-02	8.27E-02
	247.93	6.89	-4.98E-02		4.39E-01
	591.76	4.95	6.21E-02		7.92E-01
	692.42	1.78	-1.23E+00		2.35E+00
	723.30	20.06	-6.93E-02		2.24E-01
	756.80	4.52	4.89E-01		1.11E+00
	873.18	12.08	-3.15E-01		3.80E-01

Analysis Report for 09-Oct-19-10043

L1-12202B-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	6.54E-02	8.27E-02	5.25E-01
	1004.76	18.01	4.79E-02		2.76E-01
	1274.43	34.80	-4.78E-02		1.15E-01
	1596.48	1.80	5.58E-01		1.74E+00
Eu-155	45.30	1.31	3.03E+00	1.78E-01	1.14E+01
	60.01	1.22	-4.56E+00		1.29E+01
	86.55	30.70	9.80E-02		1.78E-01
	105.31	21.10	-5.77E-03		1.86E-01
Ra-226	186.21	3.64	3.43E-01	9.07E-01	9.07E-01
Pa-231	27.36	10.30	8.76E-01	1.24E+00	1.25E+00
	283.69	1.70	6.55E-01		1.76E+00
	300.07	2.47	-3.11E-01		1.24E+00
	302.65	2.20	-2.18E-01		1.33E+00
	330.06	1.40	-7.68E-02		2.50E+00
U-235	143.76	10.96	-4.43E-02	5.76E-02	2.86E-01
	163.33	5.08	-1.14E-01		6.38E-01
	185.71	57.20	2.68E-02		5.76E-02
	202.11	1.08	1.05E+00		2.89E+00
	205.31	5.01	-1.57E-01		6.16E-01
Am-241	59.54	35.90	-1.80E-01	4.46E-01	4.46E-01

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

Apex-Gamma

Analysis Report for 14-Oct-19-10014

L1-12202B-FSGS-014SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Oct-19-10014
Sample Description	: L1-12202B-FSGS-014SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.740E+03 grams
Facility	: Default
Sample Taken On	: 10/9/2019 1:03:00PM
Acquisition Started	: 10/14/2019 10:03:39AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.15 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 10/14/2019
Efficiency Calibration Description	:
Sample Number	: 80468
Fill Height	: 1740.02 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/14/2019 10:18:43AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/14/19 - 1500

J Graham

Analysis Report for 14-Oct-19-10014

L1-12202B-FSGS-014SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.53	949 -	959	954.22	1.08E+02	14.97	4.86E+01	0.74
2	351.87	1402 -	1416	1407.21	7.41E+01	11.44	1.99E+01	1.33
3	583.20	2327 -	2338	2332.00	2.44E+01	8.28	1.76E+01	0.85
4	609.23	2432 -	2441	2436.10	3.67E+01	8.46	1.53E+01	0.69
5	1460.71	5831 -	5853	5842.68	3.54E+02	18.81	0.00E+00	1.47

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.53E+00	5.85E-01
Tl-208	1.00	583.19	*	85.00	3.97E-02	1.37E-02
Bi-211	0.90	351.07	*	13.02	5.54E-01	9.65E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.90E-01	3.04E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.15E-01	2.73E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 14-Oct-19-10014

L1-12202B-FSGS-014SB

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	2.03E-01	3.52E-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	8.53E+00	5.85E-01	
	Tl-208	1.000	3.97E-02	1.37E-02	
?	Bi-211	0.903	5.54E-01	9.65E-02	
	Pb-212	0.999	1.90E-01	3.04E-02	
	Bi-214	1.000	1.15E-01	2.73E-02	
?	Pb-214	1.000	2.03E-01	3.52E-02	

Analysis Report for 14-Oct-19-10014

L1-12202B-FSGS-014SB

? = 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 14-Oct-19-10014

L1-12202B-FSGS-014SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/14/2019 10:18:43AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	-3.32E-03	6.15E-02	6.15E-02
	BE-7	477.60		10.44	3.57E-01	4.60E-01	4.60E-01
+	K-40	1460.82	*	10.66	8.53E+00	6.93E-02	6.93E-02
	Mn-54	834.85		99.98	-2.22E-03	4.68E-02	4.68E-02
	Co-60	1173.23		99.85	-4.64E-02	5.44E-02	6.25E-02
		1332.49		99.98	-2.80E-02		5.44E-02
	Nb-94	702.65		99.81	-2.66E-02	4.64E-02	4.64E-02
		871.09		99.89	1.03E-02		4.68E-02
	Ag-108m	79.13		6.60	8.64E-01	4.32E-02	1.97E+00
		433.94		90.50	-3.24E-02		4.32E-02
		614.28		89.80	-4.26E-02		6.07E-02
		722.94		90.80	4.04E-02		5.27E-02
	Sb-125	176.31		6.84	5.52E-02	1.42E-01	5.66E-01
		380.45		1.52	1.11E+00		2.68E+00
		427.87		29.60	-5.15E-02		1.42E-01
		463.36		10.49	-1.72E-01		3.62E-01
		600.60		17.65	-8.59E-02		2.44E-01
		606.71		4.98	1.08E+00		1.35E+00
		635.95		11.22	9.51E-02		3.87E-01

Analysis Report for 14-Oct-19-10014

L1-12202B-FSGS-014SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.98E+00	1.42E-01	2.59E+00
Ba-133	79.61	2.65	3.94E-01	7.16E-02	4.77E+00
	81.00	32.90	-1.29E-01		3.24E-01
	276.40	7.16	1.93E-01		5.63E-01
	302.85	18.34	-6.29E-02		2.13E-01
	356.01	62.05	-1.93E-02		7.16E-02
	383.85	8.94	-1.49E-01		4.38E-01
Cs-134	475.36	1.48	-4.49E-01	6.41E-02	2.92E+00
	563.25	8.34	2.75E-01		5.14E-01
	569.33	15.37	8.43E-02		2.51E-01
	604.72	97.62	-6.19E-02		6.63E-02
	795.86	85.46	2.35E-02		6.41E-02
	801.95	8.69	2.52E-01		5.11E-01
	1038.61	0.99	-1.38E-01		5.74E+00
	1167.97	1.79	3.45E-01		3.54E+00
	1365.19	3.02	1.07E+00		1.93E+00
Cs-137	661.66	85.10	-5.89E-03	5.23E-02	5.23E-02
Eu-152	121.78	28.67	1.32E-01	1.45E-01	1.65E-01
	244.70	7.61	1.43E-01		5.33E-01
	295.94	0.45	3.94E+00		1.06E+01
	344.28	26.60	-1.14E-01		1.45E-01
	367.79	0.86	5.51E-01		4.48E+00
	411.12	2.24	-6.03E-01		1.61E+00
	443.96	2.83	-1.34E+00		1.39E+00
	488.68	0.42	1.52E+00		9.68E+00
	563.99	0.49	-2.14E+00		8.60E+00
	586.26	0.46	4.34E+00		1.27E+01
	678.62	0.47	-3.44E+00		9.87E+00
	688.67	0.86	1.17E+00		4.83E+00
	719.35	0.28	9.57E+00		1.59E+01
	778.90	12.96	-5.53E-02		3.88E-01
	810.45	0.32	-9.34E+00		1.39E+01
	867.37	4.26	-1.06E+00		1.12E+00
	919.33	0.43	2.04E+00		1.20E+01
	964.08	14.65	1.21E-01		4.87E-01
	1085.87	10.24	-4.24E-01		5.09E-01
	1089.74	1.73	2.16E+00		3.54E+00
	1112.07	13.69	3.98E-01		5.05E-01
	1212.95	1.43	6.82E-01		4.94E+00
	1249.94	0.19	-1.65E+01		3.85E+01
	1299.14	1.63	1.67E+00		3.97E+00
	1408.01	21.07	5.55E-02		2.23E-01
	1457.64	0.50	1.75E+02		4.77E+01
	1528.10	0.28	3.15E-01		1.38E+01
Eu-154	123.07	40.40	2.45E-02	1.14E-01	1.14E-01
	247.93	6.89	-8.93E-02		5.50E-01
	591.76	4.95	5.97E-01		8.81E-01
	692.42	1.78	-1.10E+00		2.47E+00
	723.30	20.06	-8.76E-02		2.32E-01
	756.80	4.52	8.72E-02		1.11E+00
	873.18	12.08	2.21E-01		4.10E-01

Analysis Report for 14-Oct-19-10014

L1-12202B-FSGS-014SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.22E-01	1.14E-01	4.80E-01
	1004.76	18.01	1.50E-01		3.27E-01
	1274.43	34.80	7.19E-02		1.95E-01
	1596.48	1.80	6.13E-01		1.91E+00
Eu-155	45.30	1.31	-2.40E+01	2.71E-01	2.95E+01
	60.01	1.22	-9.81E+00		3.13E+01
	86.55	30.70	-4.88E-03		2.71E-01
	105.31	21.10	1.31E-01		2.73E-01
Ra-226	186.21	3.64	1.69E-01	1.06E+00	1.06E+00
Pa-231	27.36	10.30	3.11E+00	1.53E+00	3.55E+00
	283.69	1.70	-2.88E-01		2.21E+00
	300.07	2.47	-3.41E+00		1.53E+00
	302.65	2.20	-1.80E-01		1.79E+00
	330.06	1.40	1.45E+00		2.97E+00
U-235	143.76	10.96	1.11E-02	6.77E-02	3.79E-01
	163.33	5.08	3.82E-01		8.32E-01
	185.71	57.20	1.48E-03		6.77E-02
	202.11	1.08	-1.27E-01		3.51E+00
	205.31	5.01	-3.53E-01		7.68E-01
Am-241	59.54	35.90	-1.79E-01	1.13E+00	1.13E+00

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

Apex-Gamma

Analysis Report for 14-Oct-19-10015

L1-12202B-FSGS-015SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Oct-19-10015
Sample Description	: L1-12202B-FSGS-015SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.538E+03 grams
Facility	: Default
Sample Taken On	: 10/9/2019 12:43:00PM
Acquisition Started	: 10/14/2019 10:03:47AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 10/14/2019
Efficiency Calibration Description	:
Sample Number	: 80469
Fill Height	: 1537.85 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/14/2019 10:19:03AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/14/19 - 1500

J Graham

Analysis Report for 14-Oct-19-10015

L1-12202B-FSGS-015SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	87.39	347 -	353	350.04	1.55E+01	9.62	4.05E+01	0.63
2	238.81	947 -	961	954.84	1.24E+02	17.43	6.05E+01	1.24
3	295.35	1176 -	1185	1180.70	3.57E+01	8.91	1.93E+01	0.36
4	338.36	1348 -	1360	1352.52	4.71E+01	9.57	1.69E+01	0.73
5	351.74	1398 -	1412	1405.98	6.90E+01	11.52	2.20E+01	1.05
6	608.91	2426 -	2439	2433.66	5.11E+01	10.72	2.19E+01	0.63
7	1460.00	5824 -	5849	5837.92	3.96E+02	20.21	3.08E+00	2.23

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.89	1460.82	*	10.66	8.87E+00	5.94E-01
Cd-109	0.93	88.03	*	3.70	3.85E-01	2.42E-01
Eu-155	0.93	45.30		1.31		
		60.01		1.22		
		86.55	*	30.70	4.61E-02	2.90E-02
		105.31		21.10		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.97E-01	3.19E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		

Analysis Report for 14-Oct-19-10015

L1-12202B-FSGS-015SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	1.00	77.11		17.10		
		87.35	*	3.97	3.56E-01	2.24E-01
		89.78		1.46		
Bi-214	0.98	609.32	*	45.49	1.48E-01	3.22E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.52E-01	4.00E-02
		351.93	*	35.60	1.73E-01	3.21E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11		9.70		
		87.35	*	2.24	6.31E-01	3.98E-01
		89.78		0.82		
Ac-228	0.57	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.63E-01	7.96E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

Analysis Report for 14-Oct-19-10015

L1-12202B-FSGS-015SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.897	8.87E+00	5.94E-01	
?	Cd-109	0.937	3.85E-01	2.42E-01	
?	Eu-155	0.937	4.61E-02	2.90E-02	
X	Bi-211	0.930			
	Pb-212	0.995	1.97E-01	3.19E-02	
?	Pb212-XR	1.000	3.56E-01	2.24E-01	
	Bi-214	0.989	1.48E-01	3.22E-02	
	Pb-214	0.996	1.65E-01	2.50E-02	
?	Pb214-XR	1.000	6.31E-01	3.98E-01	
	Ac-228	0.575	3.63E-01	7.96E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 14-Oct-19-10015

L1-12202B-FSGS-015SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/14/2019 10:19:03AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.24E-02	5.72E-02	5.72E-02
	BE-7	477.60		10.44	-9.93E-03	3.31E-01	3.31E-01
+	K-40	1460.82	*	10.66	8.87E+00	3.34E-01	3.34E-01
	Mn-54	834.85		99.98	1.31E-02	4.80E-02	4.80E-02
	Co-60	1173.23		99.85	2.73E-02	4.79E-02	6.82E-02
		1332.49		99.98	5.02E-03		4.79E-02
	Nb-94	702.65		99.81	2.72E-02	4.48E-02	4.48E-02
		871.09		99.89	-2.74E-02		4.89E-02
	Ag-108m	79.13		6.60	6.69E-01	3.73E-02	1.12E+00
		433.94		90.50	-1.18E-02		3.73E-02
		614.28		89.80	-5.75E-02		5.37E-02
		722.94		90.80	4.84E-02		5.02E-02
	Sb-125	176.31		6.84	-2.47E-01	1.17E-01	4.27E-01
		380.45		1.52	3.89E-01		2.11E+00
		427.87		29.60	5.32E-03		1.17E-01
		463.36		10.49	1.62E-01		3.42E-01
		600.60		17.65	1.47E-01		2.54E-01
		606.71		4.98	2.17E+00		1.39E+00
		635.95		11.22	-6.69E-03		3.20E-01

Analysis Report for 14-Oct-19-10015

L1-12202B-FSGS-015SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.30E+00	1.17E-01	2.30E+00
Ba-133	79.61	2.65	2.32E+00	5.83E-02	2.76E+00
	81.00	32.90	-3.02E-01		1.84E-01
	276.40	7.16	1.57E-01		4.72E-01
	302.85	18.34	7.63E-02		1.82E-01
	356.01	62.05	-5.18E-02		5.83E-02
	383.85	8.94	-9.70E-02		3.74E-01
Cs-134	475.36	1.48	-9.61E-01	5.40E-02	2.23E+00
	563.25	8.34	-4.88E-01		4.88E-01
	569.33	15.37	5.53E-03		2.12E-01
	604.72	97.62	-1.38E-02		6.20E-02
	795.86	85.46	3.66E-02		5.40E-02
	801.95	8.69	2.12E-01		5.58E-01
	1038.61	0.99	-2.56E+00		5.15E+00
	1167.97	1.79	1.91E+00		3.85E+00
	1365.19	3.02	-2.08E-01		1.36E+00
Cs-137	661.66	85.10	1.85E-02	4.85E-02	4.85E-02
Eu-152	121.78	28.67	-1.28E-01	1.05E-01	1.05E-01
	244.70	7.61	1.05E-01		4.49E-01
	295.94	0.45	-5.97E+00		8.15E+00
	344.28	26.60	-7.54E-03		1.23E-01
	367.79	0.86	-1.20E+00		3.88E+00
	411.12	2.24	-1.17E+00		1.49E+00
	443.96	2.83	-8.74E-01		1.11E+00
	488.68	0.42	1.71E+00		8.08E+00
	563.99	0.49	-7.61E+00		7.74E+00
	586.26	0.46	1.21E+01		1.30E+01
	678.62	0.47	7.78E+00		9.86E+00
	688.67	0.86	1.07E-01		4.48E+00
	719.35	0.28	3.98E+00		1.37E+01
	778.90	12.96	-6.68E-02		3.05E-01
	810.45	0.32	-5.48E+00		1.45E+01
	867.37	4.26	-4.91E-01		1.11E+00
	919.33	0.43	2.21E-01		1.17E+01
	964.08	14.65	6.81E-02		4.35E-01
	1085.87	10.24	2.10E-01		5.79E-01
	1089.74	1.73	-7.52E-03		3.29E+00
	1112.07	13.69	-3.84E-01		4.57E-01
	1212.95	1.43	1.05E+00		4.76E+00
	1249.94	0.19	-2.47E+01		3.19E+01
	1299.14	1.63	5.90E-01		3.56E+00
	1408.01	21.07	-1.38E-01		1.90E-01
	1457.64	0.50	1.89E+02		4.70E+01
	1528.10	0.28	-1.62E+01		1.09E+01
Eu-154	123.07	40.40	4.39E-02	8.04E-02	8.04E-02
	247.93	6.89	-2.34E-01		4.39E-01
	591.76	4.95	-6.98E-01		7.37E-01
	692.42	1.78	1.28E+00		2.36E+00
	723.30	20.06	1.44E-01		2.28E-01
	756.80	4.52	3.30E-01		9.07E-01
	873.18	12.08	-1.81E-01		4.18E-01

Analysis Report for 14-Oct-19-10015

L1-12202B-FSGS-015SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	1.53E-01	8.04E-02	5.63E-01
		1004.76		18.01	4.63E-02		3.17E-01
		1274.43		34.80	-1.07E-01		1.55E-01
		1596.48		1.80	-1.57E-01		1.94E+00
+	Eu-155	45.30		1.31	1.43E+00	9.71E-02	1.15E+01
		60.01		1.22	-1.34E+00		1.21E+01
		86.55	*	30.70	4.61E-02		9.71E-02
		105.31		21.10	4.07E-02		1.92E-01
	Ra-226	186.21		3.64	3.47E-01	8.87E-01	8.87E-01
	Pa-231	27.36		10.30	3.56E-01	1.16E+00	1.16E+00
		283.69		1.70	-6.35E-01		1.79E+00
		300.07		2.47	-1.04E+00		1.26E+00
		302.65		2.20	5.32E-01		1.49E+00
		330.06		1.40	-7.93E-01		2.12E+00
	U-235	143.76		10.96	-1.65E-01	5.59E-02	2.90E-01
		163.33		5.08	4.04E-01		6.34E-01
		185.71		57.20	8.48E-03		5.59E-02
		202.11		1.08	-2.57E-02		2.82E+00
		205.31		5.01	-1.53E-01		5.87E-01
	Am-241	59.54		35.90	5.88E-02	4.42E-01	4.42E-01

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

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-46637

January 23, 2020

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

CASE NARRATIVE
Work Order # 19-12059-OR

SAMPLE RECEIPT

This work order contains sixteen soil samples received 12/16/2019. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-12201-A-FSGS-002-SS-A	19-12059-04	L1-12202-B-FSGS-002-SS-A	19-12059-12
L1-12201-A-FSGS-006-SS-A	19-12059-05	L1-12202-B-FSGS-007-SS-A	19-12059-13
L1-12201-B-FSGS-013-SS-A	19-12059-06	L1-10207-E-FSGS-002-SS-A	19-12059-14
L1-12201-B-FSGS-015-SS-A	19-12059-07	L1-10207-E-FSGS-008-SS-A	19-12059-15
L1-12201-C-FSGS-006-SS-A	19-12059-08	L1-10213-C-FIGS-001-SS-A	19-12059-16
L1-12201-C-FSGS-013-SB-A	19-12059-09	L1-10213-C-QIGS-001-SS-A	19-12059-17
L1-12202-A-FSGS-001-SS-A	19-12059-10	L1-10213-C-FIGS-005-SS-A	19-12059-18
L1-12202-A-FSGS-004-SS-A	19-12059-11	L1-10213-C-FIGS-003-SB-A	19-12059-19

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. Results for the Tritium duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Tritium laboratory control sample demonstrated an acceptable percent recovery.

NICKEL-63

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

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

GAMMA SPECTROSCOPY

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

ANALYTICAL RESULTS CONTINUED

GAMMA SPECTROSCOPY CONTINUED

Samples demonstrated acceptable results for all gamma-emitting radionuclides as reported. The method blank demonstrated acceptable results for all radionuclides as reported. Results for the Actinium-228, Potassium-40 and Thorium-234 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Cobalt-60 and Cesium-137 laboratory control sample demonstrated an acceptable percent recovery.

CERTIFICATION OF ACCURACY

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

M.R. McDougall
Laboratory Manager

Date: 1/23/2020

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

Eberline Analytical
Final Report of Analysis

Report To:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-01	LCS	KNOWN	12/16/19 00:00	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	2.03E+02	7.30E+00				pCi/g
19-12059-01	LCS	SPIKE	12/16/19 00:00	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	2.18E+02	7.94E+00	1.46E+01	5.73E+00		pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-2.25E+00	3.24E+00	3.24E+00	5.75E+00	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-2.55E+00	3.12E+00	3.13E+00	5.58E+00	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-2.76E+00	3.15E+00	3.15E+00	5.63E+00	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-1.10E+00	3.20E+00	3.20E+00	5.62E+00	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-3.02E+00	3.03E+00	3.04E+00	5.45E+00	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-1.79E+00	3.10E+00	3.10E+00	5.49E+00	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	3.74E-01	3.32E+00	3.32E+00	5.73E+00	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	3.55E-01	3.15E+00	3.15E+00	5.44E+00	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-1.77E+00	3.06E+00	3.07E+00	5.43E+00	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-1.64E+00	3.16E+00	3.16E+00	5.58E+00	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-7.02E-01	3.08E+00	3.08E+00	5.38E+00	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-2.65E+00	3.03E+00	3.03E+00	5.42E+00	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-2.39E+00	3.16E+00	3.16E+00	5.63E+00	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	5.16E+01	3.61E+01	3.62E+01	6.59E+01	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-5.49E-01	3.22E+00	3.22E+00	5.61E+00	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	0.00E+00	3.09E+00	3.09E+00	5.35E+00	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-2.45E+00	3.00E+00	3.00E+00	5.36E+00	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/25/2019	19-12059	Tritium	LANL ER-210 Modified	-1.77E+00	3.06E+00	3.06E+00	5.42E+00	U	pCi/g

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

0019

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Patricia Giza		SDG:	19-12059
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
19-12059-01	LCS	KNOWN	12/16/19 00:00	12/16/2019	12/20/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	1.50E+03	4.49E+01				pCi/g
19-12059-01	LCS	SPIKE	12/16/19 00:00	12/16/2019	12/20/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	1.52E+03	1.29E+01	9.01E+01	2.97E+00		pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/20/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	6.99E-01	1.80E+00	1.80E+00	3.06E+00	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/20/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	4.80E+00	1.95E+00	1.97E+00	3.11E+00		pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/20/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	3.34E-01	1.70E+00	1.70E+00	2.93E+00	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	8.58E-02	1.74E+00	1.74E+00	3.01E+00	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	4.14E+00	1.74E+00	1.76E+00	2.79E+00		pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	8.15E-02	1.66E+00	1.66E+00	2.86E+00	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	1.87E+00	1.96E+00	1.96E+00	3.28E+00	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	-7.57E-01	1.90E+00	1.90E+00	3.32E+00	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	-3.42E-01	1.73E+00	1.73E+00	3.00E+00	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	2.65E-01	1.80E+00	1.80E+00	3.10E+00	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	1.23E+00	1.82E+00	1.82E+00	3.08E+00	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	-4.64E-01	1.87E+00	1.87E+00	3.25E+00	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	2.64E-01	1.79E+00	1.79E+00	3.08E+00	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	1.19E+00	1.90E+00	1.90E+00	3.21E+00	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	7.44E-01	1.91E+00	1.91E+00	3.26E+00	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	4.81E+00	2.02E+00	2.04E+00	3.24E+00		pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	1.11E+00	2.08E+00	2.08E+00	3.54E+00	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/21/2019	19-12059	Nickel-63	ASTM 3500-Ni Modified	-3.73E-01	1.88E+00	1.88E+00	3.27E+00	U	pCi/g

0020

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:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-01	LCS	KNOWN	12/16/19 00:00	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	5.07E+01	2.84E-01				pCi/g
19-12059-01	LCS	SPIKE	12/16/19 00:00	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	4.73E+01	2.64E+00	1.67E+01	9.31E-01		pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	6.71E-02	3.50E-01	3.51E-01	8.89E-01	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	7.05E-01	3.20E-01	4.03E-01	7.25E-01	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	1.85E-01	3.30E-01	3.37E-01	8.24E-01	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	1.99E-01	3.38E-01	3.45E-01	7.01E-01	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	-8.41E-02	3.21E-01	3.22E-01	6.97E-01	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	8.58E-02	3.54E-01	3.55E-01	7.50E-01	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	-1.27E-01	3.22E-01	3.25E-01	7.04E-01	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	1.28E-01	3.60E-01	3.63E-01	7.55E-01	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	4.02E-01	2.98E-01	3.29E-01	5.90E-01	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	-1.57E-01	2.98E-01	3.03E-01	6.54E-01	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	2.73E-01	3.14E-01	3.29E-01	6.42E-01	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	-1.09E-01	3.52E-01	3.54E-01	7.64E-01	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	3.90E-02	3.68E-01	3.68E-01	7.82E-01	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	3.68E-01	3.16E-01	3.41E-01	6.33E-01	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	1.17E-01	3.06E-01	3.09E-01	6.43E-01	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	3.53E-01	3.05E-01	3.29E-01	6.10E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	-1.45E-01	3.78E-01	3.81E-01	8.20E-01	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/24/2019	19-12059	Strontium-90	ElChroM SRW01 Modified	1.98E-01	2.34E-01	2.44E-01	4.78E-01	U	pCi/g
19-12059-01	LCS	KNOWN	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
19-12059-01	LCS	KNOWN	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
19-12059-01	LCS	SPIKE	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Cobalt-60	EPA 901.1 Modified	1.34E+02	7.75E+00	1.03E+01	9.68E-01		pCi/g
19-12059-01	LCS	SPIKE	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Cesium-137	EPA 901.1 Modified	8.49E+01	7.29E+00	8.49E+00	9.24E-01		pCi/g

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

0021

Eberline Analytical
Final Report of Analysis

Report To:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Actinium-228	EPA 901.1 Modified	1.80E-02	6.89E-02	6.89E-02	1.14E-01	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Silver-110m	EPA 901.1 Modified	-1.65E-03	2.03E-02	2.03E-02	2.12E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Americium-241	EPA 901.1 Modified	1.13E-02	2.74E-02	2.74E-02	5.44E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Barium-133	EPA 901.1 Modified	-3.30E-02	3.13E-02	3.13E-02	3.32E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Bismuth-214	EPA 901.1 Modified	2.40E-02	4.51E-02	4.51E-02	7.69E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Cobalt-60	EPA 901.1 Modified	-1.93E-03	1.89E-02	1.89E-02	3.06E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Cesium-134	EPA 901.1 Modified	-2.43E-02	2.88E-02	2.89E-02	3.35E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Cesium-137	EPA 901.1 Modified	6.04E-03	1.84E-02	1.84E-02	3.14E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Europium-152	EPA 901.1 Modified	-2.56E-03	8.46E-02	8.46E-02	8.62E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Europium-154	EPA 901.1 Modified	3.79E-02	4.63E-02	4.63E-02	4.55E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Europium-155	EPA 901.1 Modified	-4.37E-02	4.63E-02	4.63E-02	5.36E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Holmium-166m	EPA 901.1 Modified	2.56E-02	2.74E-02	2.75E-02	3.53E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Iodine-129	EPA 901.1 Modified	8.79E-02	5.23E-02	5.25E-02	9.48E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Potassium-40	EPA 901.1 Modified	2.61E-01	1.84E-01	1.85E-01	4.38E-01	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Manganese-54	EPA 901.1 Modified	6.19E-04	1.78E-02	1.78E-02	2.85E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	-9.09E-03	2.01E-02	2.01E-02	2.82E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Niobium-94	EPA 901.1 Modified	2.27E-03	2.03E-02	2.03E-02	3.04E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Lead-210	EPA 901.1 Modified	5.49E-01	4.69E-01	4.70E-01	7.06E-01	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Lead-212	EPA 901.1 Modified	6.42E-02	3.44E-02	3.46E-02	5.89E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Lead-214	EPA 901.1 Modified	6.20E-02	3.76E-02	3.77E-02	6.97E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Promethium-145	EPA 901.1 Modified	1.14E-01	6.01E-02	6.04E-02	1.01E-01	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Radium-226	EPA 901.1 Modified	2.40E-02	4.51E-02	4.51E-02	7.69E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Antimony-125	EPA 901.1 Modified	-4.53E-03	4.17E-02	4.17E-02	7.26E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Thorium-234	EPA 901.1 Modified	3.93E-01	4.19E-01	4.19E-01	6.07E-01	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Thallium-208	EPA 901.1 Modified	3.12E-02	4.52E-02	4.52E-02	8.45E-02	U	pCi/g
19-12059-02	MBL	BLANK	12/16/19 00:00	12/16/2019	12/17/2019	19-12059	Uranium-235	EPA 901.1 Modified	-2.18E-02	1.31E-01	1.31E-01	1.72E-01	U	pCi/g

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

0022

Eberline Analytical
Final Report of Analysis

Report To:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Actinium-228	EPA 901.1 Modified	2.93E-01	1.23E-01	1.24E-01	2.40E-01		pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Silver-110m	EPA 901.1 Modified	-2.08E-02	4.33E-02	4.33E-02	4.02E-02	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Americium-241	EPA 901.1 Modified	-1.01E-01	7.56E-02	7.57E-02	1.08E-01	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Barium-133	EPA 901.1 Modified	-4.81E-03	1.59E-02	1.59E-02	7.24E-02	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Bismuth-214	EPA 901.1 Modified	2.90E-01	1.03E-01	1.04E-01	1.75E-01		pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Cobalt-60	EPA 901.1 Modified	-6.29E-03	3.98E-02	3.98E-02	5.31E-02	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Cesium-134	EPA 901.1 Modified	-1.15E-02	1.57E-02	1.58E-02	6.72E-02	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Cesium-137	EPA 901.1 Modified	-1.84E-03	4.27E-02	4.27E-02	5.90E-02	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Europium-152	EPA 901.1 Modified	8.19E-03	6.40E-02	6.40E-02	1.59E-01	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Europium-154	EPA 901.1 Modified	7.54E-02	1.01E-01	1.01E-01	8.09E-02	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Europium-155	EPA 901.1 Modified	4.11E-02	8.79E-02	8.79E-02	1.30E-01	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Holmium-166m	EPA 901.1 Modified	-1.91E-02	6.59E-02	6.59E-02	5.39E-02	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Iodine-129	EPA 901.1 Modified	-9.90E-02	1.32E-01	1.32E-01	1.80E-01	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.31E+01	1.67E+00	1.80E+00	8.03E-01		pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Manganese-54	EPA 901.1 Modified	-3.44E-02	4.63E-02	4.63E-02	5.72E-02	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	6.30E-03	3.32E-02	3.32E-02	4.75E-02	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Niobium-94	EPA 901.1 Modified	8.88E-03	1.73E-02	1.73E-02	5.22E-02	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Lead-210	EPA 901.1 Modified	4.37E-01	7.67E-01	7.67E-01	1.16E+00	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Lead-212	EPA 901.1 Modified	2.92E-01	8.51E-02	8.64E-02	1.49E-01		pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Lead-214	EPA 901.1 Modified	2.51E-01	9.45E-02	9.53E-02	1.51E-01		pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Promethium-145	EPA 901.1 Modified	3.15E-03	1.06E-01	1.06E-01	1.57E-01	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Radium-226	EPA 901.1 Modified	2.90E-01	1.03E-01	1.04E-01	1.75E-01		pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Antimony-125	EPA 901.1 Modified	2.55E-02	8.99E-02	8.99E-02	1.39E-01	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Thorium-234	EPA 901.1 Modified	1.30E+00	7.08E-01	7.11E-01	1.12E+00	U	pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Thallium-208	EPA 901.1 Modified	1.75E-01	8.27E-02	8.32E-02	1.29E-01		pCi/g
19-12059-03	DUP	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Uranium-235	EPA 901.1 Modified	-8.36E-02	2.21E-01	2.21E-01	3.18E-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:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Actinium-228	EPA 901.1 Modified	2.93E-01	1.36E-01	1.37E-01	2.60E-01		pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Silver-110m	EPA 901.1 Modified	8.08E-03	3.89E-02	3.89E-02	4.14E-02	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Americium-241	EPA 901.1 Modified	-1.20E-01	8.74E-02	8.76E-02	1.16E-01	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Barium-133	EPA 901.1 Modified	4.74E-03	1.57E-02	1.57E-02	7.19E-02	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Bismuth-214	EPA 901.1 Modified	3.14E-01	8.64E-02	8.79E-02	1.48E-01		pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Cobalt-60	EPA 901.1 Modified	3.60E-02	4.03E-02	4.03E-02	5.80E-02	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Cesium-134	EPA 901.1 Modified	5.65E-03	1.30E-02	1.30E-02	5.65E-02	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Cesium-137	EPA 901.1 Modified	-4.22E-03	3.81E-02	3.81E-02	5.21E-02	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Europium-152	EPA 901.1 Modified	1.20E-02	5.11E-02	5.11E-02	1.58E-01	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Europium-154	EPA 901.1 Modified	2.23E-03	9.51E-02	9.51E-02	8.21E-02	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Europium-155	EPA 901.1 Modified	3.67E-02	6.48E-02	6.49E-02	1.25E-01	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Holmium-166m	EPA 901.1 Modified	4.48E-02	6.57E-02	6.57E-02	5.71E-02	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Iodine-129	EPA 901.1 Modified	-7.87E-02	1.33E-01	1.33E-01	1.86E-01	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.36E+01	1.73E+00	1.87E+00	7.94E-01		pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Manganese-54	EPA 901.1 Modified	2.11E-02	4.00E-02	4.00E-02	6.17E-02	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	1.48E-02	3.10E-02	3.10E-02	3.66E-02	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Niobium-94	EPA 901.1 Modified	2.51E-02	3.21E-02	3.21E-02	4.92E-02	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Lead-210	EPA 901.1 Modified	5.83E-01	7.66E-01	7.67E-01	1.17E+00	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Lead-212	EPA 901.1 Modified	2.80E-01	9.50E-02	9.61E-02	1.36E-01		pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Lead-214	EPA 901.1 Modified	1.96E-01	8.93E-02	8.99E-02	1.82E-01		pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Promethium-145	EPA 901.1 Modified	-3.80E-03	1.10E-01	1.10E-01	1.61E-01	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Radium-226	EPA 901.1 Modified	3.14E-01	8.64E-02	8.79E-02	1.48E-01		pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Antimony-125	EPA 901.1 Modified	-3.47E-02	8.39E-02	8.39E-02	1.20E-01	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Thorium-234	EPA 901.1 Modified	1.45E+00	7.51E-01	7.55E-01	1.19E+00	U	pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Thallium-208	EPA 901.1 Modified	3.18E-01	1.02E-01	1.03E-01	1.29E-01		pCi/g
19-12059-04	DO	L1-12201-A-FSGS-002-SS-A	10/07/19 08:22	12/16/2019	12/17/2019	19-12059	Uranium-235	EPA 901.1 Modified	2.62E-01	2.15E-01	2.16E-01	3.36E-01	U	pCi/g

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

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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:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Actinium-228	EPA 901.1 Modified	3.12E-01	1.43E-01	1.43E-01	3.18E-01	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Silver-110m	EPA 901.1 Modified	-2.41E-02	5.07E-02	5.08E-02	5.26E-02	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Americium-241	EPA 901.1 Modified	-1.50E-01	7.66E-02	7.70E-02	1.07E-01	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Barium-133	EPA 901.1 Modified	2.57E-02	2.69E-02	2.69E-02	9.47E-02	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Bismuth-214	EPA 901.1 Modified	3.33E-01	1.04E-01	1.05E-01	1.71E-01		pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Cobalt-60	EPA 901.1 Modified	1.88E-02	4.86E-02	4.86E-02	7.83E-02	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Cesium-134	EPA 901.1 Modified	-1.11E-01	6.93E-02	6.95E-02	6.91E-02	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Cesium-137	EPA 901.1 Modified	-1.04E-02	4.41E-02	4.41E-02	7.08E-02	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Europium-152	EPA 901.1 Modified	6.40E-02	1.06E-01	1.06E-01	1.64E-01	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Europium-154	EPA 901.1 Modified	6.86E-04	1.02E-01	1.02E-01	8.40E-02	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Europium-155	EPA 901.1 Modified	1.95E-02	8.82E-02	8.82E-02	1.31E-01	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Holmium-166m	EPA 901.1 Modified	4.93E-02	6.34E-02	6.35E-02	6.03E-02	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Iodine-129	EPA 901.1 Modified	1.11E-01	1.96E-01	1.96E-01	3.22E-01	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.28E+01	1.77E+00	1.89E+00	8.66E-01		pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Manganese-54	EPA 901.1 Modified	2.04E-02	4.61E-02	4.61E-02	7.68E-02	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	-2.75E-02	3.90E-02	3.90E-02	4.67E-02	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Niobium-94	EPA 901.1 Modified	-2.76E-02	4.61E-02	4.61E-02	5.89E-02	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Lead-210	EPA 901.1 Modified	1.52E+00	8.52E-01	8.55E-01	1.46E+00	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Lead-212	EPA 901.1 Modified	3.87E-01	1.21E-01	1.22E-01	1.63E-01		pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Lead-214	EPA 901.1 Modified	2.87E-01	9.58E-02	9.69E-02	1.75E-01		pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Promethium-145	EPA 901.1 Modified	-8.52E-02	1.33E-01	1.33E-01	2.08E-01	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Radium-226	EPA 901.1 Modified	3.33E-01	1.04E-01	1.05E-01	1.71E-01		pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Antimony-125	EPA 901.1 Modified	-8.84E-03	6.92E-02	6.92E-02	1.60E-01	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Thorium-234	EPA 901.1 Modified	1.13E+00	6.35E-01	6.37E-01	1.10E+00	U	pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Thallium-208	EPA 901.1 Modified	2.74E-01	1.09E-01	1.10E-01	1.24E-01		pCi/g
19-12059-05	TRG	L1-12201-A-FSGS-006-SS-A	10/07/19 08:30	12/16/2019	12/17/2019	19-12059	Uranium-235	EPA 901.1 Modified	7.93E-02	2.28E-01	2.28E-01	3.46E-01	U	pCi/g

0025

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:	
Patricia Giza	SDG:	19-12059
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
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Actinium-228	EPA 901.1 Modified	2.28E-01	1.47E-01	1.47E-01	2.75E-01	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Silver-110m	EPA 901.1 Modified	4.14E-04	1.83E-02	1.83E-02	4.39E-02	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Americium-241	EPA 901.1 Modified	-1.31E-01	8.35E-02	8.37E-02	1.09E-01	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Barium-133	EPA 901.1 Modified	-9.96E-03	2.61E-02	2.61E-02	7.18E-02	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Bismuth-214	EPA 901.1 Modified	3.34E-01	8.49E-02	8.66E-02	1.32E-01		pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Cobalt-60	EPA 901.1 Modified	1.11E-02	3.46E-02	3.46E-02	4.75E-02	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Cesium-134	EPA 901.1 Modified	-2.92E-03	1.93E-02	1.93E-02	5.72E-02	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Cesium-137	EPA 901.1 Modified	1.95E-02	3.61E-02	3.61E-02	5.51E-02	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Europium-152	EPA 901.1 Modified	-4.50E-03	4.43E-02	4.43E-02	1.50E-01	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Europium-154	EPA 901.1 Modified	3.88E-02	1.04E-01	1.04E-01	7.60E-02	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Europium-155	EPA 901.1 Modified	8.53E-02	5.18E-02	5.20E-02	1.48E-01	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Holmium-166m	EPA 901.1 Modified	-2.55E-03	6.25E-02	6.25E-02	5.01E-02	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Iodine-129	EPA 901.1 Modified	6.04E-02	1.17E-01	1.18E-01	1.78E-01	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.24E+01	1.59E+00	1.71E+00	8.08E-01		pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Manganese-54	EPA 901.1 Modified	-6.79E-03	4.52E-02	4.52E-02	5.98E-02	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	-3.85E-03	2.79E-02	2.79E-02	3.29E-02	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Niobium-94	EPA 901.1 Modified	-3.52E-03	1.25E-02	1.25E-02	4.97E-02	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Lead-210	EPA 901.1 Modified	4.16E-01	7.30E-01	7.30E-01	1.11E+00	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Lead-212	EPA 901.1 Modified	3.59E-01	9.55E-02	9.72E-02	1.24E-01		pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Lead-214	EPA 901.1 Modified	3.01E-01	9.98E-02	1.01E-01	1.28E-01		pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Promethium-145	EPA 901.1 Modified	-3.52E-02	1.02E-01	1.02E-01	1.46E-01	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Radium-226	EPA 901.1 Modified	3.34E-01	8.49E-02	8.66E-02	1.32E-01		pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Antimony-125	EPA 901.1 Modified	-5.32E-02	9.24E-02	9.25E-02	1.29E-01	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Thorium-234	EPA 901.1 Modified	1.23E+00	7.03E-01	7.06E-01	1.10E+00	U	pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Thallium-208	EPA 901.1 Modified	1.53E-01	8.00E-02	8.04E-02	1.22E-01		pCi/g
19-12059-06	TRG	L1-12201-B-FSGS-013-SS-A	09/23/19 08:24	12/16/2019	12/17/2019	19-12059	Uranium-235	EPA 901.1 Modified	9.62E-02	1.82E-01	1.82E-01	2.80E-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:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	3.65E-01	1.46E-01	1.47E-01	2.71E-01		pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	-3.15E-03	4.41E-02	4.41E-02	4.78E-02	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	-1.59E-01	9.92E-02	9.95E-02	1.29E-01	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	1.61E-02	2.20E-02	2.20E-02	7.94E-02	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	3.10E-01	9.37E-02	9.51E-02	1.43E-01		pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	1.48E-02	4.53E-02	4.53E-02	6.29E-02	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	3.27E-03	2.21E-02	2.21E-02	6.62E-02	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	-7.17E-03	4.31E-02	4.31E-02	5.87E-02	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	2.87E-02	7.69E-02	7.69E-02	1.65E-01	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	-7.64E-02	1.13E-01	1.14E-01	8.58E-02	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	-1.90E-02	9.94E-02	9.94E-02	1.42E-01	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	-3.61E-02	7.22E-02	7.22E-02	6.22E-02	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	-8.00E-02	1.49E-01	1.49E-01	2.09E-01	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.42E+01	1.83E+00	1.97E+00	8.76E-01		pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	-2.05E-02	5.12E-02	5.12E-02	6.28E-02	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	2.66E-02	2.92E-02	2.92E-02	4.77E-02	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	1.60E-02	3.71E-02	3.71E-02	5.05E-02	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	3.34E-01	8.66E-01	8.66E-01	1.27E+00	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	3.47E-01	9.63E-02	9.79E-02	1.25E-01		pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	2.10E-01	1.01E-01	1.02E-01	1.73E-01		pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	8.36E-02	1.02E-01	1.02E-01	1.76E-01	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	3.10E-01	9.37E-02	9.51E-02	1.43E-01		pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	-1.56E-02	9.89E-02	9.89E-02	1.48E-01	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	1.38E+00	8.38E-01	8.40E-01	1.31E+00	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	1.25E-01	1.34E-01	1.35E-01	2.07E-01	U	pCi/g
19-12059-07	TRG	L1-12201-B-FSGS-015-SS-A	09/23/19 08:28	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	-3.23E-02	1.80E-01	1.80E-01	3.48E-01	U	pCi/g

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

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:	Work Order Details:	
Patricia Giza	SDG:	19-12059
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
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	3.74E-01	1.40E-01	1.41E-01	3.13E-01		pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	-1.20E-03	2.15E-02	2.15E-02	4.81E-02	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	-8.00E-02	1.09E-01	1.09E-01	1.29E-01	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	-1.79E-02	3.69E-02	3.69E-02	6.45E-02	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	2.59E-01	8.67E-02	8.78E-02	1.19E-01		pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	-9.21E-03	4.97E-02	4.97E-02	7.02E-02	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	6.82E-03	3.28E-02	3.28E-02	6.55E-02	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	-3.54E-02	5.10E-02	5.10E-02	6.80E-02	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	5.83E-02	1.58E-01	1.58E-01	1.75E-01	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	1.23E-02	1.48E-01	1.48E-01	8.91E-02	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	-1.37E-02	1.16E-01	1.16E-01	1.49E-01	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	1.63E-02	7.09E-02	7.09E-02	6.63E-02	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	1.84E-01	1.11E-01	1.11E-01	1.79E-01	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.19E+01	1.70E+00	1.80E+00	8.87E-01		pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	-3.12E-02	4.57E-02	4.57E-02	5.80E-02	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	3.31E-03	4.01E-02	4.01E-02	3.75E-02	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	2.48E-03	3.40E-02	3.40E-02	5.49E-02	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	7.91E-01	9.56E-01	9.57E-01	1.35E+00	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	4.10E-01	9.91E-02	1.01E-01	1.75E-01		pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	2.51E-01	9.34E-02	9.42E-02	1.62E-01		pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	-1.21E-01	1.55E-01	1.55E-01	1.87E-01	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	2.59E-01	8.67E-02	8.78E-02	1.19E-01		pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	-1.87E-02	8.27E-02	8.27E-02	1.38E-01	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	6.56E-01	9.54E-01	9.54E-01	1.31E+00	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	2.08E-01	1.15E-01	1.16E-01	2.22E-01	U	pCi/g
19-12059-08	TRG	L1-12201-C-FSGS-006-SS-A	10/01/19 12:40	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	1.74E-01	2.60E-01	2.60E-01	3.68E-01	U	pCi/g

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

EBERLINE ANALYTICAL

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:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	2.66E-01	1.98E-01	1.99E-01	3.87E-01	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	-4.09E-02	5.72E-02	5.72E-02	5.28E-02	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	-1.20E-01	9.81E-02	9.83E-02	1.43E-01	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	3.07E-02	3.99E-02	4.00E-02	1.19E-01	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	3.56E-01	1.22E-01	1.24E-01	2.10E-01		pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	2.90E-02	5.54E-02	5.54E-02	9.53E-02	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	1.07E-02	2.52E-02	2.52E-02	8.18E-02	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	1.59E-01	7.65E-02	7.70E-02	1.80E-01	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	3.65E-02	1.25E-01	1.26E-01	1.98E-01	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	-7.56E-02	1.59E-01	1.59E-01	9.99E-02	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	1.04E-01	9.91E-02	9.92E-02	1.69E-01	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	4.55E-02	7.69E-02	7.69E-02	7.62E-02	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	-2.75E-02	2.94E-01	2.94E-01	4.70E-01	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.21E+01	1.75E+00	1.85E+00	5.89E-01		pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	-7.46E-03	5.71E-02	5.71E-02	8.76E-02	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	3.36E-02	1.84E-02	1.85E-02	1.16E-02		pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	8.59E-04	4.73E-02	4.73E-02	6.63E-02	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	1.05E+00	1.06E+00	1.06E+00	1.78E+00	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	4.72E-01	1.23E-01	1.25E-01	2.27E-01		pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	5.35E-01	1.50E-01	1.53E-01	2.02E-01		pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	4.65E-02	1.86E-01	1.86E-01	3.05E-01	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	3.56E-01	1.22E-01	1.24E-01	2.10E-01		pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	2.08E-02	1.37E-01	1.37E-01	2.10E-01	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	1.31E+00	8.44E-01	8.47E-01	1.44E+00	U	pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	3.88E-01	1.40E-01	1.42E-01	2.31E-01		pCi/g
19-12059-09	TRG	L1-12201-C-FSGS-013-SB-A	09/23/19 08:45	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	-2.43E-01	2.83E-01	2.83E-01	3.90E-01	U	pCi/g

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

0029

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Patricia Giza	SDG:	19-12059
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
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	2.68E-01	1.43E-01	1.43E-01	3.26E-01	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	-2.61E-02	5.18E-02	5.19E-02	4.51E-02	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	-1.02E-01	9.82E-02	9.83E-02	1.33E-01	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	5.73E-03	2.05E-02	2.05E-02	7.60E-02	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	3.12E-01	8.92E-02	9.06E-02	1.99E-01		pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	-7.89E-03	2.92E-02	2.93E-02	6.01E-02	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	-5.69E-02	6.13E-02	6.14E-02	7.48E-02	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	-1.61E-03	4.74E-02	4.74E-02	6.57E-02	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	-4.15E-02	1.12E-01	1.12E-01	1.75E-01	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	1.80E-02	1.14E-01	1.14E-01	9.12E-02	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	2.42E-02	6.16E-02	6.16E-02	1.40E-01	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	6.09E-03	6.60E-02	6.60E-02	6.40E-02	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	-5.81E-03	1.50E-01	1.50E-01	2.20E-01	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.36E+01	1.75E+00	1.89E+00	1.24E+00		pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	-1.51E-03	2.37E-02	2.37E-02	7.89E-02	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	-4.86E-03	1.95E-02	1.95E-02	5.19E-02	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	-1.30E-02	3.96E-02	3.96E-02	5.19E-02	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	1.10E-01	8.75E-01	8.75E-01	1.29E+00	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	3.85E-01	1.31E-01	1.32E-01	1.90E-01		pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	2.42E-01	9.12E-02	9.21E-02	1.61E-01		pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	-1.33E-02	1.22E-01	1.22E-01	1.79E-01	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	3.12E-01	8.92E-02	9.06E-02	1.99E-01		pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	6.41E-02	1.04E-01	1.04E-01	1.69E-01	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	1.45E+00	8.42E-01	8.46E-01	1.32E+00	U	pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	3.86E-01	1.22E-01	1.24E-01	2.29E-01		pCi/g
19-12059-10	TRG	L1-12202-A-FSGS-001-SS-A	10/08/19 08:00	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	-8.28E-02	2.52E-01	2.52E-01	3.64E-01	U	pCi/g

0030

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:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	1.70E-01	1.18E-01	1.19E-01	3.31E-01	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	-4.11E-03	3.74E-02	3.74E-02	3.79E-02	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	-9.71E-02	1.01E-01	1.01E-01	1.13E-01	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	2.63E-02	3.51E-02	3.51E-02	6.02E-02	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	2.13E-01	9.39E-02	9.46E-02	1.54E-01		pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	1.18E-02	5.05E-02	5.05E-02	7.04E-02	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	1.11E-02	2.51E-02	2.51E-02	6.02E-02	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	-2.56E-02	4.41E-02	4.41E-02	5.72E-02	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	9.17E-02	1.54E-01	1.54E-01	1.73E-01	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	-9.40E-03	1.11E-01	1.11E-01	8.98E-02	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	7.47E-03	6.84E-02	6.84E-02	1.29E-01	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	-4.76E-03	2.31E-02	2.31E-02	6.10E-02	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	5.89E-02	9.98E-02	9.98E-02	1.48E-01	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.28E+01	1.80E+00	1.91E+00	1.22E+00		pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	9.79E-03	4.74E-02	4.74E-02	7.48E-02	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	3.34E-02	3.03E-02	3.03E-02	3.83E-02	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	-2.54E-02	3.96E-02	3.96E-02	5.28E-02	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	1.24E+00	9.25E-01	9.27E-01	1.34E+00	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	3.64E-01	1.16E-01	1.18E-01	1.61E-01		pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	3.08E-01	8.69E-02	8.83E-02	1.27E-01		pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	-6.49E-02	1.35E-01	1.35E-01	1.65E-01	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	2.13E-01	9.39E-02	9.46E-02	1.54E-01		pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	1.28E-01	7.81E-02	7.83E-02	1.54E-01	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	5.43E-01	8.64E-01	8.65E-01	1.15E+00	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	1.67E-01	1.37E-01	1.37E-01	2.20E-01	U	pCi/g
19-12059-11	TRG	L1-12202-A-FSGS-004-SS-A	10/08/19 08:06	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	1.38E-01	2.57E-01	2.57E-01	3.53E-01	U	pCi/g

0031

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Eberline Analytical
Final Report of Analysis

Report To:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	3.17E-01	1.79E-01	1.80E-01	3.52E-01	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	1.08E-02	3.95E-02	3.95E-02	5.26E-02	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	-1.07E-01	8.16E-02	8.18E-02	1.22E-01	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	6.04E-03	3.33E-02	3.33E-02	9.52E-02	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	2.59E-01	1.19E-01	1.20E-01	2.03E-01		pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	-1.94E-02	6.66E-02	6.66E-02	8.39E-02	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	1.62E-03	2.19E-02	2.19E-02	6.56E-02	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	-5.13E-04	4.25E-02	4.25E-02	6.65E-02	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	-1.32E-01	1.82E-01	1.82E-01	1.82E-01	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	-9.56E-02	1.30E-01	1.30E-01	9.39E-02	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	9.87E-02	9.24E-02	9.26E-02	1.43E-01	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	6.54E-02	6.75E-02	6.75E-02	6.24E-02	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	4.75E-02	2.80E-01	2.80E-01	4.50E-01	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.17E+01	1.70E+00	1.81E+00	8.68E-01		pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	5.26E-02	5.38E-02	5.39E-02	1.09E-01	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	2.68E-02	3.14E-02	3.14E-02	5.13E-02	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	1.20E-02	4.28E-02	4.28E-02	5.50E-02	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	4.71E-01	9.88E-01	9.89E-01	1.62E+00	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	2.95E-01	8.62E-02	8.75E-02	1.62E-01		pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	2.69E-01	1.02E-01	1.03E-01	1.67E-01		pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	-8.94E-02	1.68E-01	1.68E-01	2.64E-01	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	2.59E-01	1.19E-01	1.20E-01	2.03E-01		pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	2.69E-02	1.08E-01	1.08E-01	1.73E-01	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	8.11E-01	6.95E-01	6.96E-01	1.18E+00	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	2.10E-01	1.92E-01	1.92E-01	3.14E-01	U	pCi/g
19-12059-12	TRG	L1-12202-B-FSGS-002-SS-A	10/08/19 07:22	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	7.66E-02	2.33E-01	2.33E-01	3.53E-01	U	pCi/g

0032

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:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	5.05E-01	2.04E-01	2.06E-01	3.33E-01		pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	7.31E-03	1.93E-02	1.93E-02	5.13E-02	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	5.96E-02	6.35E-02	6.35E-02	2.36E-01	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	-1.76E-02	1.98E-02	1.99E-02	8.47E-02	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	4.08E-01	1.09E-01	1.11E-01	1.82E-01		pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	3.20E-04	5.03E-02	5.03E-02	5.90E-02	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	-1.45E-02	2.48E-02	2.48E-02	7.69E-02	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	-2.04E-02	5.38E-02	5.38E-02	7.14E-02	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	-1.63E-01	1.78E-01	1.79E-01	1.98E-01	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	-1.34E-02	1.42E-01	1.42E-01	1.00E-01	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	2.39E-01	1.27E-01	1.28E-01	1.98E-01		pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	1.29E-01	7.71E-02	7.74E-02	7.08E-02	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	-1.62E-01	1.80E-01	1.80E-01	2.43E-01	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.36E+01	1.83E+00	1.95E+00	8.64E-01		pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	1.14E-02	4.93E-02	4.93E-02	7.31E-02	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	1.10E-02	4.19E-02	4.19E-02	5.86E-02	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	3.92E-02	4.23E-02	4.23E-02	6.52E-02	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	1.23E+00	9.86E-01	9.88E-01	1.54E+00	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	3.43E-01	9.18E-02	9.35E-02	1.77E-01		pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	3.59E-01	1.10E-01	1.12E-01	1.93E-01		pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	1.00E-01	1.39E-01	1.39E-01	2.14E-01	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	4.08E-01	1.09E-01	1.11E-01	1.82E-01		pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	3.38E-02	1.13E-01	1.13E-01	1.77E-01	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	2.31E+00	9.82E-01	9.89E-01	1.57E+00	U	pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	3.71E-01	1.27E-01	1.29E-01	1.68E-01		pCi/g
19-12059-13	TRG	L1-12202-B-FSGS-007-SS-A	10/08/19 07:32	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	-1.08E-01	2.78E-01	2.78E-01	3.99E-01	U	pCi/g

0033

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:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	4.28E-01	1.88E-01	1.89E-01	4.06E-01		pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	-2.51E-02	5.55E-02	5.56E-02	4.95E-02	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	-9.99E-02	1.12E-01	1.12E-01	1.31E-01	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	-1.01E-01	7.18E-02	7.20E-02	6.12E-02	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	3.84E-01	1.23E-01	1.24E-01	2.05E-01		pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	9.51E-01	1.05E-01	1.16E-01	8.68E-02		pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	-1.72E-03	1.87E-02	1.87E-02	7.30E-02	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	1.62E-03	4.86E-02	4.86E-02	7.29E-02	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	-1.12E-02	1.14E-01	1.14E-01	1.92E-01	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	4.84E-02	1.27E-01	1.27E-01	9.91E-02	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	-6.95E-02	1.22E-01	1.22E-01	1.46E-01	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	-1.45E-02	8.69E-02	8.69E-02	6.88E-02	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	5.28E-02	1.09E-01	1.09E-01	1.60E-01	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.05E+01	1.53E+00	1.62E+00	8.55E-01		pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	-1.30E-02	5.14E-02	5.14E-02	7.44E-02	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	-1.39E-02	4.41E-02	4.41E-02	5.57E-02	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	5.82E-03	4.31E-02	4.31E-02	6.86E-02	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	8.38E-01	8.98E-01	8.99E-01	1.49E+00	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	3.15E-01	8.88E-02	9.03E-02	1.72E-01		pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	4.22E-01	1.37E-01	1.39E-01	2.21E-01		pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	8.80E-02	1.42E-01	1.42E-01	1.96E-01	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	3.84E-01	1.23E-01	1.24E-01	2.05E-01		pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	-1.27E-03	1.08E-01	1.08E-01	1.81E-01	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	9.36E-01	1.10E+00	1.10E+00	1.85E+00	U	pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	3.59E-01	1.34E-01	1.35E-01	2.32E-01		pCi/g
19-12059-14	TRG	L1-10207-E-FSGS-002-SS-A	10/22/19 13:02	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	-1.40E-01	3.03E-01	3.03E-01	3.80E-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:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	3.87E-01	1.49E-01	1.51E-01	2.93E-01		pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	-3.09E-02	4.64E-02	4.64E-02	4.87E-02	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	-9.21E-02	7.47E-02	7.48E-02	1.08E-01	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	1.84E-03	3.14E-02	3.14E-02	9.00E-02	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	3.48E-01	9.61E-02	9.77E-02	1.53E-01		pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	7.74E-02	4.16E-02	4.17E-02	8.45E-02	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	-9.39E-03	1.90E-02	1.90E-02	5.61E-02	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	6.72E-02	5.01E-02	5.02E-02	7.99E-02	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	6.38E-02	1.15E-01	1.15E-01	1.61E-01	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	-1.87E-02	1.30E-01	1.30E-01	7.99E-02	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	-1.47E-02	8.80E-02	8.80E-02	1.27E-01	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	-2.12E-02	6.84E-02	6.84E-02	6.00E-02	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	-3.27E-02	1.21E-01	1.21E-01	2.77E-01	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	9.82E+00	1.41E+00	1.50E+00	5.87E-01		pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	-2.99E-02	4.50E-02	4.50E-02	6.22E-02	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	-6.47E-04	3.46E-02	3.46E-02	4.61E-02	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	4.86E-03	3.49E-02	3.49E-02	5.59E-02	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	9.14E-01	7.60E-01	7.61E-01	1.29E+00	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	3.86E-01	1.15E-01	1.17E-01	1.54E-01		pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	3.38E-01	1.02E-01	1.03E-01	1.47E-01		pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	-3.04E-02	1.21E-01	1.21E-01	1.93E-01	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	3.48E-01	9.61E-02	9.77E-02	1.53E-01		pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	5.78E-02	1.03E-01	1.03E-01	1.67E-01	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	6.96E-01	6.26E-01	6.27E-01	1.06E+00	U	pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	4.15E-01	1.13E-01	1.15E-01	1.74E-01		pCi/g
19-12059-15	TRG	L1-10207-E-FSGS-008-SS-A	10/22/19 13:14	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	1.04E-01	2.12E-01	2.12E-01	3.23E-01	U	pCi/g

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

0035

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Patricia Giza	SDG:	19-12059
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
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	6.96E-01	2.49E-01	2.51E-01	3.98E-01		pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	2.44E-02	3.40E-02	3.40E-02	8.17E-02	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	-3.64E-02	1.60E-01	1.60E-01	2.28E-01	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	-9.81E-02	1.44E-01	1.44E-01	1.45E-01	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	7.43E-01	1.66E-01	1.71E-01	2.62E-01		pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	-3.15E-02	6.82E-02	6.82E-02	9.57E-02	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	6.13E-03	2.74E-02	2.74E-02	9.79E-02	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	7.53E-01	1.38E-01	1.43E-01	1.54E-01		pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	-1.32E-01	2.42E-01	2.42E-01	2.74E-01	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	-5.73E-02	1.87E-01	1.87E-01	1.42E-01	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	1.59E-01	1.28E-01	1.28E-01	2.46E-01	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	-3.66E-03	1.10E-01	1.10E-01	9.96E-02	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	-5.36E-01	3.05E-01	3.07E-01	3.72E-01	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.70E+01	2.25E+00	2.41E+00	1.43E+00		pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	-1.73E-03	6.29E-02	6.29E-02	8.80E-02	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	-5.05E-03	5.41E-02	5.41E-02	6.47E-02	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	-7.95E-03	1.49E-02	1.49E-02	7.09E-02	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	1.86E+00	1.74E+00	1.74E+00	2.89E+00	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	7.07E-01	1.63E-01	1.67E-01	2.82E-01		pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	8.29E-01	1.95E-01	1.99E-01	2.91E-01		pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	6.28E-03	2.33E-01	2.33E-01	3.41E-01	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	7.43E-01	1.66E-01	1.71E-01	2.62E-01		pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	-1.42E-01	1.68E-01	1.68E-01	2.26E-01	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	2.15E+00	1.46E+00	1.47E+00	2.23E+00	U	pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	7.09E-01	1.78E-01	1.82E-01	2.09E-01		pCi/g
19-12059-16	TRG	L1-10213-C-FIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	-9.73E-02	3.42E-01	3.42E-01	5.52E-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:	
Patricia Giza	SDG:	19-12059
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
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	5.88E-01	1.75E-01	1.78E-01	3.46E-01		pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	1.68E-02	5.20E-02	5.20E-02	5.71E-02	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	-2.91E-02	5.94E-02	5.94E-02	1.58E-01	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	-6.50E-03	4.55E-02	4.55E-02	8.32E-02	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	4.88E-01	1.25E-01	1.28E-01	1.67E-01		pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	-1.03E-02	7.07E-02	7.07E-02	8.19E-02	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	2.22E-03	3.02E-02	3.02E-02	7.42E-02	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	8.32E-01	1.14E-01	1.22E-01	1.32E-01		pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	-1.04E-01	2.11E-01	2.11E-01	2.30E-01	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	2.41E-03	1.36E-01	1.36E-01	1.20E-01	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	1.17E-01	1.33E-01	1.33E-01	2.22E-01	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	7.08E-03	8.01E-02	8.01E-02	8.17E-02	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	5.31E-02	1.47E-01	1.47E-01	2.07E-01	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.41E+01	1.99E+00	2.12E+00	1.16E+00		pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	-4.56E-03	5.10E-02	5.10E-02	7.71E-02	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	-6.97E-03	3.49E-02	3.49E-02	5.51E-02	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	-1.63E-02	4.47E-02	4.47E-02	6.55E-02	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	1.29E+00	1.47E+00	1.47E+00	2.45E+00	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	5.94E-01	1.70E-01	1.73E-01	2.36E-01		pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	6.55E-01	1.57E-01	1.60E-01	2.44E-01		pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	-3.96E-02	1.81E-01	1.81E-01	2.32E-01	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	4.88E-01	1.25E-01	1.28E-01	1.67E-01		pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	-2.22E-02	1.14E-01	1.14E-01	1.84E-01	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	1.21E+00	1.10E+00	1.10E+00	1.82E+00	U	pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	5.54E-01	1.52E-01	1.55E-01	2.25E-01		pCi/g
19-12059-17	TRG	L1-10213-C-QIGS-001-SS-A	11/14/19 09:06	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	3.83E-02	3.63E-01	3.63E-01	4.77E-01	U	pCi/g

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Eberline Analytical
Final Report of Analysis

Report To:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	6.31E-01	2.76E-01	2.78E-01	5.90E-01		pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	1.76E-02	7.27E-02	7.27E-02	1.06E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	-1.01E-01	1.34E-01	1.34E-01	2.03E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	7.18E-02	1.68E-01	1.68E-01	1.74E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	7.30E-01	1.85E-01	1.89E-01	2.88E-01		pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	7.28E-02	3.93E-02	3.94E-02	1.01E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	1.83E-02	4.59E-02	4.60E-02	1.09E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	4.55E-01	1.16E-01	1.18E-01	1.41E-01		pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	-1.50E-02	2.15E-01	2.15E-01	2.90E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	7.73E-02	2.15E-01	2.15E-01	1.45E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	4.04E-01	2.03E-01	2.04E-01	2.91E-01		pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	8.32E-02	7.54E-02	7.55E-02	1.26E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	3.58E-01	4.28E-01	4.29E-01	6.92E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.81E+01	2.60E+00	2.76E+00	1.34E+00		pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	3.32E-02	7.11E-02	7.11E-02	1.19E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	-5.43E-02	7.11E-02	7.12E-02	9.68E-02	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	-6.07E-03	5.49E-02	5.49E-02	8.39E-02	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	2.54E+00	1.55E+00	1.55E+00	2.62E+00	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	7.79E-01	1.81E-01	1.86E-01	2.66E-01		pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	9.78E-01	2.45E-01	2.50E-01	3.68E-01		pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	-3.08E-01	2.44E-01	2.45E-01	3.57E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	7.30E-01	1.85E-01	1.89E-01	2.88E-01		pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	-1.03E-02	1.81E-01	1.81E-01	2.75E-01	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	1.71E+00	1.93E+00	1.93E+00	3.23E+00	U	pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	6.90E-01	2.20E-01	2.23E-01	1.98E-01		pCi/g
19-12059-18	TRG	L1-10213-C-FIGS-005-SS-A	11/14/19 09:14	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	1.25E-01	4.06E-01	4.06E-01	6.04E-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:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-12059
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
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Actinium-228	EPA 901.1 Modified	3.97E-01	2.14E-01	2.15E-01	4.00E-01	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Silver-110m	EPA 901.1 Modified	1.72E-02	5.27E-02	5.27E-02	5.09E-02	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Americium-241	EPA 901.1 Modified	5.77E-02	6.41E-02	6.41E-02	2.22E-01	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Barium-133	EPA 901.1 Modified	2.12E-02	3.52E-02	3.52E-02	9.90E-02	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Bismuth-214	EPA 901.1 Modified	2.92E-01	9.12E-02	9.24E-02	6.68E-02		pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Cobalt-60	EPA 901.1 Modified	-3.01E-02	4.48E-02	4.49E-02	6.53E-02	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Cesium-134	EPA 901.1 Modified	-7.66E-02	7.35E-02	7.36E-02	8.64E-02	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Cesium-137	EPA 901.1 Modified	1.24E-01	5.47E-02	5.50E-02	7.82E-02		pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Europium-152	EPA 901.1 Modified	4.32E-02	9.53E-02	9.53E-02	2.03E-01	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Europium-154	EPA 901.1 Modified	-3.75E-02	5.10E-02	5.10E-02	1.01E-01	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Europium-155	EPA 901.1 Modified	8.45E-02	5.75E-02	5.77E-02	2.06E-01	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Holmium-166m	EPA 901.1 Modified	2.41E-02	6.92E-02	6.92E-02	7.57E-02	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Iodine-129	EPA 901.1 Modified	-2.72E-02	1.72E-01	1.72E-01	2.53E-01	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Potassium-40	EPA 901.1 Modified	1.12E+01	1.64E+00	1.73E+00	8.77E-01		pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Manganese-54	EPA 901.1 Modified	-1.96E-03	5.30E-02	5.30E-02	7.51E-02	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Molybdenum-93	EPA 901.1 Modified	5.06E-03	2.77E-02	2.77E-02	6.41E-02	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Niobium-94	EPA 901.1 Modified	1.31E-02	4.76E-02	4.77E-02	6.60E-02	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Lead-210	EPA 901.1 Modified	6.54E-01	1.04E+00	1.04E+00	1.60E+00	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Lead-212	EPA 901.1 Modified	4.68E-01	1.40E-01	1.42E-01	1.91E-01		pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Lead-214	EPA 901.1 Modified	3.68E-01	1.14E-01	1.15E-01	1.89E-01		pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Promethium-145	EPA 901.1 Modified	-1.13E-01	1.51E-01	1.51E-01	2.08E-01	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Radium-226	EPA 901.1 Modified	2.92E-01	9.12E-02	9.24E-02	6.68E-02		pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Antimony-125	EPA 901.1 Modified	-4.08E-05	1.12E-01	1.12E-01	1.71E-01	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Thorium-234	EPA 901.1 Modified	2.94E+00	1.02E+00	1.03E+00	1.68E+00	U	pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Thallium-208	EPA 901.1 Modified	2.82E-01	1.21E-01	1.22E-01	2.21E-01		pCi/g
19-12059-19	TRG	L1-10213-C-FIGS-003-SB-A	11/14/19 12:35	12/16/2019	12/18/2019	19-12059	Uranium-235	EPA 901.1 Modified	6.01E-02	2.81E-01	2.81E-01	4.23E-01	U	pCi/g

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

0039

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ZION SOLUTIONS LLC
An EnergySolutions Company

19-12059

REC'D DEC 16 2019

ZS-WM-131
Revision 0
Information Use

Attachment 1 – Chain-of-Custody Form

	Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
4	L1-12201-A-FSGS-002-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**10/7/19**	**0822**	**5 ROC HTD**	**NA**	**857.35**
5	L1-12201-A-FSGS-006-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**10/7/19**	**0830**	**5 ROC HTD**	**NA**	**800.06**
6	L1-12201-B-FSGS-013-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**9/23/19**	**0824**	**5 ROC HTD**	**NA**	**944.12**
7	L1-12201-B-FSGS-015-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**9/23/19**	**0828**	**5 ROC HTD**	**NA**	**836.06**
8	L1-12201-C-FSGS-006-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**10/1/19**	**1240**	**5 ROC HTD**	**NA**	**753.32**
9	L1-12201-C-FSGS-013-SB-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**9/23/19**	**0845**	**5 ROC HTD**	**NA**	**712.42**
10	L1-12202-A-FSGS-001-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**10/8/19**	**0800**	**5 ROC HTD**	**NA**	**779.07**
11	L1-12202-A-FSGS-004-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**10/8/19**	**0806**	**5 ROC HTD**	**NA**	**797.37**
12	L1-12202-B-FSGS-002-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**10/8/19**	**0722**	**5 ROC HTD**	**NA**	**844.73**
13	L1-12202-B-FSGS-007-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**10/8/19**	**0732**	**5 ROC HTD**	**NA**	**671.18**
14	L1-10207-E-FSGS-002-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**10/22/19**	**1302**	**5 ROC HTD**	**NA**	**705.16**
15	L1-10207-E-FSGS-008-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**10/22/19**	**1314**	**5 ROC HTD**	**NA**	**889.02**
16	L1-10213-C-FIGS-001-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**11/14/19**	**0906**	**5 ROC HTD**	**NA**	**526.84**
17	L1-10213-C-QIGS-001-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**11/14/19**	**0906**	**5 ROC HTD**	**NA**	**670.18**
18	L1-10213-C-FIGS-005-SS-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**11/14/19**	**0914**	**5 ROC HTD**	**NA**	**579.96**
19	L1-10213-C-FIGS-003-SB-A	NA	NA	**SOIL**	500	ml	**MARINELLI**	1	**11/14/19**	**1235**	**5 ROC HTD**	**NA**	**626.28**

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ZION SOLUTIONS LLC
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19-12059 REC'D DEC 16 2019

ZS-WM-131
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Information Use

Laboratory:	Date Submitted To Lab:		Ship Container No.:	Cooler Temperature:	Airbill Number:
EBERLINE LABS			001 ~~NA~~	**N/A**	FedEx Ground MASTER 7772 0642 4470

Relinquished by:	Date (mm/dd/yyyy): 12/10/19	Time: 1320	Received by: Richard F. Rickert	Date: (mm/dd/yyyy): 12/10/2019	1320
Relinquished by: Richard F. Rickert	Date (mm/dd/yyyy): 12/11/2019	Time: 1600	Received by: FedEx Ground	Date: (mm/dd/yyyy): 12/11/2019	1600
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by: Jennifer Owens	Date: (mm/dd/yyyy): 12/16/19	10:15am
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	

Comments
HTD's PO # 67718 14 Day Turn Around

9000