ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

SOUTH WAREHOUSE AREA

SURVEY UNIT 10208A

REVISION 1

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
AMCG	Average Member of the Critical Group
BcDCGL	Base Case DCGL
BcSOF	Base Case Sum of Fractions
C/LT	Characterization/License Termination
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 10208A, "South Warehouse Area," has been generated for the Zion Station Restoration Project (ZSRP) in accordance with Zion*Solutions* procedure ZS-LT-300-001-005, *"Final Status Survey Data Reporting"* (Reference 1) and satisfies the requirements of Section 5.11 of the *"Zion Station Restoration Project License Termination Plan"* (LTP) (Reference 2).

An FSS package (L1-10208A-F) was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, *"Final Status Survey Package Development"* (Reference 3), the ZSRP LTP, and guidance from NUREG-1575, "*Multi-Agency Radiation Survey and Site Investigation Manual"* (MARSSIM) (Reference 4).

This open land survey unit has a MARSSIM classification of one. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I (α) and Type II (β) decision error rates were set at 0.05. Twenty-one (21) 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 10208A indicate that the Sum of Fractions (SOF) for each sample, when compared to the Operational Derived Concentration Guideline Levels (OpDCGL), was less than 1.0, with a maximum Operational SOF (OpSOF) of 0.089. The mean OpSOF for the systematic samples was 0.046. The mean Base Case SOF (BcSOF), when the analytical results were compared to the Base Case DCGLs (BcDCGL), was 0.012, which results in a dose assigned to the survey unit of 0.297 mrem/yr Total Effective Dose Equivalent (TEDE). Therefore, the null hypothesis is rejected and survey unit 10208A is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 10208A, "South Warehouse Area," is a Class 1 open land survey unit and is 2,460 m^2 in size. It is bounded on the west by survey unit 10205, the east by survey unit 10208B, the north by survey units 10207A and 10207B; and the south by survey unit 10218A.

The topography of the survey unit is mainly flat with some small dips and depressions. The soil is mostly loam. A rail spur, with a ballast made up of gravel, runs through the survey unit from the north to south.

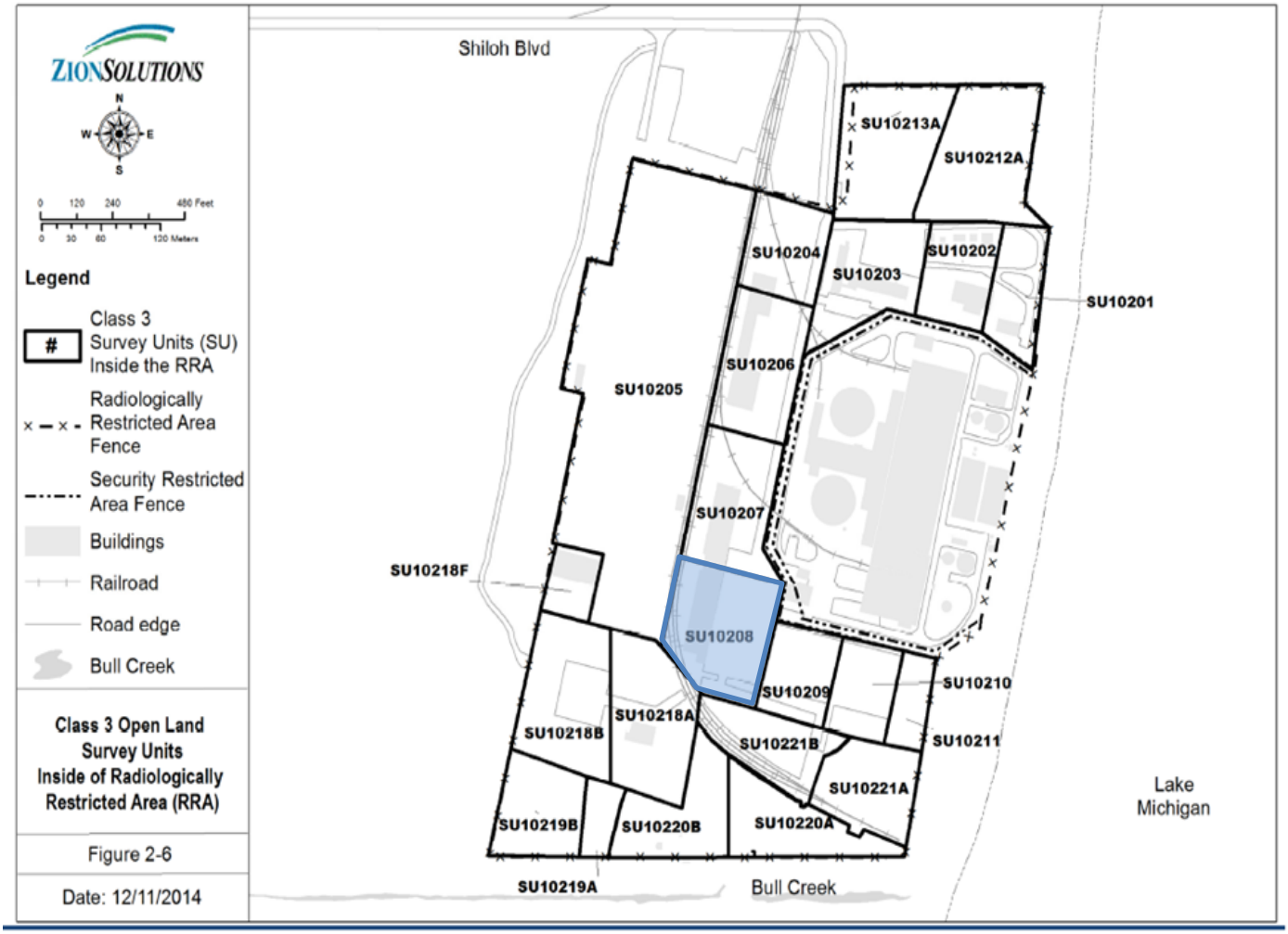
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 10208A was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 5).

The area encompassing this survey unit was described in the *"Zion Station Historical Site Assessment"* (HSA) (Reference 6) as the "South Warehouse Area" and was located within survey unit 10208 as identified in Figures 3 and 4 of the HSA. This area was also described as the "South Warehouse Area" (survey unit 10208) in Table 2-4 of the ZSRP License LTP as represented in Figure 2-6 of the LTP which is replicated below as Figure 1.

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



The HSA states that this area contained the South Warehouse and, prior to the parking area being paved, was used to temporarily store Radioactive Waste Shipments. It also noted that virtually all known excavations on site had soil dumped in this area.

The HSA discusses the potential for low levels of radiological contamination due to elevated environmental sample results from the 1970s. The elevated environmental samples appeared to have consisted primarily of tritium with the highest concentration (80 pCi/ml) found in the "south ditch." The source was believed to be backup from storm drains which tied into the south oil separator and the fire sump system.

A characterization survey was performed in May and June of 2013 for the Class 3 survey unit 10208. The following data was obtained:

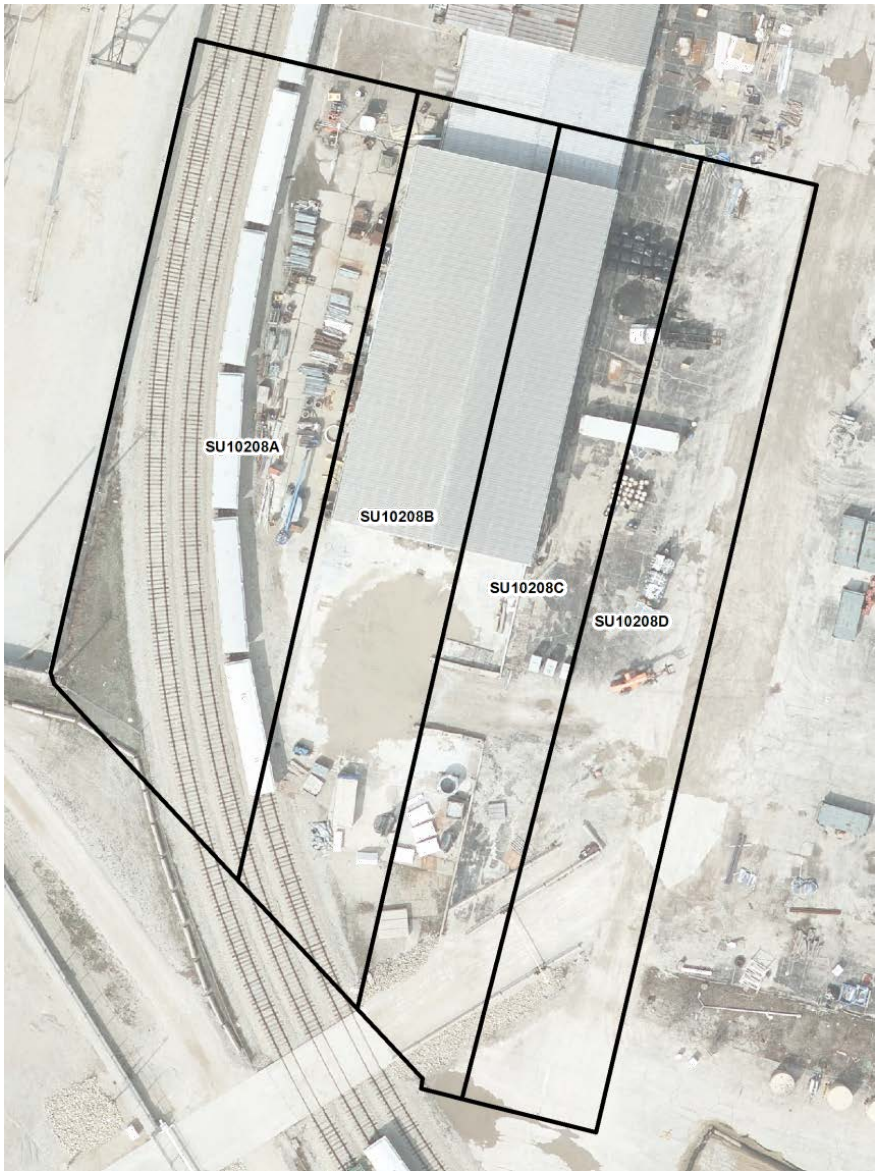
- Eight (8) judgmental surface samples and one (1) judgmental subsurface sample taken at the direction of the cognizant Radiological Engineer (RE) in areas that could have served as collection points for runoff from the parking lot.
- Twenty-two (22) random surface samples and one (1) random subsurface sample.
- Three (3) investigation surface samples and one (1) investigation subsurface sample taken in areas identified by scan alarms.
- Sodium iodide (NaI) walkover scans of approximately 34% of the surface area in the survey unit.

The results of the characterization survey were:

- All eight (8) of the judgmental surface samples and the one (1) judgmental subsurface sample were less than the Minimum Detectable Concentration (MDC) for the Radionuclides of Concern (ROC).
- All twenty-two (22) of the random surface samples and the one (1) random subsurface sample were < MDC for the ROC.
- All three (3) of the investigation surface samples and the one (1) investigation subsurface sample were <MDC for the ROC.

On June 12, 2017, due to changing radiological and operational conditions brought about by site decommissioning activities inside or adjacent to this area, survey unit 10208 was reclassified as Class 1, and divided into four survey units: 10208A, 10208B, 10208C and 10208D to comply with the survey unit size recommendations from MARSSIM Section 4.6. The following figure 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 Four Class 1 Open Land Survey Units Created from the Original Class 3 Survey Unit 10208



An RE and a Characterization/License Termination (C/LT) Supervisor performed a visual inspection and walk-down of the survey unit on October 3, 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 10208A 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 10208A does not exceed the release criteria specified in the LTP and that the potential dose from residual radioactivity is As Low As Reasonably Achievable (ALARA).

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

Zion*Solutions* TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* (Reference 8), was written to refine the initial selection of ROC for decommissioning at the ZSRP. The list of ROC was evaluated using Containment 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 the 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 reproduced below in Table 4 and Table 5, respectively.

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

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

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

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

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

Instrument DQOs included a verification of the ability of the survey instrument to detect the radiation(s) of interest at the required scan MDC, which for Class 1 open land survey units, is the *a priori* elevated measurement comparison DCGL (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 10208A. 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 10208A, the surrogate OpDCGLs for Co-60 and Cs-137 were computed based on the maximum ratios from Table 6. The equation for calculating a surrogate DCGL is as follows:

Equation 1

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

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

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

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

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

Equation 2

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

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

Equation 3

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

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

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

Equation 4

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

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

Equation 5

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

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

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

Table 7 - Investigation Levels

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

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

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

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

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

The number of soil samples for FSS was determined in accordance with ZS-LT-300-001-001. The relative shift (Δ/σ) for the survey unit data set is defined as shift (Δ), which is the Upper Bound of the Gray Region (UBGR), or the DCGL (SOF of 1), minus the Lower Bound of the Gray Region (LBGR) (SOF of 0.5), divided by sigma (σ), which is the standard deviation of the data set used for survey design. The optimal value for Δ/σ should range between one and three. The largest value the Δ/σ can have is three. If the Δ/σ exceeds three, then the value of three will be used for Δ/σ. A conservative estimate of the sample variability of 0.30 was used as the coefficient of variation to calculate Δ/σ.

The calculated relative shift was 1.67. Both the Type I error, or α value and the Type II error, or β value was set at 0.05. The sample size from Table 5.5 of MARSSIM that equates to the Type I and Type II error of 0.05 for use with the Sign Test is an N value of seventeen (17). Since the area of this survey unit is 2,460 m^2, which is above the suggested size limitation of 2,000 m^2 for Class 1 Open Land areas, four (4) additional samples were collected to maintain the grid spacing at approximately 11.6 m, which is the calculated result based on a survey unit size of 2,000 m^2. A total of twenty-one (21) systematic samples were prescribed for FSS.

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 twenty-one. 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: $A = \frac{A_{SU}}{N} = \frac{2460}{21} = 117.1\ m^2$
- From the LTP, Table 5-16, the Area Factors for the next larger area (300 m^2) were used:
  - Cs-137 - 1.46
  - Cs-134 - 1.30
  - Co-60 - 1.16
- The $DCGL_{EMC}$ is the Surrogate Base Case DCGL times the Area Factor:
  - The $DCGL_{EMC}$ for Cs-137 = $1.46 * 14.15 = 20.66\ pCi/g$
  - The $DCGL_{EMC}$ for Cs-134 = $1.30 * 6.77 = 8.80\ pCi/g$
  - The $DCGL_{EMC}$ for Co-60 = $1.16 * 3.51 = 4.07\ pCi/g$

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

The implementation of quality control (QC) measures as referenced by LTP Chapter 5, 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. Two (2) surface soil samples (L1-10208A-FQGS-019-SS and L1-10208A-FQGS-021-SS) were selected randomly for split sample analysis for the FSS of this survey unit.

In accordance with Section 5.7.1.6.2 of the LTP, a subsurface soil sample was taken at 10%

of the systematic surface soil sample locations in the survey unit with the location(s) selected at random. Locations L1-10208A-FSGS-005-SB, L1-10208A-010-SB and L1-10208A-FSGS-015-SB were selected for this survey unit. However, sample location L1-10208A-FSGS-015-SB was not accessible for the Geoprobe machine and the adjacent sample location, L1-10208A-FSGS-012-SB, was selected instead.

The locations of the twenty-one (21) systematic samples are listed in Table 8. Also included are the locations of the three (3) 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)
L1-10208A-FSGS-001-SS	641600.77	343464.72
L1-10208A-FSGS-002-SS	641610.80	343458.93
L1-10208A-FSGS-003-SS	641620.83	343453.14
L1-10208A-FSGS-004-SS	641620.83	343464.72
L1-10208A-FSGS-005-SS	641630.86	343447.35
L1-10208A-FSGS-006-SS	641630.86	343458.93
L1-10208A-FSGS-007-SS	641630.86	343470.52
L1-10208A-FSGS-008-SS	641640.90	343453.14
L1-10208A-FSGS-009-SS	641640.90	343464.72
L1-10208A-FSGS-010-SS	641650.93	343458.93
L1-10208A-FSGS-011-SS	641650.93	343470.52
L1-10208A-FSGS-012-SS	641660.96	343453.14
L1-10208A-FSGS-013-SS	641660.96	343464.72
L1-10208A-FSGS-014-SS	641660.96	343476.31
L1-10208A-FSGS-015-SS	641670.99	343458.93
L1-10208A-FSGS-016-SS	641670.99	343470.52
L1-10208A-FSGS-017-SS	641670.99	343482.10
L1-10208A-FSGS-018-SS	641681.03	343464.72
L1-10208A-FSGS-019-SS	641681.03	343476.31
L1-10208A-FSGS-020-SS	641691.06	343470.52
L1-10208A-FSGS-021-SS	641691.06	343482.10
L1-10208A-FSGS-005-SB	641630.86	343447.35
L1-10208A-FSGS-010-SB	641650.93	343458.93
L1-10208A-FSGS-012-SB	641660.96	343453.14

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 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.

Three (3) soil samples, L1-10208A-FSGS-009-SS, L1-10208A-FSGS-020-SS and L1-10208A-FSGS-021-SS, were selected to meet the requirement that 10% of the samples collected during FSS of Open Land survey units be analyzed for HTD ROC. These samples were selected based on exhibiting the highest concentrations of Cs-137 and Co-60 among all the samples. 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 Chapter 5, 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. This threshold was not encountered during the FSS of survey unit 10208A.

Table 9 provides a synopsis of the survey design for survey unit 10208A.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	2,460 m^2	GPS measurements of area
Number of Surface Soil Samples	21 (Systematic)	• $\sigma = 0.30$ • UBGR = SOF of 1 • LBGR = SOF of 0.5 • Type I error = 0.05 • Type II error = 0.05 • $\Delta/\sigma = 1.67$ (MARSSIM Table 5.5)
Grid Spacing	11.6 m	(LTP Chapter 5, 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 three (3) soil samples selected for HTD ROC analysis	(LTP, Section 5.1)
Measurement Investigation Level	Operational DCGL	(LTP, Table 5-25)
Scan Survey Area Coverage	100%	(LTP, Table 5-24)
QC	Two (2) surface soil sample selected randomly for split sample analysis	(LTP, Section 5.9)
Number of Subsurface Soil Samples	Three (3) systematic surface soil sample locations selected, at locations 5, 10 and 12	(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 L1-10208A-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 10208A, 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, three (3) 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 10208A.

FSS field activities were conducted under FSS sample plan L1-10208A-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 4, 2019, and concluding on October 16, 2019.

The twenty-one (21) systematic surface soil sample locations were marked with flags based on GPS coordinates provided by VSP. Eleven (11) samples were relocated because they fell on the rail spur, which consists of gravel and not soil. The relocated sample points are listed in Table 22 and are shown on the systematic sample map in Attachment 1 and the posting plot in Attachment 6.

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" x 2") NaI detector operated in the rate-meter mode and using audio response. The probe was positioned within 2 inches of the ground and was moved at a scan speed of approximately 0.5 meters per second. No areas of elevated activity were detected on the scans.

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

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

Table 10 - Instruments and Detectors

Instrument/Detector Type	Serial #	Calibration Due Date
Ludlum 2350-1/Ludlum 44-10	304712/PR372143	09/09/2020
Ludlum 2350-1/Ludlum 44-10	216166/PR372106	11/29/2019
Ludlum 2350-1/Ludlum 44-10	304726/PR363452	08/28/2020
Ludlum 2350-1/Ludlum 44-10	266657/PR308037	05/13/2020
Ludlum 2350-1/Ludlum 44-10	304711/PR321902	01/18/2020
Ludlum 2350-1/Ludlum 44-10	304708/PR321892	09/04/2020
Ludlum 2350-1/Ludlum 44-10	266656/PR311750	07/24/2020
Ludlum 2350-1/Ludlum 44-10	216188/PR372152	12/03/2019

In accordance with the survey design, twenty-one (21) surface soil samples were collected at the designated systematic sample points along with three (3) subsurface samples taken at randomly selected locations. In addition, one (1) judgmental surface sample was collected in the southwest corner of the survey unit.

Three (3) samples (L1-10208A-FSGS-009-SS, L1-10208A-FSGS-020-SS and L1-10208A-FSGS-021-SS) were selected for HTD radionuclide analysis.

7. SURVEY RESULTS

One hundred percent (100%) of the surface area of the survey unit was scanned for elevated radiation levels. Ninety-eight (98) 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	2326	2931	None	None
Row 2	2379	2931	None	None
Row 3	2243	2931	None	None
Row 4	2394	2931	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 5	2644	2931	None	None
Row 6	2703	2931	None	None
Row 7	2629	2931	None	None
Row 8	3396	3771	None	None
Row 9	2949	3352	None	None
Row 10	3228	3352	None	None
Row 11	3262	3352	None	None
Row 12	3152	3352	None	None
Row 13	3315	3352	None	None
Row 14	3191	3352	None	None
Row 15	3297	3352	None	None
Row 16	3349	3352	None	None
Row 17	3213	3352	None	None
Row 18	3293	3352	None	None
Row 19	3175	3352	None	None
Row 20	3296	3352	None	None
Row 21	3230	3352	None	None
Row 22	3348	3352	None	None
Row 23	3227	3352	None	None
Row 24	3005	3352	None	None
Row 25	3296	3352	None	None
Row 26	3049	3352	None	None
Row 27	2913	3352	None	None
Row 28	2982	3352	None	None
Row 29	2820	3352	None	None
Row 30	2831	2861	None	None
Row 31	2835	2861	None	None
Row 32	2722	2861	None	None
Row 33	2801	2861	None	None
Row 34	2797	2861	None	None
Row 35	2694	2861	None	None
Row 36	2776	2861	None	None
Row 37	2736	2861	None	None
Row 38	2785	2861	None	None
Row 39	2752	2861	None	None
Row 40	2688	2861	None	None
Row 41	2652	2861	None	None
Row 42	2780	2861	None	None
Row 43	2990	3343	None	None
Row 44	3054	3343	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 45	2777	3343	None	None
Row 46	2649	2748	None	None
Row 47	2615	2748	None	None
Row 48	2612	2748	None	None
Row 49	2549	2748	None	None
Row 50	2581	2748	None	None
Row 51	2608	2796	None	None
Row 52	2576	2748	None	None
Row 53	2522	2748	None	None
Row 54	2665	2748	None	None
Row 55	2640	2748	None	None
Row 56	2528	2748	None	None
Row 57	4275	4642	None	None
Row 58	4003	4642	None	None
Row 59	4414	4642	None	None
Row 60	4105	4642	None	None
Row 61	4508	4642	None	None
Row 62	3904	4642	None	None
Row 63	4488	4642	None	None
Row 64	3945	4642	None	None
Row 65	4088	4642	None	None
Row 66	4122	4642	None	None
Row 67	4009	4642	None	None
Row 68	3877	4642	None	None
Row 69	3886	4642	None	None
Row 70	3809	4642	None	None
Row 71	4897	5072	None	None
Row 72	4758	5072	None	None
Row 73	4948	5072	None	None
Row 74	4598	5072	None	None
Row 75	4777	5072	None	None
Row 76	4533	5072	None	None
Row 77	4722	5072	None	None
Row 78	4435	5072	None	None
Row 79	4670	5072	None	None
Row 80	4445	5072	None	None
Row 81	4854	5072	None	None
Row 82	4506	5072	None	None
Row 83	4919	5072	None	None
Row 84	4506	5072	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 85	4744	4919	None	None
Row 86	4717	4919	None	None
Row 87	4774	4919	None	None
Row 88	4561	4919	None	None
Row 89	4546	4919	None	None
Row 90	4545	4919	None	None
Row 91	4486	4919	None	None
Row 92	4516	4919	None	None
Row 93	4599	4919	None	None
Row 94	4489	4919	None	None
Row 95	4665	4919	None	None
Row 96	4478	4919	None	None
Row 97	4580	4919	None	None
Row 98	4440	4919	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 twenty-one (21) soil samples taken for non-parametric statistical testing, the one (1) biased surface soil sample (judgmental) and the three (3) subsurface soil samples were analyzed using the on-site gamma spectroscopy system. Summaries of the sample analysis results are provided in Tables 12, 13 and 14, respectively. The basic statistics for the systematic sample population are summarized in Table 21. For the systematic samples, the gamma spectroscopy results revealed three (3) samples with activity levels above MDC for Cs-137, one (1) sample with an activity level above MDC for Co-60 and no samples with activity levels above MDC for 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)
L1-10208A-FSGS-001-SS	3.89E-02	1.70E-02	3.64E-02	7.02E+00	7.28E-05
L1-10208A-FSGS-002-SS	2.25E-03	1.95E-02	0.00E+00	4.06E-01	0.00E+00
L1-10208A-FSGS-003-SS	2.64E-02	3.41E-03	1.65E-02	4.76E+00	3.30E-05
L1-10208A-FSGS-004-SS	2.38E-02	1.21E-02	6.38E-02	4.29E+00	1.28E-04
L1-10208A-FSGS-005-SS	1.26E-02	0.00E+00	3.08E-02	2.27E+00	6.16E-05
L1-10208A-FSGS-006-SS	4.87E-02	3.53E-02	1.85E-02	8.79E+00	3.70E-05
L1-10208A-FSGS-007-SS	1.93E-03	1.76E-02	2.45E-02	3.48E-01	4.90E-05
L1-10208A-FSGS-008-SS	0.00E+00	1.80E-02	2.90E-02	0.00E+00	5.80E-05
L1-10208A-FSGS-009-SS	**3.21E-02**	0.00E+00	**5.93E-02**	5.79E+00	1.19E-04
L1-10208A-FSGS-010-SS	3.46E-02	3.93E-02	3.01E-02	6.24E+00	6.02E-05
L1-10208A-FSGS-011-SS	3.23E-02	0.00E+00	4.92E-02	5.83E+00	9.84E-05
L1-10208A-FSGS-012-SS	1.81E-02	0.00E+00	0.00E+00	3.27E+00	0.00E+00
L1-10208A-FSGS-013-SS	4.58E-02	6.99E-03	3.51E-02	8.26E+00	7.02E-05
L1-10208A-FSGS-014-SS	4.80E-04	9.89E-03	1.42E-03	8.66E-02	2.84E-06
L1-10208A-FSGS-015-SS	3.63E-02	4.49E-03	3.59E-02	6.55E+00	7.18E-05
L1-10208A-FSGS-016-SS	2.20E-02	4.60E-03	2.27E-02	3.97E+00	4.54E-05
L1-10208A-FSGS-017-SS	4.86E-02	4.90E-02	2.39E-02	8.77E+00	4.78E-05
L1-10208A-FSGS-018-SS	2.90E-02	0.00E+00	4.54E-02	5.23E+00	9.08E-05
L1-10208A-FSGS-019-SS	6.13E-02	4.39E-03	3.84E-02	1.11E+01	7.68E-05
L1-10208A-FSGS-020-SS	1.91E-02	1.56E-03	**7.25E-02**	3.45E+00	1.45E-04
L1-10208A-FSGS-021-SS	3.54E-02	0.00E+00	**8.74E-02**	6.39E+00	1.75E-04

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

Table 13 - Summary of Gamma Spectroscopy Results for Biased Surface Soil Samples

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L1-10208A-FJGS-001-SS	0.00E+00	5.59E-03	0.00E+00	0.00E+00	0.00E+00

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

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

MEASUREMENT ID	Co-60[1] (pCi/g)	Cs-134[1] (pCi/g)	Cs-137[1] (pCi/g)	Ni-63[2] (pCi/g)	Sr-90[2] (pCi/g)
L1-10208A-FSGS-005-SB	0.00E+00	1.59E-03	0.00E+00	0.00E+00	0.00E+00
L1-10208A-FSGS-010-SB	1.25E-02	0.00E+00	4.69E-02	2.26E+00	9.38E-05
L1-10208A-FSGS-012-SB	1.78E-02	0.00E+00	2.66E-02	3.21E+00	5.32E-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.

The off-site laboratory, Eberline Analytical, processed the three (3) samples selected for HTD ROC analysis (L1-10208A-FSGS-009-SS-A, L1-10208A-FSGS-020-SS-A and L1-10208A-FSGS-021-SS-A). Only HTD radionuclides included as ROC (Ni-63 and Sr-90 for soils) were included in the analysis. All analyses met the required MDC. Only Cs-137 and Co-60 were positively detected at concentrations greater than MDC in the samples. Consequently, comparison of existing ratios versus the maximum ratios from Table 6 was not required. The results are provided in Table 15.

Table 15 - Off-Site Analysis Results

Sample # L1-10208A-FSGS-009-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	4.56E-02	2.05E-02	3.44E-02	Yes
Cs-134	9.38E-03	1.84E-02	5.86E-02	No
Cs-137	9.74E-02	3.59E-02	5.65E-02	Yes
Ni-63	-2.58E-01	1.80E+00	3.11E+00	No
Sr-90	5.80E-02	2.86E-01	6.07E-01	No

Sample # L1-10208A-FSGS-020-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	6.93E-02	3.89E-02	7.86E-02	No
Cs-134	4.30E-02	3.88E-02	1.16E-01	No
Cs-137	2.62E-01	7.70E-02	9.57E-02	Yes
Ni-63	1.62E-01	1.72E+00	2.95E+00	No
Sr-90	1.01E-01	3.12E-01	6.58E-01	No

Table 15 (continued) - Off-Site Analysis Results
Sample # L1-10208A-FSGS-021-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	7.17E-03	6.38E-02	7.72E-02	No
Cs-134	-1.88E-01	8.81E-02	6.16E-02	No
Cs-137	1.15E-01	4.87E-02	1.42E-01	No
Ni-63	5.98E-01	1.81E+00	3.09E+00	No
Sr-90	5.22E-02	2.37E-01	5.03E-01	No

The implementation of survey specific QC measures included the collection of two (2) samples (L1-10208A-FQGS-019-SS and L1-10208A-FQGS-021-SS) for "split sample" analysis. The on-site laboratory analyzed the designated QC samples using the on-site gamma spectroscopy system. Gamma spectroscopy results (summarized in Table 16) indicate that concentrations were greater than MDC for Cs-137 and less than MDC for Co-60 and Cs-134 in both of the samples. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6.

Table 16 - Summary of Gamma Spectroscopy Results for QC 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)
L1-10208A-FQGS-019-SS	3.52E-02	4.79E-02	**4.57E-02**	6.35E+00	9.14E-05
L1-10208A-FQGS-021-SS	4.01E-02	2.59E-02	**5.53E-02**	7.24E+00	1.11E-04

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

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

Equation 6

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

Where: C_n = concentration of radionuclide *n*

$DCGL_n$ = DCGL of radionuclide *n*.

The results of the unity rule calculation for the ROC in the systematic sample population when compared against the OpDCGLs for surface soils for survey unit 10208A are presented in Table 17. The result of the unity rule calculation for the ROC for the biased surface sample is presented in Table 18. The results of the unity rule calculation for the subsurface samples are presented in Table 19 and the results for the QC samples are presented in Table 20.

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-10208A-FSGS-001-SS	3.57E-02	9.81E-03	1.00E-02	7.68E-03	2.35E-05	0.063
L1-10208A-FSGS-002-SS	2.06E-03	1.13E-02	0.00E+00	4.44E-04	0.00E+00	0.014
L1-10208A-FSGS-003-SS	2.42E-02	1.97E-03	4.55E-03	5.21E-03	1.07E-05	0.036
L1-10208A-FSGS-004-SS	2.18E-02	6.98E-03	1.76E-02	4.70E-03	4.12E-05	0.051
L1-10208A-FSGS-005-SS	1.15E-02	0.00E+00	8.48E-03	2.49E-03	1.99E-05	0.023
L1-10208A-FSGS-006-SS	4.46E-02	2.04E-02	5.10E-03	9.61E-03	1.20E-05	0.080
L1-10208A-FSGS-007-SS	1.77E-03	1.02E-02	6.75E-03	3.81E-04	1.58E-05	0.019
L1-10208A-FSGS-008-SS	0.00E+00	1.04E-02	7.99E-03	0.00E+00	1.87E-05	0.018
L1-10208A-FSGS-009-SS	2.94E-02	0.00E+00	1.63E-02	6.33E-03	3.83E-05	0.052
L1-10208A-FSGS-010-SS	3.17E-02	2.27E-02	8.29E-03	6.83E-03	1.95E-05	0.070
L1-10208A-FSGS-011-SS	2.96E-02	0.00E+00	1.36E-02	6.37E-03	3.18E-05	0.050
L1-10208A-FSGS-012-SS	1.66E-02	0.00E+00	0.00E+00	3.57E-03	0.00E+00	0.020
L1-10208A-FSGS-013-SS	4.20E-02	4.03E-03	9.67E-03	9.04E-03	2.27E-05	0.065
L1-10208A-FSGS-014-SS	4.40E-04	5.71E-03	3.91E-04	9.47E-05	9.18E-07	0.007
L1-10208A-FSGS-015-SS	3.33E-02	2.59E-03	9.89E-03	7.16E-03	2.32E-05	0.053
L1-10208A-FSGS-016-SS	2.02E-02	2.65E-03	6.25E-03	4.34E-03	1.47E-05	0.033
L1-10208A-FSGS-017-SS	4.45E-02	2.83E-02	6.58E-03	9.59E-03	1.54E-05	0.089
L1-10208A-FSGS-018-SS	2.66E-02	0.00E+00	1.25E-02	5.72E-03	2.93E-05	0.045
L1-10208A-FSGS-019-SS	5.62E-02	2.53E-03	1.06E-02	1.21E-02	2.48E-05	0.081
L1-10208A-FSGS-020-SS	1.75E-02	9.00E-04	2.00E-02	3.77E-03	4.68E-05	0.042
L1-10208A-FSGS-021-SS	3.24E-02	0.00E+00	2.41E-02	6.99E-03	5.65E-05	0.064

Systematic Measurements

Number of Systematic Measurements =	21
# of Systematic Measurements with OpSOF $\geq$ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	0
Max Individual Systematic Measurement OpSOF =	0.089
Mean Systematic Measurement OpSOF =	0.046

Table 18 - Sum of Fractions for Individual Biased 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	
L1-10208A-FJGS-001-SS	0.00E+00	3.23E-03	0.00E+00	0.00E+00	0.00E+00	0.003

Table 19 - 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	
L1-10208A-FSGS-005-SB	0.00E+00	1.40E-03	0.00E+00	0.00E+00	0.00E+00	0.001
L1-10208A-FSGS-010-SB	1.42E-02	0.00E+00	2.36E-02	1.15E-02	2.21E-04	0.050
L1-10208A-FSGS-012-SB	2.02E-02	0.00E+00	1.34E-02	1.64E-02	1.25E-04	0.050

Table 20 - Sum of Fractions for Individual Surface Soil Samples, when compared to the OpDCGLs (QC)

MEASUREMENT ID	Fraction of the OpDCGLs for Surface soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-10208A-FQGS-019-SS	3.23E-02	2.76E-02	1.26E-02	6.95E-03	2.95E-05	0.079
L1-10208A-FQGS-021-SS	3.68E-02	1.49E-02	1.52E-02	7.91E-03	3.57E-05	0.075

Table 21 - Basic Statistical Properties of Systematic Sample Population

ROC	Mean (pCi/g)	Median (pCi/g)	Max (pCi/g)	Min (pCi/g)	Std. Dev. (pCi/g)	BcDCGL (pCi/g)	Avg. SOF per ROC	Avg. Dose Per ROC
Co-60	2.71E-02	2.90E-02	6.13E-02	0.00E+00	0.017	4.26	6.37E-03	1.59E-01
Cs-134	1.16E-02	4.60E-03	4.90E-02	0.00E+00	0.014	6.77	1.71E-03	4.28E-02
Cs-137	3.43E-02	3.08E-02	8.74E-02	0.00E+00	0.023	14.18	2.42E-03	6.05E-02
Ni-63	4.90E+00	5.23E+00	1.11E+01	0.00E+00	3.110	3572.1	1.37E-03	3.43E-02
Sr-90	6.86E-05	6.16E-05	1.75E-04	0.00E+00	0.000	12.09	5.68E-06	1.42E-04

The mean BcSOF for survey unit 10208A is 0.012 which equates to a dose of 0.297 mrem/yr TEDE.

The mean of all identified isotopes are less than the Consultation Triggers for Residential and Commercial/Industrial Soil Contamination depicted in Table H.1 of NUREG 1757, Vol. 1, (MOU Table 1). The full table is included in Attachment 3 of this Release Record.

8. QUALITY CONTROL

The on-site laboratory processed two (2) split samples, L1-10208A-FQGS-019-SS and L1-10208A-FQGS-021-SS, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in ZS-LT-01. There was acceptable agreement between field split results. Refer to Attachment 5 for data and quality control analysis results.

9. INVESTIGATIONS AND RESULTS

No investigations were performed in survey unit 10208A.

10. REMEDIATION AND RESULTS

No remediation was performed in this survey unit.

11. CHANGES FROM THE SURVEY PLAN

Eleven (11) systematic samples were relocated to the closest adjacent suitable location due to the original locations falling on the railroad spur which is made up of gravel and not soil. The coordinates of the relocated samples are listed in the table below. The map included in Attachment 1 shows the original and relocated sample points.

Table 22 - Relocated Systematic Sample Location

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L1-10208A-FSGS-001-SS	641606.16	343457.35
L1-10208A-FSGS-002-SS	641609.96	343456.42
L1-10208A-FSGS-004-SS	641621.14	343468.53
L1-10208A-FSGS-006-SS	641630.81	343453.41
L1-10208A-FSGS-008-SS	641640.67	343452.45
L1-10208A-FSGS-009-SS	641641.24	343467.48
L1-10208A-FSGS-010-SS	641651.73	343449.14
L1-10208A-FSGS-013-SS	641661.16	343468.96
L1-10208A-FSGS-015-SS	641671.88	343455.50
L1-10208A-FSGS-018-SS	641683.56	343457.39
L1-10208A-FSGS-020-SS	641690.11	343474.29

One of the sample locations randomly selected in the Sample Plan for a subsurface sample, L1-10208A-FSGS-015-SB, was not accessible for the Geoprobe machine to obtain a sample, so a sample was collected at the adjacent location: L1-10208A-FSGS-012-SB.

The Sample Plan prescribed that 5% of the total number of biased samples would require a split sample analysis with a minimum of one (1). One (1) biased surface soil sample was obtained during the FSS of this survey unit without being split. This was deemed acceptable because split sample analysis was performed on two (2) systematic surface soil samples during the FSS satisfying the Quality Assurance Project Plan requirement that split sample analysis be performed on 5% of the soil samples collected in a survey unit.

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 10208A has met the DQOs of the FSS plan. The ALARA criteria for soils as specified in Chapter 4 of the LTP were achieved. The EMC for soils was not needed for this survey unit and remediation was not required.

All identified ROC were used for statistical testing to determine the adequacy of the survey unit for FSS. Evaluation of the data shows that none of the ROC concentration values exceeds the OpDCGL or any investigational levels; therefore, in accordance with the LTP Section 5.10, the survey unit meets the release criterion.

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

The mean BcSOF, when the analytical results were compared to the BcDCGLs, was 0.012, which results in a dose contribution from soil in survey unit 10208A of 0.297 mrem/yr 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 10208A is acceptable for unrestricted release.

15. REFERENCES

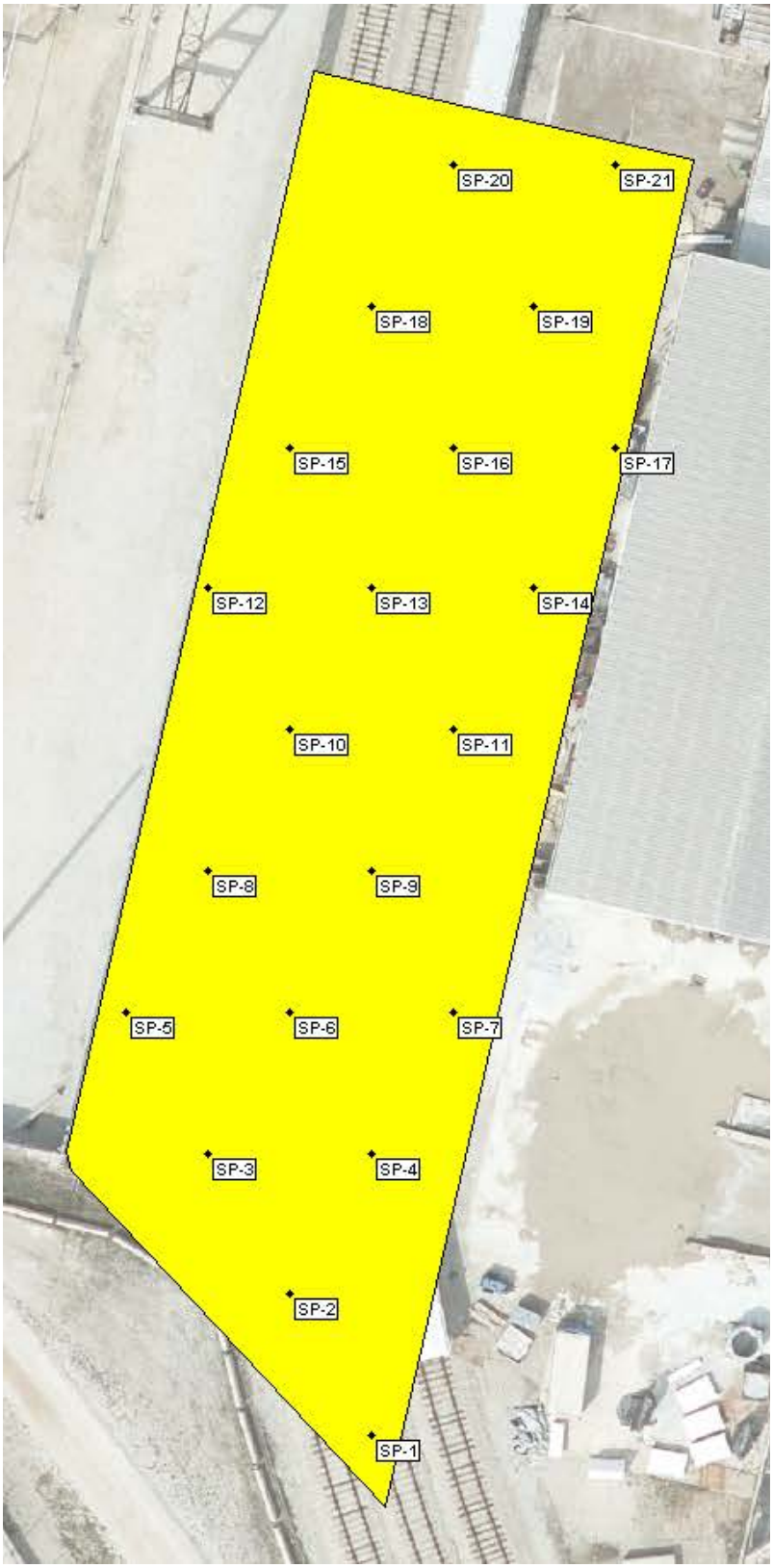
1. Zion*Solutions* procedure ZS-LT-300-001-005, "Final Status Survey Data Reporting"
2. Zion Station Restoration Project License Termination Plan
3. Zion*Solutions* procedure ZS-LT-300-001-001, "Final Status Survey Package Development"
4. NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation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

16. ATTACHMENTS

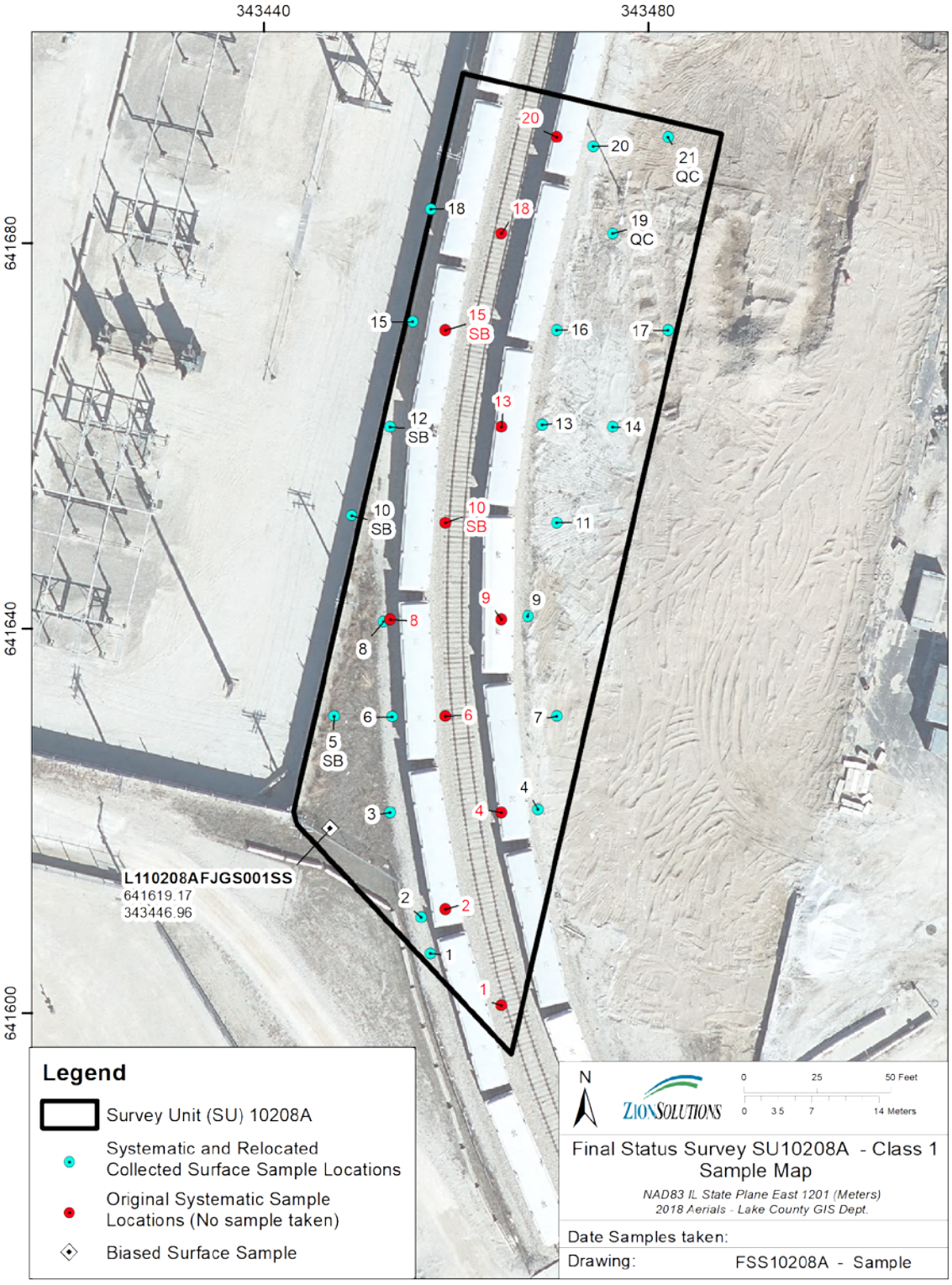
1. Attachment 1 - Figures and Map
2. Attachment 2 - Scan Data
3. Attachment 3 - Consultation Triggers for Residential and Commercial/Industrial Soil Contamination
4. Attachment 4 - Sign Test
5. Attachment 5 - QC Sample Assessment
6. Attachment 6 - Graphical Presentations
7. Attachment 7 - Sample Analytical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

ATTACHMENT 1
FIGURES AND MAP

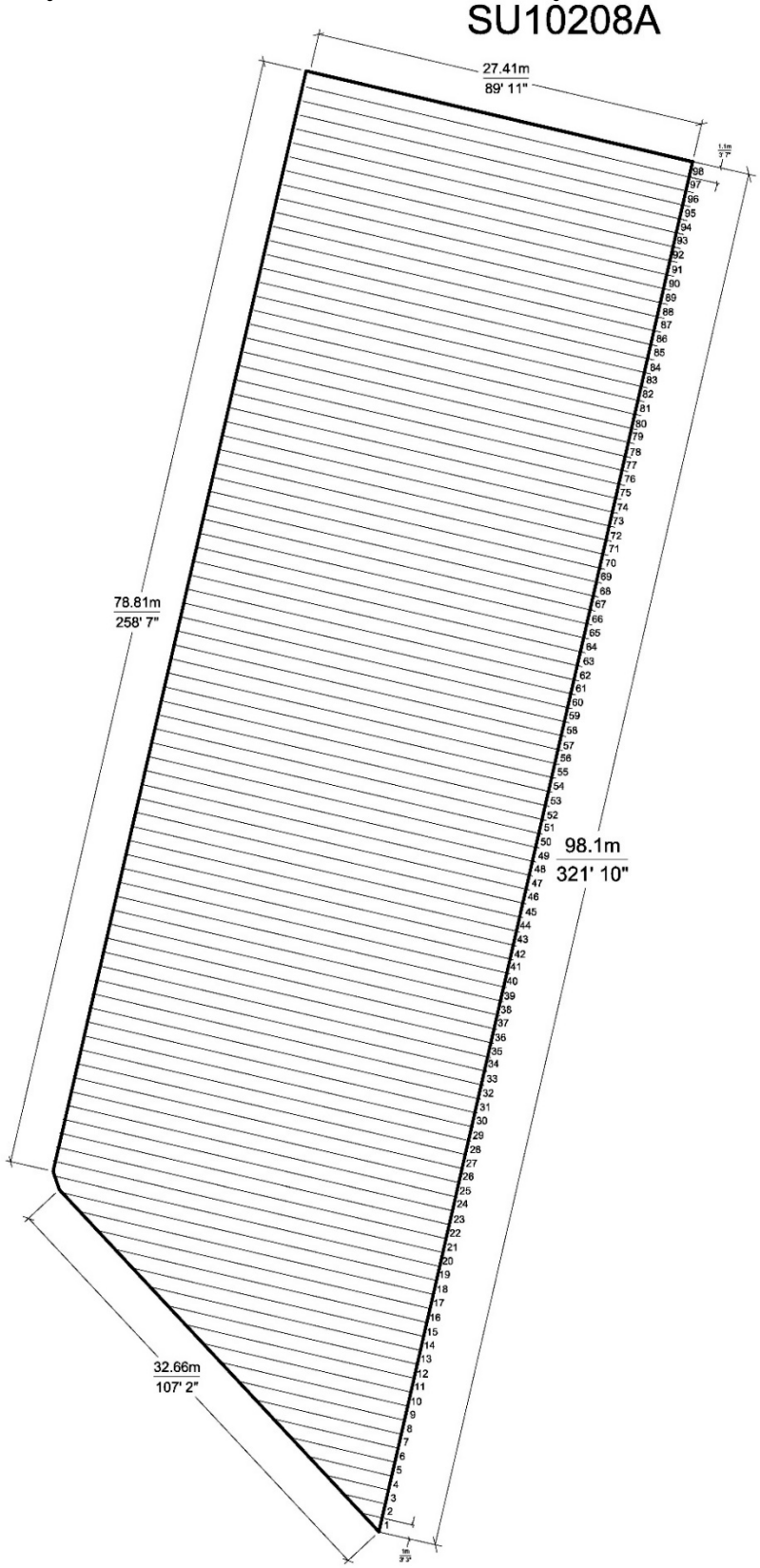
Survey Unit 10208A Final Status Survey Boundaries and Systematic Sample Points



Survey Unit 10208A Final Status Survey Boundaries with Relocated Systematic Sample Points



Survey Unit 10208A 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	PR363452	304726	10208A	GS043	10/4/2019 12:39	1604	1301	1846	No
44-10	PR363452	304726	10208A	GS044	10/4/2019 12:43	1713	1301	1846	No
44-10	PR363452	304726	10208A	GS045	10/4/2019 12:47	1599	1301	1846	No
44-10	PR363452	304726	10208A	GS046	10/4/2019 12:51	1643	1301	1846	No
44-10	PR363452	304726	10208A	GS047	10/4/2019 12:55	1837	1301	1846	No
44-10	PR363452	304726	10208A	GS048	10/4/2019 12:59	1703	1301	1846	No
44-10	PR363452	304726	10208A	GS049	10/4/2019 13:04	1664	1301	1846	No
44-10	PR363452	304726	10208A	GS050	10/4/2019 13:08	1808	1301	1846	No
44-10	PR363452	304726	10208A	GS051	10/4/2019 13:13	1694	1301	1846	No
44-10	PR363452	304726	10208A	GS052	10/4/2019 13:16	1549	1301	1846	No
44-10	PR363452	304726	10208A	GS053	10/4/2019 13:20	1728	1301	1846	No
44-10	PR363452	304726	10208A	GS054	10/4/2019 13:25	1592	1301	1846	No
44-10	PR363452	304726	10208A	GS055	10/4/2019 13:29	1686	1301	1846	No
44-10	PR363452	304726	10208A	GS056	10/4/2019 13:32	1663	1301	1846	No
44-10	PR363452	304726	10208A	GS046	10/4/2019 13:59	2600	2102	2796	No
44-10	PR363452	304726	10208A	GS047	10/4/2019 14:03	2423	2102	2796	No
44-10	PR363452	304726	10208A	GS048	10/4/2019 14:07	2411	2102	2796	No
44-10	PR363452	304726	10208A	GS049	10/4/2019 14:11	2490	2102	2796	No
44-10	PR363452	304726	10208A	GS050	10/4/2019 14:13	2442	2102	2796	No
44-10	PR363452	304726	10208A	GS051	10/4/2019 14:18	2608	2102	2796	No
44-10	PR363452	304726	10208A	GS052	10/4/2019 14:21	2500	2102	2796	No
44-10	PR363452	304726	10208A	GS053	10/4/2019 14:23	2506	2102	2796	No
44-10	PR363452	304726	10208A	GS054	10/4/2019 14:27	2376	2102	2796	No
44-10	PR363452	304726	10208A	GS055	10/4/2019 14:30	2424	2102	2796	No
44-10	PR363452	304726	10208A	GS056	10/4/2019 14:33	2280	2102	2796	No
44-10	PR372106	216166	10208A	GS085	10/4/2019 10:08	3248	2766	3562	No
44-10	PR372106	216166	10208A	GS085	10/4/2019 10:10	3148	2766	3562	No
44-10	PR372106	216166	10208A	GS086	10/4/2019 10:12	3403	2766	3562	No
44-10	PR372106	216166	10208A	GS086	10/4/2019 10:14	3310	2766	3562	No
44-10	PR372106	216166	10208A	GS087	10/4/2019 10:16	3358	2766	3562	No
44-10	PR372106	216166	10208A	GS087	10/4/2019 10:18	3254	2766	3562	No
44-10	PR372106	216166	10208A	GS088	10/4/2019 10:20	3019	2766	3562	No
44-10	PR372106	216166	10208A	GS088	10/4/2019 10:22	3302	2766	3562	No
44-10	PR372106	216166	10208A	GS089	10/4/2019 10:24	3025	2766	3562	No
44-10	PR372106	216166	10208A	GS089	10/4/2019 10:26	3113	2766	3562	No
44-10	PR372106	216166	10208A	GS090	10/4/2019 10:28	3232	2766	3562	No
44-10	PR372106	216166	10208A	GS090	10/4/2019 10:30	3043	2766	3562	No
44-10	PR372106	216166	10208A	GS091	10/4/2019 10:32	3301	2766	3562	No
44-10	PR372106	216166	10208A	GS091	10/4/2019 10:34	3550	2766	3562	No
44-10	PR372106	216166	10208A	GS092	10/4/2019 12:29	3537	2766	3562	No
44-10	PR372106	216166	10208A	GS092	10/4/2019 12:31	3198	2766	3562	No
44-10	PR372106	216166	10208A	GS093	10/4/2019 12:33	3107	2766	3562	No
44-10	PR372106	216166	10208A	GS093	10/4/2019 12:35	3318	2766	3562	No
44-10	PR372106	216166	10208A	GS094	10/4/2019 12:37	3209	2766	3562	No
44-10	PR372106	216166	10208A	GS094	10/4/2019 12:39	3315	2766	3562	No
44-10	PR372106	216166	10208A	GS095	10/4/2019 12:41	3188	2766	3562	No
44-10	PR372106	216166	10208A	GS095	10/4/2019 12:43	3388	2766	3562	No
44-10	PR372106	216166	10208A	GS096	10/4/2019 12:45	3328	2766	3562	No
44-10	PR372106	216166	10208A	GS096	10/4/2019 12:47	3142	2766	3562	No
44-10	PR372106	216166	10208A	GS097	10/4/2019 12:49	3173	2766	3562	No
44-10	PR372106	216166	10208A	GS097	10/4/2019 12:51	3380	2766	3562	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	PR372106	216166	10208A	GS098	10/4/2019 12:53	3482	2766	3562	No
44-10	PR372106	216166	10208A	GS098	10/4/2019 12:55	3054	2766	3562	No
44-10	PR308037	266657	10208A	GS057	10/4/2019 12:44	4275	3720	4642	No
44-10	PR308037	266657	10208A	GS057	10/4/2019 12:46	3855	3720	4642	No
44-10	PR308037	266657	10208A	GS058	10/4/2019 12:50	4003	3720	4642	No
44-10	PR308037	266657	10208A	GS058	10/4/2019 12:52	3843	3720	4642	No
44-10	PR308037	266657	10208A	GS059	10/4/2019 12:55	4414	3720	4642	No
44-10	PR308037	266657	10208A	GS059	10/4/2019 12:58	4299	3720	4642	No
44-10	PR308037	266657	10208A	GS060	10/4/2019 13:01	4105	3720	4642	No
44-10	PR308037	266657	10208A	GS060	10/4/2019 13:03	3839	3720	4642	No
44-10	PR308037	266657	10208A	GS061	10/4/2019 13:07	3945	3720	4642	No
44-10	PR308037	266657	10208A	GS061	10/4/2019 13:09	4508	3720	4642	No
44-10	PR308037	266657	10208A	GS062	10/4/2019 13:12	3904	3720	4642	No
44-10	PR308037	266657	10208A	GS062	10/4/2019 13:15	3757	3720	4642	No
44-10	PR308037	266657	10208A	GS063	10/4/2019 13:18	3871	3720	4642	No
44-10	PR308037	266657	10208A	GS063	10/4/2019 13:20	4488	3720	4642	No
44-10	PR308037	266657	10208A	GS064	10/4/2019 13:23	3945	3720	4642	No
44-10	PR308037	266657	10208A	GS064	10/4/2019 13:26	3762	3720	4642	No
44-10	PR308037	266657	10208A	GS065	10/4/2019 13:29	4040	3720	4642	No
44-10	PR308037	266657	10208A	GS065	10/4/2019 13:31	4088	3720	4642	No
44-10	PR308037	266657	10208A	GS066	10/4/2019 13:34	3951	3720	4642	No
44-10	PR308037	266657	10208A	GS066	10/4/2019 13:37	4122	3720	4642	No
44-10	PR308037	266657	10208A	GS067	10/4/2019 13:41	3988	3720	4642	No
44-10	PR308037	266657	10208A	GS067	10/4/2019 13:43	4009	3720	4642	No
44-10	PR308037	266657	10208A	GS068	10/4/2019 13:47	3877	3720	4642	No
44-10	PR308037	266657	10208A	GS068	10/4/2019 13:49	3725	3720	4642	No
44-10	PR308037	266657	10208A	GS069	10/4/2019 13:54	3729	3720	4642	No
44-10	PR308037	266657	10208A	GS069	10/4/2019 13:57	3886	3720	4642	No
44-10	PR308037	266657	10208A	GS070	10/4/2019 14:00	3724	3720	4642	No
44-10	PR308037	266657	10208A	GS070	10/4/2019 14:09	3809	3720	4642	No
44-10	PR372143	304712	10208A	GS071	10/4/2019 12:46	3620	3202	4057	No
44-10	PR372143	304712	10208A	GS071	10/4/2019 12:49	3959	3202	4057	No
44-10	PR372143	304712	10208A	GS072	10/4/2019 12:52	3686	3202	4057	No
44-10	PR372143	304712	10208A	GS072	10/4/2019 12:54	3372	3202	4057	No
44-10	PR372143	304712	10208A	GS073	10/4/2019 12:57	3560	3202	4057	No
44-10	PR372143	304712	10208A	GS073	10/4/2019 12:59	3644	3202	4057	No
44-10	PR372143	304712	10208A	GS074	10/4/2019 13:06	3923	3202	4057	No
44-10	PR372143	304712	10208A	GS074	10/4/2019 13:08	3522	3202	4057	No
44-10	PR372143	304712	10208A	GS075	10/4/2019 13:11	3602	3202	4057	No
44-10	PR372143	304712	10208A	GS075	10/4/2019 13:13	3926	3202	4057	No
44-10	PR372143	304712	10208A	GS076	10/4/2019 13:17	3673	3202	4057	No
44-10	PR372143	304712	10208A	GS076	10/4/2019 13:20	3411	3202	4057	No
44-10	PR372143	304712	10208A	GS077	10/4/2019 13:23	3655	3202	4057	No
44-10	PR372143	304712	10208A	GS077	10/4/2019 13:25	3589	3202	4057	No
44-10	PR372143	304712	10208A	GS078	10/4/2019 13:29	3586	3202	4057	No
44-10	PR372143	304712	10208A	GS078	10/4/2019 13:31	3492	3202	4057	No
44-10	PR372143	304712	10208A	GS079	10/4/2019 13:34	3547	3202	4057	No
44-10	PR372143	304712	10208A	GS079	10/4/2019 13:37	3591	3202	4057	No
44-10	PR372143	304712	10208A	GS080	10/4/2019 13:40	3542	3202	4057	No
44-10	PR372143	304712	10208A	GS080	10/4/2019 13:44	3336	3202	4057	No
44-10	PR372143	304712	10208A	GS081	10/4/2019 13:47	3286	3202	4057	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR372143	304712	10208A	GS081	10/4/2019 13:49	3547	3202	4057	No
44-10	PR372143	304712	10208A	GS082	10/4/2019 13:53	3934	3202	4057	No
44-10	PR372143	304712	10208A	GS082	10/4/2019 13:55	3697	3202	4057	No
44-10	PR372143	304712	10208A	GS083	10/4/2019 13:58	3429	3202	4057	No
44-10	PR372143	304712	10208A	GS083	10/4/2019 14:00	3655	3202	4057	No
44-10	PR372143	304712	10208A	GS084	10/4/2019 14:03	3434	3202	4057	No
44-10	PR372143	304712	10208A	GS084	10/4/2019 14:06	3513	3202	4057	No
44-10	PR321892	304708	10208A	GS001	10/4/2019 10:06	2326	2219	2931	No
44-10	PR321892	304708	10208A	GS002	10/4/2019 10:09	2379	2219	2931	No
44-10	PR321892	304708	10208A	GS003	10/4/2019 10:13	2243	2219	2931	No
44-10	PR321892	304708	10208A	GS004	10/4/2019 10:16	2394	2219	2931	No
44-10	PR321892	304708	10208A	GS005	10/4/2019 10:22	2644	2219	2931	No
44-10	PR321892	304708	10208A	GS006	10/4/2019 10:26	2703	2219	2931	No
44-10	PR321892	304708	10208A	GS007	10/4/2019 12:23	2629	2219	2931	No
44-10	PR321892	304708	10208A	GS008	10/4/2019 12:28	2779	2219	2931	No
44-10	PR321892	304708	10208A	GS009	10/4/2019 12:45	2695	2219	2931	No
44-10	PR321892	304708	10208A	GS010	10/4/2019 12:49	2311	2219	2931	No
44-10	PR321892	304708	10208A	GS011	10/4/2019 12:51	2447	2219	2931	No
44-10	PR321892	304708	10208A	GS012	10/4/2019 12:53	2531	2219	2931	No
44-10	PR321892	304708	10208A	GS013	10/4/2019 12:55	2454	2219	2931	No
44-10	PR321892	304708	10208A	GS014	10/4/2019 12:59	2288	2219	2931	No
44-10	PR321892	304708	10208A	GS015	10/4/2019 13:01	2433	2219	2931	No
44-10	PR321892	304708	10208A	GS016	10/4/2019 13:03	2296	2219	2931	No
44-10	PR321892	304708	10208A	GS017	10/4/2019 13:06	2370	2219	2931	No
44-10	PR321892	304708	10208A	GS018	10/4/2019 13:08	2317	2219	2931	No
44-10	PR321892	304708	10208A	GS019	10/4/2019 13:12	2325	2219	2931	No
44-10	PR321892	304708	10208A	GS020	10/4/2019 13:15	2279	2219	2931	No
44-10	PR321892	304708	10208A	GS021	10/4/2019 13:19	2228	2219	2931	No
44-10	PR321892	304708	10208A	GS022	10/4/2019 13:22	2321	2219	2931	No
44-10	PR321892	304708	10208A	GS023	10/4/2019 13:24	2265	2219	2931	No
44-10	PR321892	304708	10208A	GS024	10/4/2019 13:26	2374	2219	2931	No
44-10	PR321892	304708	10208A	GS025	10/4/2019 13:29	2262	2219	2931	No
44-10	PR321892	304708	10208A	GS026	10/4/2019 13:34	2291	2219	2931	No
44-10	PR311750	266656	10208A	GS029	10/4/2019 13:12	2098	1581	2182	No
44-10	PR311750	266656	10208A	GS029	10/4/2019 13:16	1800	1581	2182	No
44-10	PR311750	266656	10208A	GS030	10/4/2019 13:19	2125	1581	2182	No
44-10	PR311750	266656	10208A	GS030	10/4/2019 13:22	1998	1581	2182	No
44-10	PR311750	266656	10208A	GS031	10/4/2019 13:25	1989	1581	2182	No
44-10	PR311750	266656	10208A	GS031	10/4/2019 13:28	2043	1581	2182	No
44-10	PR311750	266656	10208A	GS032	10/4/2019 13:32	2081	1581	2182	No
44-10	PR311750	266656	10208A	GS032	10/4/2019 13:36	2156	1581	2182	No
44-10	PR311750	266656	10208A	GS033	10/4/2019 13:39	2076	1581	2182	No
44-10	PR311750	266656	10208A	GS033	10/4/2019 13:42	2074	1581	2182	No
44-10	PR311750	266656	10208A	GS034	10/4/2019 13:45	1824	1581	2182	No
44-10	PR311750	266656	10208A	GS034	10/4/2019 13:48	1900	1581	2182	No
44-10	PR311750	266656	10208A	GS035	10/4/2019 13:50	1822	1581	2182	No
44-10	PR311750	266656	10208A	GS035	10/4/2019 13:52	1829	1581	2182	No
44-10	PR311750	266656	10208A	GS036	10/4/2019 13:54	1777	1581	2182	No
44-10	PR311750	266656	10208A	GS036	10/4/2019 13:57	2027	1581	2182	No
44-10	PR311750	266656	10208A	GS037	10/4/2019 14:00	1712	1581	2182	No
44-10	PR311750	266656	10208A	GS037	10/4/2019 14:03	1990	1581	2182	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR311750	266656	10208A	GS038	10/4/2019 14:05	1890	1581	2182	No
44-10	PR311750	266656	10208A	GS038	10/4/2019 14:08	1913	1581	2182	No
44-10	PR311750	266656	10208A	GS039	10/4/2019 14:11	1820	1581	2182	No
44-10	PR311750	266656	10208A	GS039	10/4/2019 14:14	1857	1581	2182	No
44-10	PR311750	266656	10208A	GS040	10/4/2019 14:16	1701	1581	2182	No
44-10	PR311750	266656	10208A	GS040	10/4/2019 14:18	1889	1581	2182	No
44-10	PR311750	266656	10208A	GS041	10/4/2019 14:20	1993	1581	2182	No
44-10	PR311750	266656	10208A	GS041	10/4/2019 14:22	1883	1581	2182	No
44-10	PR311750	266656	10208A	GS042	10/4/2019 14:25	1852	1581	2182	No
44-10	PR311750	266656	10208A	GS042	10/4/2019 14:27	1745	1581	2182	No
44-10	PR311750	266656	10208A	GS029	10/4/2019 14:41	2850	2158	2861	No
44-10	PR311750	266656	10208A	GS029	10/4/2019 14:43	2795	2158	2861	No
44-10	PR311750	266656	10208A	GS030	10/4/2019 14:45	2831	2158	2861	No
44-10	PR311750	266656	10208A	GS030	10/4/2019 14:47	2553	2158	2861	No
44-10	PR311750	266656	10208A	GS031	10/4/2019 14:50	2835	2158	2861	No
44-10	PR311750	266656	10208A	GS031	10/4/2019 14:52	2311	2158	2861	No
44-10	PR311750	266656	10208A	GS032	10/4/2019 14:56	2722	2158	2861	No
44-10	PR311750	266656	10208A	GS032	10/4/2019 14:58	2532	2158	2861	No
44-10	PR311750	266656	10208A	GS033	10/4/2019 15:02	2801	2158	2861	No
44-10	PR311750	266656	10208A	GS034	10/4/2019 15:05	2797	2158	2861	No
44-10	PR311750	266656	10208A	GS035	10/4/2019 15:09	2694	2158	2861	No
44-10	PR311750	266656	10208A	GS036	10/4/2019 15:13	2776	2158	2861	No
44-10	PR311750	266656	10208A	GS037	10/4/2019 15:15	2736	2158	2861	No
44-10	PR311750	266656	10208A	GS038	10/4/2019 15:19	2785	2158	2861	No
44-10	PR311750	266656	10208A	GS039	10/4/2019 15:22	2752	2158	2861	No
44-10	PR311750	266656	10208A	GS040	10/4/2019 15:24	2688	2158	2861	No
44-10	PR311750	266656	10208A	GS041	10/4/2019 15:26	2652	2158	2861	No
44-10	PR311750	266656	10208A	GS042	10/4/2019 15:28	2780	2158	2861	No
44-10	PR372152	216188	10208A	GS030	10/8/2019 8:35	2646	2213	2924	No
44-10	PR372152	216188	10208A	GS031	10/8/2019 8:37	2630	2213	2924	No
44-10	PR372152	216188	10208A	GS032	10/8/2019 8:39	2672	2213	2924	No
44-10	PR372152	216188	10208A	GS033	10/8/2019 8:41	2691	2213	2924	No
44-10	PR372152	216188	10208A	GS034	10/8/2019 8:43	2525	2213	2924	No
44-10	PR372152	216188	10208A	GS035	10/8/2019 8:45	2446	2213	2924	No
44-10	PR372152	216188	10208A	GS036	10/8/2019 8:47	2611	2213	2924	No
44-10	PR372152	216188	10208A	GS037	10/8/2019 8:49	2338	2213	2924	No
44-10	PR372152	216188	10208A	GS038	10/8/2019 8:51	2480	2213	2924	No
44-10	PR372152	216188	10208A	GS039	10/8/2019 8:53	2462	2213	2924	No
44-10	PR372152	216188	10208A	GS040	10/8/2019 8:55	2614	2213	2924	No
44-10	PR372152	216188	10208A	GS041	10/8/2019 8:57	2373	2213	2924	No
44-10	PR372152	216188	10208A	GS042	10/8/2019 8:59	2484	2213	2924	No
44-10	PR372152	216188	10208A	GS085	10/8/2019 9:24	4744	3967	4919	No
44-10	PR372152	216188	10208A	GS085	10/8/2019 9:26	4556	3967	4919	No
44-10	PR372152	216188	10208A	GS086	10/8/2019 9:28	4438	3967	4919	No
44-10	PR372152	216188	10208A	GS086	10/8/2019 9:30	4717	3967	4919	No
44-10	PR372152	216188	10208A	GS087	10/8/2019 9:32	4774	3967	4919	No
44-10	PR372152	216188	10208A	GS087	10/8/2019 9:34	4393	3967	4919	No
44-10	PR372152	216188	10208A	GS088	10/8/2019 9:36	4316	3967	4919	No
44-10	PR372152	216188	10208A	GS088	10/8/2019 9:38	4561	3967	4919	No
44-10	PR372152	216188	10208A	GS089	10/8/2019 9:40	4546	3967	4919	No
44-10	PR372152	216188	10208A	GS089	10/8/2019 9:42	4482	3967	4919	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	PR372152	216188	10208A	GS090	10/8/2019 9:44	4545	3967	4919	No
44-10	PR372152	216188	10208A	GS090	10/8/2019 9:46	4451	3967	4919	No
44-10	PR372152	216188	10208A	GS091	10/8/2019 9:48	4486	3967	4919	No
44-10	PR372152	216188	10208A	GS091	10/8/2019 9:50	4371	3967	4919	No
44-10	PR372152	216188	10208A	GS092	10/8/2019 9:52	4366	3967	4919	No
44-10	PR372152	216188	10208A	GS092	10/8/2019 9:54	4516	3967	4919	No
44-10	PR372152	216188	10208A	GS093	10/8/2019 9:56	4599	3967	4919	No
44-10	PR372152	216188	10208A	GS093	10/8/2019 9:58	4341	3967	4919	No
44-10	PR372152	216188	10208A	GS094	10/8/2019 10:00	4196	3967	4919	No
44-10	PR372152	216188	10208A	GS094	10/8/2019 10:02	4489	3967	4919	No
44-10	PR372152	216188	10208A	GS095	10/8/2019 10:04	4665	3967	4919	No
44-10	PR372152	216188	10208A	GS095	10/8/2019 10:06	4598	3967	4919	No
44-10	PR372152	216188	10208A	GS096	10/8/2019 10:08	4057	3967	4919	No
44-10	PR372152	216188	10208A	GS096	10/8/2019 10:10	4478	3967	4919	No
44-10	PR372152	216188	10208A	GS097	10/8/2019 10:12	4580	3967	4919	No
44-10	PR372152	216188	10208A	GS097	10/8/2019 10:14	4290	3967	4919	No
44-10	PR372152	216188	10208A	GS098	10/8/2019 10:16	4440	3967	4919	No
44-10	PR372152	216188	10208A	GS098	10/8/2019 10:18	4322	3967	4919	No
44-10	PR308037	266657	10208A	GS057	10/8/2019 9:42	2087	1923	2586	No
44-10	PR308037	266657	10208A	GS057	10/8/2019 9:44	2409	1923	2586	No
44-10	PR308037	266657	10208A	GS058	10/8/2019 9:47	2106	1923	2586	No
44-10	PR308037	266657	10208A	GS058	10/8/2019 9:49	1991	1923	2586	No
44-10	PR308037	266657	10208A	GS059	10/8/2019 9:53	2032	1923	2586	No
44-10	PR308037	266657	10208A	GS059	10/8/2019 9:55	2214	1923	2586	No
44-10	PR308037	266657	10208A	GS060	10/8/2019 9:58	2141	1923	2586	No
44-10	PR308037	266657	10208A	GS060	10/8/2019 10:00	2058	1923	2586	No
44-10	PR308037	266657	10208A	GS061	10/8/2019 10:02	2049	1923	2586	No
44-10	PR308037	266657	10208A	GS061	10/8/2019 10:05	2101	1923	2586	No
44-10	PR308037	266657	10208A	GS062	10/8/2019 10:08	2205	1923	2586	No
44-10	PR308037	266657	10208A	GS062	10/8/2019 10:10	2151	1923	2586	No
44-10	PR308037	266657	10208A	GS063	10/8/2019 10:13	2000	1923	2586	No
44-10	PR308037	266657	10208A	GS063	10/8/2019 10:15	2124	1923	2586	No
44-10	PR308037	266657	10208A	GS064	10/8/2019 10:18	2198	1923	2586	No
44-10	PR308037	266657	10208A	GS064	10/8/2019 10:20	1962	1923	2586	No
44-10	PR308037	266657	10208A	GS065	10/8/2019 10:23	1973	1923	2586	No
44-10	PR308037	266657	10208A	GS065	10/8/2019 10:25	2017	1923	2586	No
44-10	PR308037	266657	10208A	GS066	10/8/2019 10:27	2156	1923	2586	No
44-10	PR308037	266657	10208A	GS066	10/8/2019 10:30	1969	1923	2586	No
44-10	PR308037	266657	10208A	GS067	10/8/2019 10:33	1973	1923	2586	No
44-10	PR308037	266657	10208A	GS067	10/8/2019 10:35	2182	1923	2586	No
44-10	PR308037	266657	10208A	GS068	10/8/2019 10:37	2069	1923	2586	No
44-10	PR308037	266657	10208A	GS068	10/8/2019 10:39	1972	1923	2586	No
44-10	PR308037	266657	10208A	GS069	10/8/2019 10:42	1998	1923	2586	No
44-10	PR308037	266657	10208A	GS069	10/8/2019 10:44	2079	1923	2586	No
44-10	PR308037	266657	10208A	GS070	10/8/2019 10:47	2292	1923	2586	No
44-10	PR308037	266657	10208A	GS070	10/8/2019 10:50	2025	1923	2586	No
44-10	PR363452	304726	10208A	GS043	10/8/2019 9:41	2551	2062	2748	No
44-10	PR363452	304726	10208A	GS044	10/8/2019 9:47	2388	2062	2748	No
44-10	PR363452	304726	10208A	GS045	10/8/2019 9:50	2448	2062	2748	No
44-10	PR363452	304726	10208A	GS046	10/8/2019 9:53	2649	2062	2748	No
44-10	PR363452	304726	10208A	GS047	10/8/2019 9:56	2615	2062	2748	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	10208A	GS048	10/8/2019 10:01	2612	2062	2748	No
44-10	PR363452	304726	10208A	GS049	10/8/2019 10:04	2549	2062	2748	No
44-10	PR363452	304726	10208A	GS050	10/8/2019 10:07	2581	2062	2748	No
44-10	PR363452	304726	10208A	GS051	10/8/2019 10:10	2470	2062	2748	No
44-10	PR363452	304726	10208A	GS052	10/8/2019 10:13	2576	2062	2748	No
44-10	PR363452	304726	10208A	GS053	10/8/2019 10:17	2522	2062	2748	No
44-10	PR363452	304726	10208A	GS054	10/8/2019 10:22	2665	2062	2748	No
44-10	PR363452	304726	10208A	GS055	10/8/2019 10:25	2640	2062	2748	No
44-10	PR363452	304726	10208A	GS056	10/8/2019 10:28	2528	2062	2748	No
44-10	PR372143	304712	10208A	GS071	10/8/2019 9:53	4897	4104	5072	No
44-10	PR372143	304712	10208A	GS071	10/8/2019 9:55	4774	4104	5072	No
44-10	PR372143	304712	10208A	GS072	10/8/2019 9:59	4444	4104	5072	No
44-10	PR372143	304712	10208A	GS072	10/8/2019 10:01	4758	4104	5072	No
44-10	PR372143	304712	10208A	GS073	10/8/2019 10:04	4803	4104	5072	No
44-10	PR372143	304712	10208A	GS073	10/8/2019 10:06	4948	4104	5072	No
44-10	PR372143	304712	10208A	GS074	10/8/2019 10:09	4598	4104	5072	No
44-10	PR372143	304712	10208A	GS074	10/8/2019 10:11	4574	4104	5072	No
44-10	PR372143	304712	10208A	GS075	10/8/2019 10:14	4777	4104	5072	No
44-10	PR372143	304712	10208A	GS075	10/8/2019 10:17	4339	4104	5072	No
44-10	PR372143	304712	10208A	GS076	10/8/2019 10:20	4533	4104	5072	No
44-10	PR372143	304712	10208A	GS076	10/8/2019 10:22	4512	4104	5072	No
44-10	PR372143	304712	10208A	GS077	10/8/2019 10:25	4722	4104	5072	No
44-10	PR372143	304712	10208A	GS077	10/8/2019 10:28	4676	4104	5072	No
44-10	PR372143	304712	10208A	GS078	10/8/2019 10:31	4375	4104	5072	No
44-10	PR372143	304712	10208A	GS078	10/8/2019 10:33	4435	4104	5072	No
44-10	PR372143	304712	10208A	GS079	10/8/2019 10:36	4670	4104	5072	No
44-10	PR372143	304712	10208A	GS079	10/8/2019 10:38	4464	4104	5072	No
44-10	PR372143	304712	10208A	GS080	10/8/2019 10:41	4389	4104	5072	No
44-10	PR372143	304712	10208A	GS080	10/8/2019 10:44	4445	4104	5072	No
44-10	PR372143	304712	10208A	GS081	10/8/2019 10:47	4854	4104	5072	No
44-10	PR372143	304712	10208A	GS081	10/8/2019 10:50	4315	4104	5072	No
44-10	PR372143	304712	10208A	GS082	10/8/2019 12:49	4506	4104	5072	No
44-10	PR372143	304712	10208A	GS082	10/8/2019 12:52	4453	4104	5072	No
44-10	PR372143	304712	10208A	GS083	10/8/2019 12:56	4919	4104	5072	No
44-10	PR372143	304712	10208A	GS083	10/8/2019 12:58	4448	4104	5072	No
44-10	PR372143	304712	10208A	GS084	10/8/2019 13:01	4506	4104	5072	No
44-10	PR372143	304712	10208A	GS084	10/8/2019 13:04	4412	4104	5072	No
44-10	PR321902	304711	10208A	GS009	10/8/2019 9:09	2949	2583	3352	No
44-10	PR321902	304711	10208A	GS010	10/8/2019 9:14	3228	2583	3352	No
44-10	PR321902	304711	10208A	GS011	10/8/2019 9:17	3262	2583	3352	No
44-10	PR321902	304711	10208A	GS012	10/8/2019 9:33	3152	2583	3352	No
44-10	PR321902	304711	10208A	GS013	10/8/2019 9:37	3315	2583	3352	No
44-10	PR321902	304711	10208A	GS014	10/8/2019 9:40	3191	2583	3352	No
44-10	PR321902	304711	10208A	GS014	10/8/2019 9:42	2895	2583	3352	No
44-10	PR321902	304711	10208A	GS015	10/8/2019 9:46	3192	2583	3352	No
44-10	PR321902	304711	10208A	GS015	10/8/2019 9:49	3297	2583	3352	No
44-10	PR321902	304711	10208A	GS016	10/8/2019 9:53	2970	2583	3352	No
44-10	PR321902	304711	10208A	GS016	10/8/2019 9:56	3349	2583	3352	No
44-10	PR321902	304711	10208A	GS017	10/8/2019 9:59	3118	2583	3352	No
44-10	PR321902	304711	10208A	GS017	10/8/2019 10:01	3213	2583	3352	No
44-10	PR321902	304711	10208A	GS018	10/8/2019 10:30	3293	2583	3352	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	10208A	GS018	10/8/2019 10:32	3240	2583	3352	No
44-10	PR321902	304711	10208A	GS019	10/8/2019 10:35	3175	2583	3352	No
44-10	PR321902	304711	10208A	GS019	10/8/2019 10:38	3175	2583	3352	No
44-10	PR321902	304711	10208A	GS020	10/8/2019 10:40	3183	2583	3352	No
44-10	PR321902	304711	10208A	GS020	10/8/2019 10:44	3296	2583	3352	No
44-10	PR321902	304711	10208A	GS021	10/8/2019 10:47	3129	2583	3352	No
44-10	PR321902	304711	10208A	GS021	10/8/2019 10:49	3230	2583	3352	No
44-10	PR321902	304711	10208A	GS022	10/8/2019 10:56	3348	2583	3352	No
44-10	PR321902	304711	10208A	GS022	10/8/2019 10:59	3041	2583	3352	No
44-10	PR321902	304711	10208A	GS023	10/8/2019 11:02	3227	2583	3352	No
44-10	PR321902	304711	10208A	GS023	10/8/2019 11:04	3222	2583	3352	No
44-10	PR321902	304711	10208A	GS024	10/8/2019 12:30	3005	2583	3352	No
44-10	PR321902	304711	10208A	GS024	10/8/2019 12:33	3005	2583	3352	No
44-10	PR321902	304711	10208A	CS025	10/8/2019 12:35	3011	2583	3352	No
44-10	PR321902	304711	10208A	CS025	10/8/2019 12:37	3296	2583	3352	No
44-10	PR321902	304711	10208A	GS026	10/8/2019 12:40	3049	2583	3352	No
44-10	PR321902	304711	10208A	GS026	10/8/2019 12:42	2881	2583	3352	No
44-10	PR321902	304711	10208A	GS027	10/8/2019 12:57	2913	2583	3352	No
44-10	PR321902	304711	10208A	GS028	10/8/2019 13:01	2982	2583	3352	No
44-10	PR321902	304711	10208A	GS029	10/8/2019 13:07	2820	2583	3352	No
44-10	PR321902	304711	10208A	GS027	10/8/2019 13:11	2231	1759	2393	No
44-10	PR321902	304711	10208A	GS027	10/8/2019 13:15	1858	1759	2393	No
44-10	PR321902	304711	10208A	GS028	10/8/2019 13:19	1841	1759	2393	No
44-10	PR321902	304711	10208A	GS028	10/8/2019 13:21	2037	1759	2393	No
44-10	PR321902	304711	10208A	GS029	10/8/2019 13:24	1954	1759	2393	No
44-10	PR321902	304711	10208A	GS029	10/8/2019 13:26	2109	1759	2393	No
44-10	PR321902	304711	10208A	GS008	10/9/2019 10:36	3396	2950	3771	No
44-10	PR363452	304726	10208A	GS043	10/16/2019 14:04	2990	2576	3343	No
44-10	PR363452	304726	10208A	GS044	10/16/2019 14:09	3054	2576	3343	No
44-10	PR363452	304726	10208A	GS045	10/16/2019 14:13	2777	2576	3343	No

ATTACHMENT 3

CONSULTATION TRIGGERS FOR RESIDENTIAL AND COMMERCIAL/INDUSTRIAL SOIL CONTAMINATION

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

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

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

ATTACHMENT 4
SIGN TEST

ZION SOLUTIONS LLC
An EnergySolutions Company

Attachment 12
Sign Statistical Test

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

Survey Area: No. 10200 **Description:** Radiological Restricted Area Grounds
Survey Unit: No. 10208A **Description:** South Warehouse Area
Classification: 1 **Type I (α) Error:** 0.05 **Number of Samples:** 21

#	Fraction of the Release Criterion					Activity or SOF (as applicable)	Weighted Sum (W_s)	1-W_s	Sign
	Radionuclides of Concern								
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90				
1	3.57E-02	9.81E-03	1.00E-02	7.68E-03	2.35E-05	SOF	0.063	0.937	+
2	2.06E-03	1.13E-02	0.00E+00	4.44E-04	0.00E+00	SOF	0.014	0.986	+
3	2.42E-02	1.97E-03	4.55E-03	5.21E-03	1.07E-05	SOF	0.036	0.964	+
4	2.18E-02	6.98E-03	1.76E-02	4.70E-03	4.12E-05	SOF	0.051	0.949	+
5	1.15E-02	0.00E+00	8.48E-03	2.49E-03	1.99E-05	SOF	0.023	0.977	+
6	4.46E-02	2.04E-02	5.10E-03	9.61E-03	1.20E-05	SOF	0.080	0.920	+
7	1.77E-03	1.02E-02	6.75E-03	3.81E-04	1.58E-05	SOF	0.019	0.981	+
8	0.00E+00	1.04E-02	7.99E-03	0.00E+00	1.87E-05	SOF	0.018	0.982	+
9	2.94E-02	0.00E+00	1.63E-02	6.33E-03	3.83E-05	SOF	0.052	0.948	+
10	3.17E-02	2.27E-02	8.29E-03	6.83E-03	1.95E-05	SOF	0.070	0.930	+
11	2.96E-02	0.00E+00	1.36E-02	6.37E-03	3.18E-05	SOF	0.050	0.950	+
12	1.66E-02	0.00E+00	0.00E+00	3.57E-03	0.00E+00	SOF	0.020	0.980	+
13	4.20E-02	4.03E-03	9.67E-03	9.04E-03	2.27E-05	SOF	0.065	0.935	+
14	4.40E-04	5.71E-03	3.91E-04	9.47E-05	9.18E-07	SOF	0.007	0.993	+
15	3.33E-02	2.59E-03	9.89E-03	7.16E-03	2.32E-05	SOF	0.053	0.947	+
16	2.02E-02	2.65E-03	6.25E-03	4.34E-03	1.47E-05	SOF	0.033	0.967	+
17	4.45E-02	2.83E-02	6.58E-03	9.59E-03	1.54E-05	SOF	0.089	0.911	+
18	2.66E-02	0.00E+00	1.25E-02	5.72E-03	2.93E-05	SOF	0.045	0.955	+
19	5.62E-02	2.53E-03	1.06E-02	1.21E-02	2.48E-05	SOF	0.081	0.919	+
20	1.75E-02	9.00E-04	2.00E-02	3.77E-03	4.68E-05	SOF	0.042	0.958	+
21	3.24E-02	0.00E+00	2.41E-02	6.99E-03	5.65E-05	SOF	0.064	0.936	+

Critical Value (Table I.3 of MARSSIM) = **14** Number of Positive Differences (S+) = **21**

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

Prepared By (RE): R. J. Mandis / (Signature) 1-10-20
(Print Name) (Date)

Peer Reviewed By (RE): G. Wood / G Wood 1-10-20
(Print Name) (Signature) (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #: 10200	Survey Unit # 10208A	Survey Unit Name: South Warehouse Area
Sample Plan#: L1-10208A-F		

Sample Description: Comparison of split samples collected from systematic surface soil sample locations #19 and #21. The samples were analyzed using gamma spectroscopy by on-site HPGe system. The standard/comparison samples were L1-10208A-FSGS-019SS/L1-10208A-FQGS-019SS and L1-10208A-FSGS-021SS/L1-10208A-FQGS-021SS.

	STANDARD				COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
Systematic Sample #19								
K-40	8.94E+00	6.11E-01	14.63	0.6-1.66	9.44E+00	6.20E-01	0.95	Y
Systematic Sample #21								
Cs-137	8.74E-02	1.62E-02	5.40	0.5-2.0	5.53E-02	1.61E-02	1.58	Y

Comments/Corrective Actions:
For systematic sample #19, the standard sample and QC sample did not both have positive results for a gamma emitting ROC greater than MDC, therefore K-40 was used in the QC comparison. There was acceptable agreement when using K-40. No further action is necessary.
For systematic sample #21, the standard sample and QC sample both had positive activity for Cs-137. There was acceptable agreement on the Cs-137 results for this sample.

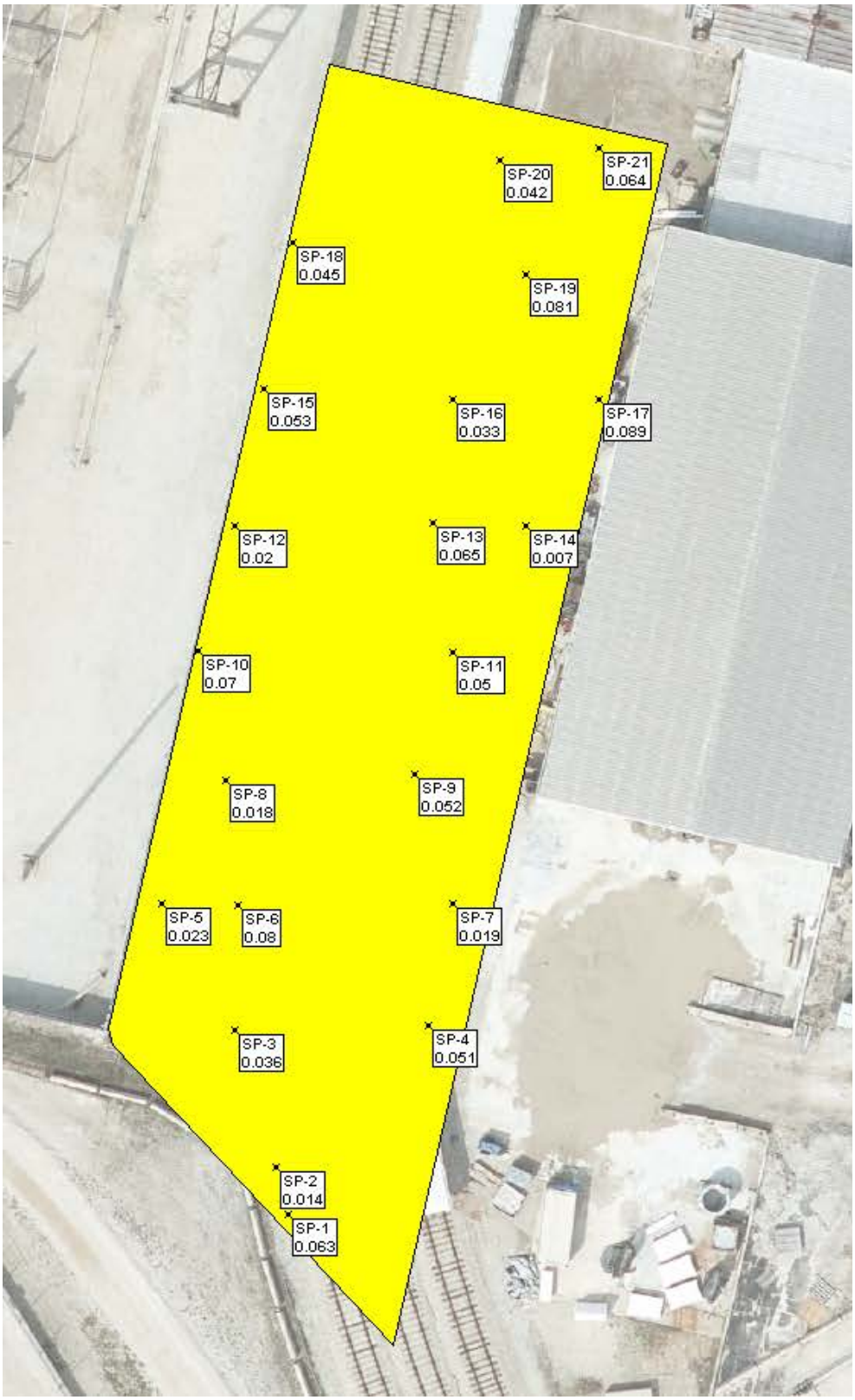
Table 4-1 from the QAPP is reproduced below to show acceptance criteria used to assess split samples.

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:
R.S. Mandia /	1-10-20	G.L. Woods /	1-10-20

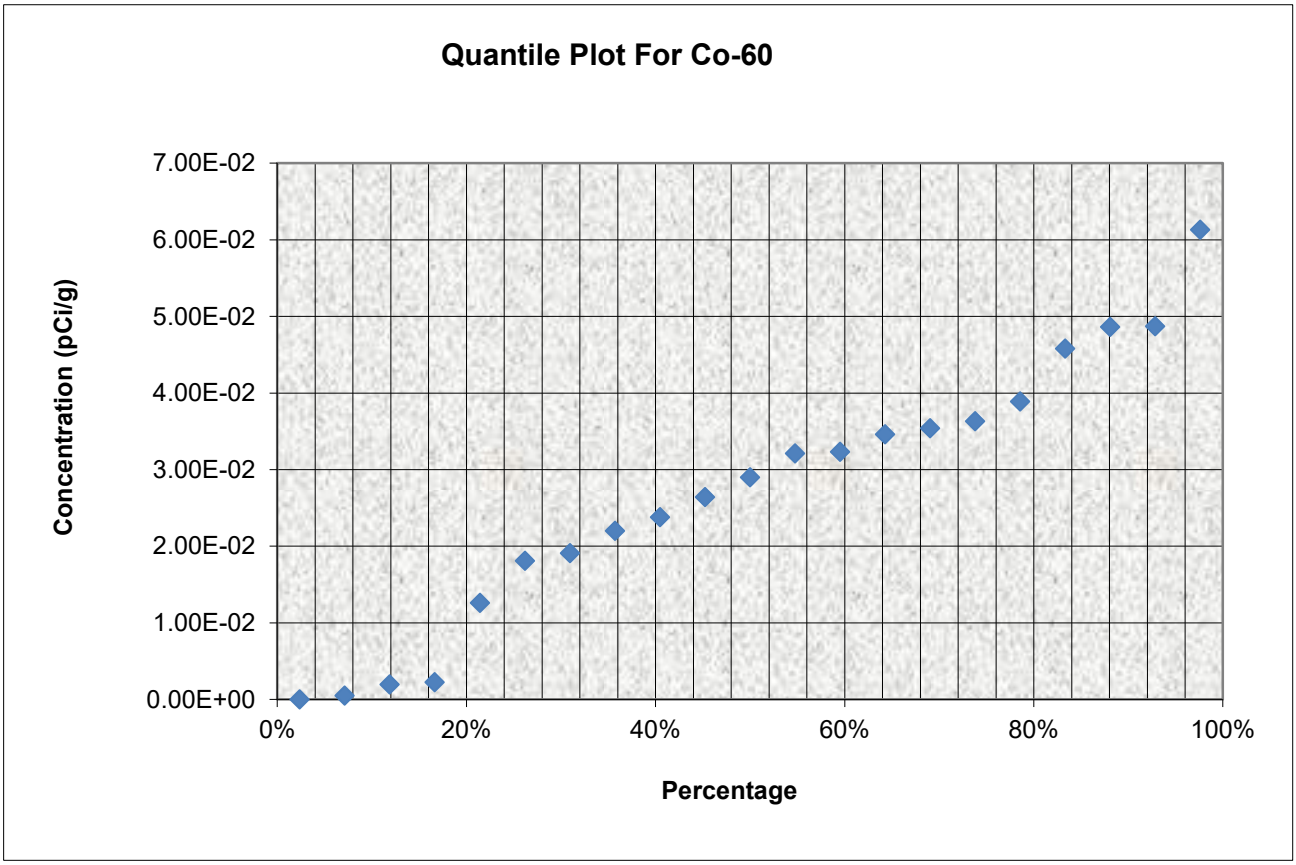
ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot



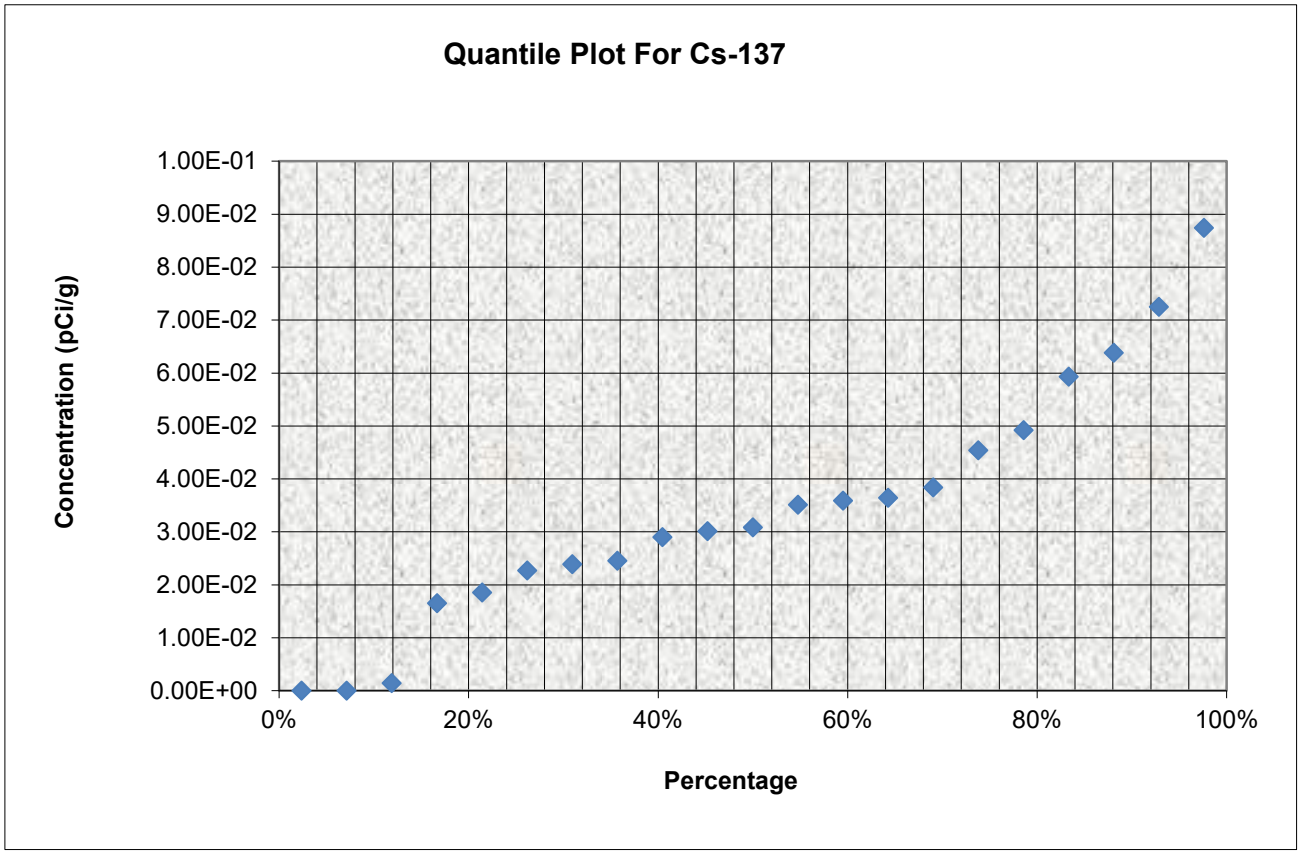
QUANTILE PLOT FOR Co-60

Survey Unit: 10208A
Survey Unit Name: South Warehouse Area
Mean: 2.71E-02 pCi/g



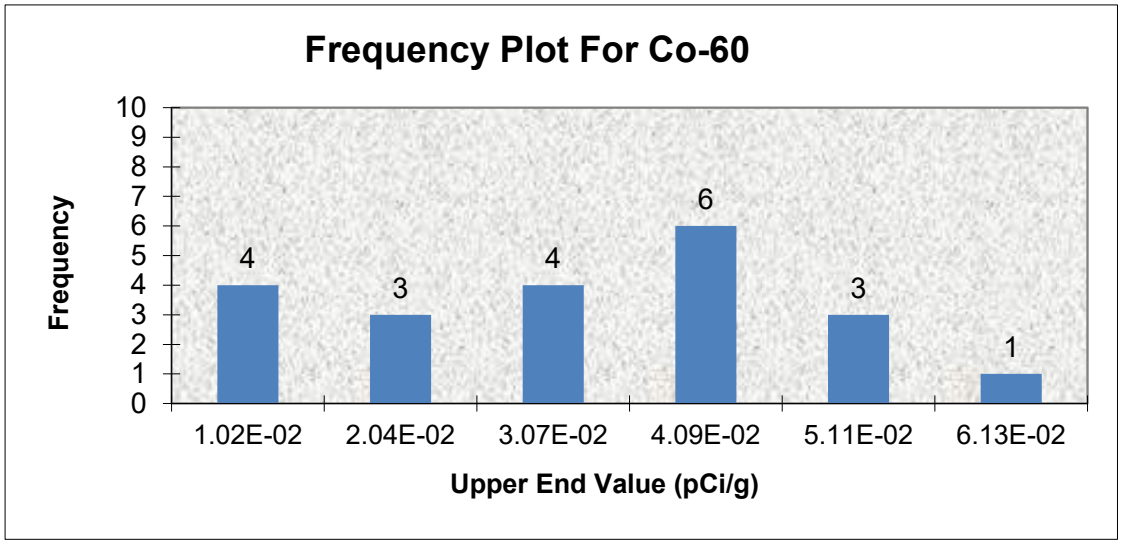
QUANTILE PLOT FOR Cs-137

Survey Unit: 10208A
Survey Unit Name: South Warehouse Area
Mean: 3.43E-02 pCi/g



HISTOGRAM FOR Co-60

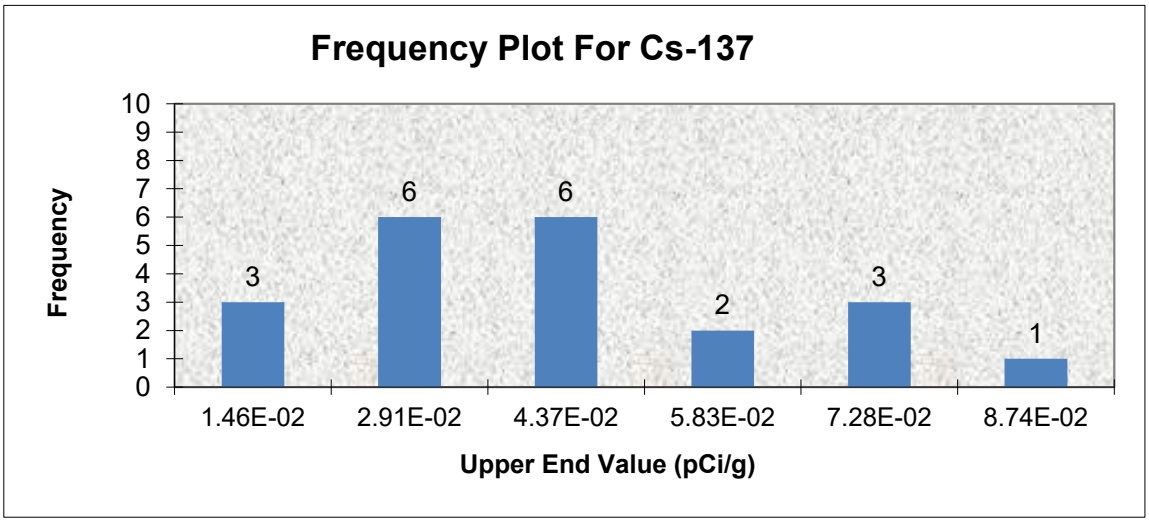
Survey Unit: 10208A
Survey Unit Name: South Warehouse Area
Mean: 2.71E-02 pCi/g
Median: 2.90E-02 pCi/g
ST DEV: 0.017
Skew: -0.051



Upper Value	Observation Frequency	Observation %
1.02E-02	4	19%
2.04E-02	3	14%
3.07E-02	4	19%
4.09E-02	6	29%
5.11E-02	3	14%
6.13E-02	1	5%
TOTAL	21	100%

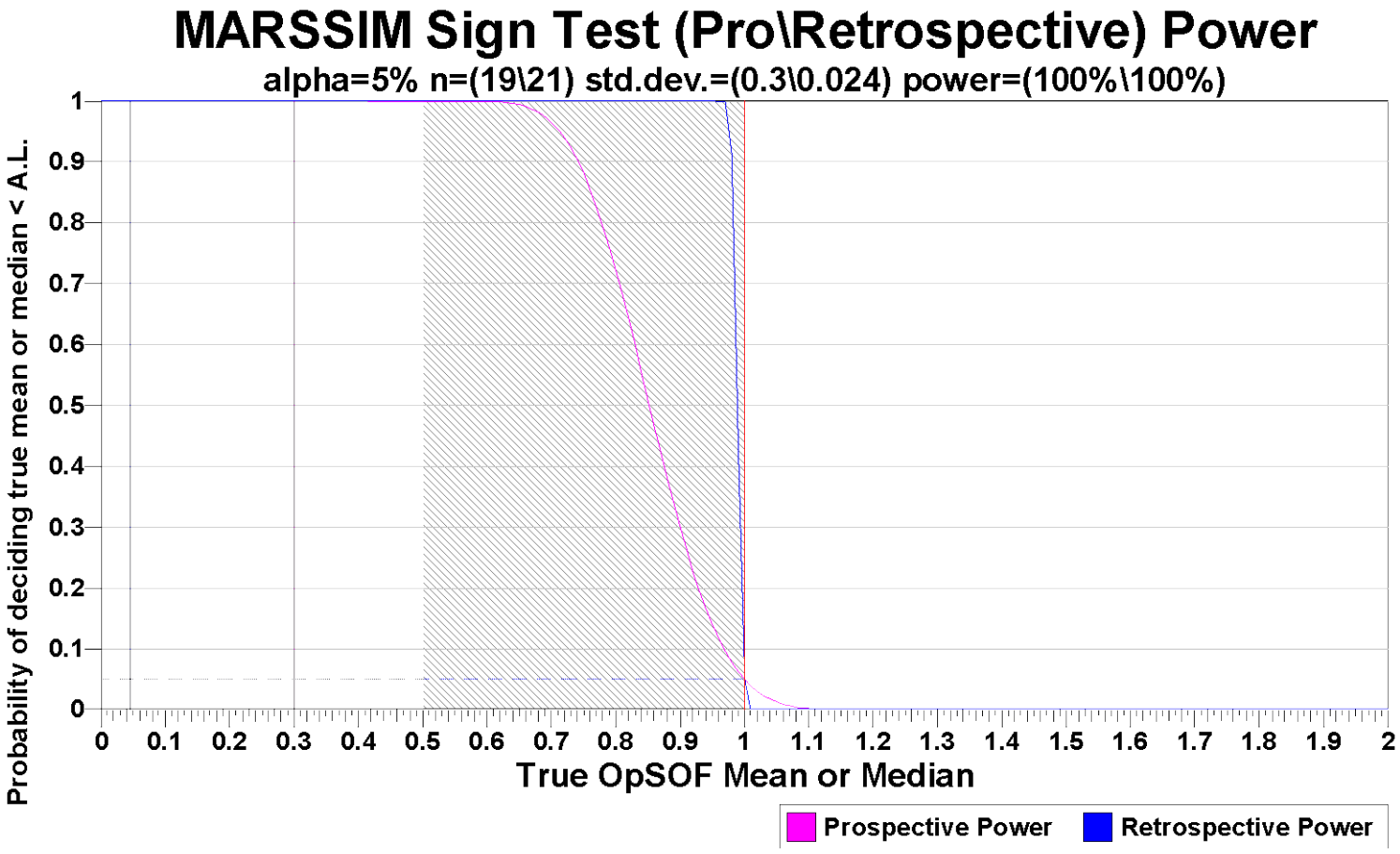
HISTOGRAM FOR Cs-137

Survey Unit: 10208A
Survey Unit Name: South Warehouse Area
Mean: 3.43E-02 pCi/g
Median: 3.08E-02 pCi/g
ST DEV: 0.023
Skew: 0.553



Upper Value	Observation Frequency	Observation %
1.46E-02	3	14%
2.91E-02	6	29%
4.37E-02	6	29%
5.83E-02	2	10%
7.28E-02	3	14%
8.74E-02	1	5%
TOTAL	21	100%

Prospective and Retrospective Power Curves for Survey Unit 10208A



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 10-Oct-19-10032

L1-10208A-FSGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10032
Sample Description	: L1-10208A-FSGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.485E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:00:00PM
Acquisition Started	: 10/10/2019 12:27:16PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80422
Fill Height	: 1484.75 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 12:42:19PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated

0830 10/10/19

Analysis Report for 10-Oct-19-10032

L1-10208A-FSGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.67	473 -	481	477.51	7.68E+01	16.59	9.12E+01	1.13
2	338.11	673 -	681	676.20	1.73E+01	8.60	2.57E+01	0.86
3	351.80	698 -	708	703.54	7.21E+01	11.98	2.99E+01	1.22
4	583.02	1160 -	1171	1165.63	4.45E+01	8.84	1.35E+01	1.17
5	609.27	1214 -	1223	1218.12	5.31E+01	9.22	1.39E+01	1.20
6	910.88	1817 -	1825	1821.22	2.80E+01	6.87	9.00E+00	0.89
7	968.76	1933 -	1942	1936.98	1.59E+01	7.40	1.71E+01	1.51
8	1460.66	2914 -	2928	2921.38	2.16E+02	14.70	0.00E+00	1.50

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	4.10E+00	3.31E-01
Tl-208	0.99	583.19	*	85.00	5.78E-02	1.20E-02
Bi-211	0.91	351.07	*	13.02	4.35E-01	8.02E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.08E-01	2.50E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.33E-01	2.43E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 10-Oct-19-10032

L1-10208A-FSGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.59E-01	2.93E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.17E-01	5.90E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.61E-01	4.00E-02
		964.77		4.99		
		968.97	*	15.80	1.55E-01	7.24E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10032

L1-10208A-FSGS-001SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.996	4.10E+00	3.31E-01	
	Tl-208	0.995	5.78E-02	1.20E-02	
?	Bi-211	0.919	4.35E-01	8.02E-02	
	Pb-212	1.000	1.08E-01	2.50E-02	
	Bi-214	1.000	1.33E-01	2.43E-02	
?	Pb-214	0.998	1.59E-01	2.93E-02	
	Ac-228	0.993	1.48E-01	3.01E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10032

L1-10208A-FSGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 12:42:19PM
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	5.79E-02	4.83E-02	4.83E-02
	BE-7	477.60		10.44	-8.63E-04	3.29E-01	3.29E-01
+	K-40	1460.82	*	10.66	4.10E+00	5.45E-02	5.45E-02
	Mn-54	834.85		99.98	2.42E-02	4.71E-02	4.71E-02
	Co-60	1173.23		99.85	3.89E-02	3.81E-02	5.79E-02
		1332.49		99.98	-7.88E-03		3.81E-02
	Nb-94	702.65		99.81	6.81E-03	2.80E-02	3.11E-02
		871.09		99.89	-2.42E-02		2.80E-02
	Ag-108m	79.13		6.60	3.23E-01	3.40E-02	1.07E+00
		433.94		90.50	-9.53E-03		3.40E-02
		614.28		89.80	-2.97E-03		4.46E-02
		722.94		90.80	1.15E-02		4.02E-02
	Sb-125	176.31		6.84	-2.57E-02	9.61E-02	4.34E-01
		380.45		1.52	-4.27E-01		1.86E+00
		427.87		29.60	-6.49E-02		9.61E-02
		463.36		10.49	3.74E-02		2.93E-01
		600.60		17.65	9.10E-02		2.07E-01
		606.71		4.98	-4.33E-01		1.05E+00
		635.95		11.22	1.24E-01		3.08E-01

Analysis Report for 10-Oct-19-10032

L1-10208A-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	5.40E-01	9.61E-02	1.97E+00
Ba-133	79.61	2.65	9.22E-01	6.27E-02	2.57E+00
	81.00	32.90	-1.07E-01		1.75E-01
	276.40	7.16	-6.24E-02		3.77E-01
	302.85	18.34	-1.58E-02		1.66E-01
	356.01	62.05	-2.79E-02		6.27E-02
	383.85	8.94	7.38E-02		3.53E-01
Cs-134	475.36	1.48	7.30E-01	4.26E-02	2.19E+00
	563.25	8.34	-5.90E-02		3.66E-01
	569.33	15.37	-3.71E-02		1.80E-01
	604.72	97.62	-2.28E-02		4.75E-02
	795.86	85.46	1.70E-02		4.26E-02
	801.95	8.69	-8.28E-02		3.90E-01
	1038.61	0.99	-1.48E-01		4.13E+00
	1167.97	1.79	-1.69E+00		2.70E+00
	1365.19	3.02	-9.04E-02		1.24E+00
Cs-137	661.66	85.10	3.64E-02	5.28E-02	5.28E-02
Eu-152	121.78	28.67	9.02E-04	1.03E-01	1.03E-01
	244.70	7.61	-9.01E-02		4.11E-01
	295.94	0.45	4.62E+00		8.05E+00
	344.28	26.60	2.88E-02		1.03E-01
	367.79	0.86	-2.56E+00		3.26E+00
	411.12	2.24	-1.72E-02		1.19E+00
	443.96	2.83	3.23E-01		1.10E+00
	488.68	0.42	1.83E+00		8.27E+00
	563.99	0.49	-3.47E+00		6.01E+00
	586.26	0.46	-1.54E+00		1.00E+01
	678.62	0.47	1.10E+00		6.94E+00
	688.67	0.86	-1.92E+00		3.49E+00
	719.35	0.28	-2.30E+00		1.00E+01
	778.90	12.96	8.19E-03		2.61E-01
	810.45	0.32	-1.81E+00		1.08E+01
	867.37	4.26	-2.14E-01		7.61E-01
	919.33	0.43	-1.27E+00		7.47E+00
	964.08	14.65	-2.12E-02		3.75E-01
	1085.87	10.24	1.25E-01		4.34E-01
	1089.74	1.73	-1.92E-01		2.38E+00
	1112.07	13.69	3.87E-02		2.99E-01
	1212.95	1.43	1.27E+00		3.22E+00
	1249.94	0.19	9.87E+00		2.57E+01
	1299.14	1.63	1.83E+00		2.96E+00
	1408.01	21.07	-2.51E-03		1.88E-01
	1457.64	0.50	-3.46E+00		2.96E+01
	1528.10	0.28	6.95E-01		9.25E+00
Eu-154	123.07	40.40	2.14E-02	7.55E-02	7.55E-02
	247.93	6.89	3.49E-01		4.47E-01
	591.76	4.95	-2.45E-01		6.16E-01
	692.42	1.78	-1.08E+00		1.87E+00
	723.30	20.06	8.74E-02		1.88E-01
	756.80	4.52	-4.70E-01		6.39E-01
	873.18	12.08	-4.25E-04		2.48E-01

Analysis Report for 10-Oct-19-10032

L1-10208A-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-9.38E-02	7.55E-02	3.39E-01
	1004.76	18.01	5.89E-03		1.77E-01
	1274.43	34.80	-6.28E-02		1.22E-01
	1596.48	1.80	-2.96E-01		1.76E+00
Eu-155	45.30	1.31	2.98E+00	1.58E-01	1.04E+01
	60.01	1.22	-5.07E+00		1.14E+01
	86.55	30.70	2.95E-03		1.61E-01
	105.31	21.10	-4.89E-02		1.58E-01
Ra-226	186.21	3.64	4.86E-01	9.49E-01	9.49E-01
Pa-231	27.36	10.30	4.08E-01	1.05E+00	1.05E+00
	283.69	1.70	-2.01E-01		1.68E+00
	300.07	2.47	-1.86E+00		1.17E+00
	302.65	2.20	-1.32E-01		1.38E+00
	330.06	1.40	-2.59E-01		2.25E+00
U-235	143.76	10.96	4.79E-02	5.88E-02	2.63E-01
	163.33	5.08	1.01E-01		5.89E-01
	185.71	57.20	6.13E-03		5.88E-02
	202.11	1.08	-8.11E-01		2.93E+00
	205.31	5.01	5.48E-02		6.27E-01
Am-241	59.54	35.90	-1.24E-01	4.00E-01	4.00E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10033

L1-10208A-FSGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10033
Sample Description	: L1-10208A-FSGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.533E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:02:00PM
Acquisition Started	: 10/10/2019 12:27:23PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.2 seconds
Dead Time	: 0.13 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80423
Fill Height	: 1533.43 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 12:42:27PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 10/4/19

Analysis Report for 10-Oct-19-10033

L1-10208A-FSGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.98	738 -	748	744.19	3.33E+01	11.00	3.57E+01	0.63
2	238.71	950 -	960	954.95	9.33E+01	14.83	5.27E+01	1.04
3	352.06	1403 -	1413	1407.99	3.86E+01	9.33	2.04E+01	0.61
4	583.18	2327 -	2336	2331.94	2.05E+01	8.43	2.25E+01	0.72
5	609.53	2430 -	2443	2437.31	3.05E+01	8.93	1.75E+01	0.63
6	911.22	3639 -	3650	3643.86	2.35E+01	6.99	9.50E+00	0.56
7	968.71	3868 -	3879	3873.81	1.90E+01	5.83	6.00E+00	0.53
8	1460.76	5833 -	5855	5842.88	2.23E+02	15.95	8.30E+00	1.89

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	5.55E+00	4.65E-01
Tl-208	1.00	583.19	*	85.00	3.42E-02	1.42E-02
Bi-211	0.85	351.07	*	13.02	2.96E-01	7.53E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.67E-01	2.97E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	9.80E-02	2.93E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 10-Oct-19-10033

L1-10208A-FSGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.08E-01	2.75E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	6.36E-01	2.16E-01
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.75E-01	5.26E-02
		964.77		4.99		
		968.97	*	15.80	2.41E-01	7.47E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.04E-02	1.37E-02
		202.11		1.08		
		205.31		5.01		

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

Analysis Report for 10-Oct-19-10033

L1-10208A-FSGS-002SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	5.55E+00	4.65E-01	
	Tl-208	1.000	3.42E-02	1.42E-02	
?	Bi-211	0.854	2.96E-01	7.53E-02	
	Pb-212	0.999	1.67E-01	2.97E-02	
	Bi-214	0.997	9.80E-02	2.93E-02	
?	Pb-214	0.998	1.08E-01	2.75E-02	
?	Ra-226	0.991	6.36E-01	2.16E-01	
	Ac-228	0.998	1.97E-01	4.30E-02	
?	U-235	0.992	4.04E-02	1.37E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10033

L1-10208A-FSGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 12:42:27PM
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	6.97E-02	5.71E-02	5.71E-02
	BE-7	477.60		10.44	1.46E-01	4.34E-01	4.34E-01
+	K-40	1460.82	*	10.66	5.55E+00	5.47E-01	5.47E-01
	Mn-54	834.85		99.98	1.96E-02	4.51E-02	4.51E-02
	Co-60	1173.23		99.85	-4.85E-02	4.65E-02	6.01E-02
		1332.49		99.98	2.25E-03		4.65E-02
	Nb-94	702.65		99.81	3.28E-02	3.76E-02	5.11E-02
		871.09		99.89	2.36E-03		3.76E-02
	Ag-108m	79.13		6.60	1.16E+00	4.09E-02	1.79E+00
		433.94		90.50	-5.69E-02		4.09E-02
		614.28		89.80	-1.32E-02		6.70E-02
		722.94		90.80	-4.35E-02		4.77E-02
	Sb-125	176.31		6.84	-1.07E-01	1.24E-01	5.30E-01
		380.45		1.52	5.77E-01		2.65E+00
		427.87		29.60	5.80E-02		1.24E-01
		463.36		10.49	1.80E-01		3.51E-01
		600.60		17.65	-5.91E-02		2.24E-01
		606.71		4.98	7.51E-01		1.22E+00
		635.95		11.22	-4.30E-02		3.61E-01

Analysis Report for 10-Oct-19-10033

L1-10208A-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.65E+00	1.24E-01	2.30E+00
Ba-133	79.61	2.65	1.91E+00	6.87E-02	4.21E+00
	81.00	32.90	-3.85E-01		2.82E-01
	276.40	7.16	-6.18E-02		4.78E-01
	302.85	18.34	6.43E-02		2.04E-01
	356.01	62.05	-2.44E-02		6.87E-02
	383.85	8.94	3.67E-03		4.41E-01
Cs-134	475.36	1.48	9.77E-01	5.23E-02	2.99E+00
	563.25	8.34	1.03E-01		4.77E-01
	569.33	15.37	-2.31E-02		2.44E-01
	604.72	97.62	-1.34E-02		5.23E-02
	795.86	85.46	1.95E-02		5.98E-02
	801.95	8.69	2.79E-01		5.35E-01
	1038.61	0.99	-6.80E-01		5.81E+00
	1167.97	1.79	1.45E+00		3.70E+00
	1365.19	3.02	-1.05E+00		1.69E+00
Cs-137	661.66	85.10	-3.32E-03	5.22E-02	5.22E-02
Eu-152	121.78	28.67	-1.72E-01	1.32E-01	1.32E-01
	244.70	7.61	-1.21E-01		5.01E-01
	295.94	0.45	-1.53E-01		9.54E+00
	344.28	26.60	-2.93E-02		1.35E-01
	367.79	0.86	-1.89E-01		4.27E+00
	411.12	2.24	-9.85E-02		1.80E+00
	443.96	2.83	-1.30E+00		1.47E+00
	488.68	0.42	-1.79E+00		8.84E+00
	563.99	0.49	-4.49E+00		7.72E+00
	586.26	0.46	1.01E+01		1.38E+01
	678.62	0.47	4.61E+00		8.79E+00
	688.67	0.86	7.55E-01		4.88E+00
	719.35	0.28	-1.45E+01		1.43E+01
	778.90	12.96	-2.47E-01		3.17E-01
	810.45	0.32	7.42E-01		1.22E+01
	867.37	4.26	-1.99E+00		8.78E-01
	919.33	0.43	-8.02E+00		9.97E+00
	964.08	14.65	1.72E-02		4.78E-01
	1085.87	10.24	-2.67E-01		5.36E-01
	1089.74	1.73	4.82E-01		3.11E+00
	1112.07	13.69	-1.52E-01		3.90E-01
	1212.95	1.43	-5.01E+00		4.82E+00
	1249.94	0.19	1.10E+01		3.60E+01
	1299.14	1.63	-2.02E+00		2.92E+00
	1408.01	21.07	1.72E-01		2.55E-01
	1457.64	0.50	1.23E+02		4.04E+01
	1528.10	0.28	-6.91E+00		1.09E+01
Eu-154	123.07	40.40	-7.28E-02	9.66E-02	9.66E-02
	247.93	6.89	2.18E-01		5.27E-01
	591.76	4.95	-3.27E-01		8.81E-01
	692.42	1.78	-4.26E-01		2.45E+00
	723.30	20.06	-1.31E-01		2.20E-01
	756.80	4.52	-3.41E-01		9.31E-01
	873.18	12.08	-1.62E-01		3.01E-01

Analysis Report for 10-Oct-19-10033

L1-10208A-FSGS-002SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-6.60E-02	9.66E-02	3.93E-01
		1004.76		18.01	1.84E-02		2.30E-01
		1274.43		34.80	3.21E-02		1.68E-01
		1596.48		1.80	-1.66E+00		1.98E+00
	Eu-155	45.30		1.31	-1.83E+01	2.44E-01	2.74E+01
		60.01		1.22	-1.77E+01		2.72E+01
		86.55		30.70	-1.32E-02		2.44E-01
		105.31		21.10	8.81E-02		2.70E-01
+	Ra-226	186.21	*	3.64	6.36E-01	6.61E-01	6.61E-01
	Pa-231	27.36		10.30	2.42E+00	1.52E+00	3.32E+00
		283.69		1.70	-6.19E-01		1.93E+00
		300.07		2.47	-9.37E-01		1.52E+00
		302.65		2.20	5.64E-02		1.67E+00
		330.06		1.40	2.73E-01		2.86E+00
+	U-235	143.76		10.96	-1.86E-01	4.20E-02	3.60E-01
		163.33		5.08	5.07E-02		7.58E-01
		185.71	*	57.20	4.04E-02		4.20E-02
		202.11		1.08	-1.57E+00		3.21E+00
		205.31		5.01	-2.10E-01		6.72E-01
	Am-241	59.54		35.90	-6.76E-01	9.71E-01	9.71E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10034

L1-10208A-FSGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10034
Sample Description	: L1-10208A-FSGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.527E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:04:00PM
Acquisition Started	: 10/10/2019 12:27:30PM
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80424
Fill Height	: 1526.66 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 12:42:40PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 10/11/19

Analysis Report for 10-Oct-19-10034

L1-10208A-FSGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.14	306 -	315	309.10	4.34E+01	12.40	4.86E+01	0.91
2	238.74	949 -	961	954.53	1.21E+02	17.19	6.47E+01	0.93
3	338.00	1347 -	1355	1351.10	1.69E+01	7.55	1.81E+01	0.48
4	582.93	2324 -	2338	2329.85	6.05E+01	8.03	1.54E+00	1.17
5	609.21	2429 -	2440	2434.86	2.77E+01	7.82	1.33E+01	0.32
6	1459.96	5827 -	5850	5837.76	2.43E+02	16.66	8.73E+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	0.88	1460.82	*	10.66	5.46E+00	4.43E-01
Tl-208	0.99	583.19	*	85.00	9.10E-02	1.33E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.93E-01	3.14E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	3.07E-01	9.32E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	8.04E-02	2.32E-02
		768.36		4.89		

Analysis Report for 10-Oct-19-10034

L1-10208A-FSGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	5.41E-01	1.66E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.31E-01	5.93E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10034

L1-10208A-FSGS-003SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.887	5.46E+00	4.43E-01	
	Tl-208	0.990	9.10E-02	1.33E-02	
	Pb-212	0.998	1.93E-01	3.14E-02	
?	Pb212-XR	1.000	3.07E-01	9.32E-02	
	Bi-214	0.999	8.04E-02	2.32E-02	
?	Pb214-XR	1.000	5.41E-01	1.66E-01	
	Ac-228	0.998	1.31E-01	5.93E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10034

L1-10208A-FSGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 12:42:40PM
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	7.84E-02	5.58E-02	5.58E-02
	BE-7	477.60		10.44	4.15E-01	3.72E-01	3.72E-01
+	K-40	1460.82	*	10.66	5.46E+00	5.11E-01	5.11E-01
	Mn-54	834.85		99.98	1.86E-02	4.56E-02	4.56E-02
	Co-60	1173.23		99.85	2.64E-02	4.66E-02	4.66E-02
		1332.49		99.98	5.02E-03		4.79E-02
	Nb-94	702.65		99.81	1.05E-02	3.69E-02	3.69E-02
		871.09		99.89	1.68E-02		3.71E-02
	Ag-108m	79.13		6.60	7.43E-02	3.45E-02	1.11E+00
		433.94		90.50	-2.86E-02		3.45E-02
		614.28		89.80	-6.36E-02		4.79E-02
		722.94		90.80	3.93E-02		5.10E-02
	Sb-125	176.31		6.84	1.77E-01	1.06E-01	4.15E-01
		380.45		1.52	4.42E-01		2.17E+00
		427.87		29.60	9.12E-03		1.06E-01
		463.36		10.49	-1.80E-01		3.08E-01
		600.60		17.65	9.26E-03		2.13E-01
		606.71		4.98	8.98E-01		1.10E+00
		635.95		11.22	7.30E-02		3.31E-01

Analysis Report for 10-Oct-19-10034

L1-10208A-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.79E-01	1.06E-01	2.00E+00
Ba-133	79.61	2.65	3.77E-01	6.43E-02	2.69E+00
	81.00	32.90	2.07E-02		1.78E-01
	276.40	7.16	2.44E-01		4.13E-01
	302.85	18.34	-8.14E-03		1.78E-01
	356.01	62.05	-2.51E-02		6.43E-02
	383.85	8.94	-1.35E-02		3.75E-01
Cs-134	475.36	1.48	7.38E-01	5.09E-02	2.53E+00
	563.25	8.34	-4.92E-01		4.57E-01
	569.33	15.37	1.11E-01		2.32E-01
	604.72	97.62	-3.08E-02		5.09E-02
	795.86	85.46	3.41E-03		5.24E-02
	801.95	8.69	1.97E-01		4.55E-01
	1038.61	0.99	-2.60E+00		4.56E+00
	1167.97	1.79	-6.66E-01		3.34E+00
	1365.19	3.02	-2.08E-01		1.36E+00
Cs-137	661.66	85.10	1.65E-02	4.78E-02	4.78E-02
Eu-152	121.78	28.67	2.78E-02	1.10E-01	1.10E-01
	244.70	7.61	2.73E-01		4.68E-01
	295.94	0.45	2.09E+00		7.86E+00
	344.28	26.60	-3.44E-02		1.17E-01
	367.79	0.86	1.54E+00		3.61E+00
	411.12	2.24	5.83E-01		1.59E+00
	443.96	2.83	1.79E-01		1.21E+00
	488.68	0.42	3.17E+00		8.74E+00
	563.99	0.49	-1.31E+01		6.96E+00
	586.26	0.46	-2.45E+00		1.22E+01
	678.62	0.47	-8.39E+00		6.64E+00
	688.67	0.86	-2.59E-01		4.48E+00
	719.35	0.28	-8.24E+00		1.32E+01
	778.90	12.96	-3.46E-02		3.34E-01
	810.45	0.32	5.61E-01		1.10E+01
	867.37	4.26	2.42E-01		8.44E-01
	919.33	0.43	1.84E+00		1.13E+01
	964.08	14.65	3.85E-01		4.27E-01
	1085.87	10.24	-7.02E-02		4.20E-01
	1089.74	1.73	-6.70E-01		2.12E+00
	1112.07	13.69	-2.10E-01		3.95E-01
	1212.95	1.43	-5.19E-01		4.35E+00
	1249.94	0.19	2.02E+01		2.99E+01
	1299.14	1.63	-2.01E+00		2.54E+00
	1408.01	21.07	8.84E-02		1.82E-01
	1457.64	0.50	1.23E+02		3.80E+01
	1528.10	0.28	-4.29E+00		1.10E+01
Eu-154	123.07	40.40	1.73E-02	7.97E-02	7.97E-02
	247.93	6.89	-3.34E-01		4.40E-01
	591.76	4.95	-1.56E-01		6.63E-01
	692.42	1.78	1.07E+00		2.10E+00
	723.30	20.06	2.54E-01		2.40E-01
	756.80	4.52	2.66E-01		8.04E-01
	873.18	12.08	-1.11E-02		3.07E-01

Analysis Report for 10-Oct-19-10034

L1-10208A-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-6.16E-02	7.97E-02	4.18E-01
	1004.76	18.01	1.52E-01		2.81E-01
	1274.43	34.80	1.96E-02		1.76E-01
	1596.48	1.80	8.56E-01		2.09E+00
Eu-155	45.30	1.31	8.39E+00	1.60E-01	1.19E+01
	60.01	1.22	-8.11E+00		9.71E+00
	86.55	30.70	4.60E-02		1.60E-01
	105.31	21.10	1.14E-01		1.82E-01
Ra-226	186.21	3.64	5.21E-01	8.80E-01	8.80E-01
Pa-231	27.36	10.30	8.75E-01	1.15E+00	1.15E+00
	283.69	1.70	3.08E-01		1.57E+00
	300.07	2.47	-1.06E+00		1.26E+00
	302.65	2.20	2.49E-01		1.49E+00
	330.06	1.40	4.71E-01		2.54E+00
U-235	143.76	10.96	3.41E-02	5.57E-02	2.69E-01
	163.33	5.08	-3.02E-01		5.50E-01
	185.71	57.20	2.10E-02		5.57E-02
	202.11	1.08	5.50E-02		2.66E+00
	205.31	5.01	-7.59E-01		5.23E-01
Am-241	59.54	35.90	-5.71E-02	3.59E-01	3.59E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10035

L1-10208A-FSGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10035
Sample Description	: L1-10208A-FSGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.233E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:06:00PM
Acquisition Started	: 10/10/2019 12:27:37PM
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80425
Fill Height	: 1233.04 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 12:42:48PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 10-11-19

Analysis Report for 10-Oct-19-10035

L1-10208A-FSGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.61	948 -	961	954.89	9.73E+01	16.19	5.97E+01	0.96
2	295.08	1173 -	1189	1180.53	6.83E+01	11.53	2.07E+01	1.62
3	338.31	1349 -	1359	1353.28	2.59E+01	7.76	1.41E+01	1.33
4	351.90	1401 -	1414	1407.61	7.87E+01	11.24	1.73E+01	1.23
5	583.08	2325 -	2337	2331.63	4.62E+01	8.49	9.77E+00	0.89
6	609.17	2429 -	2444	2435.94	5.90E+01	9.12	8.00E+00	0.73
7	911.24	3639 -	3650	3644.01	1.80E+01	7.52	1.50E+01	0.84
8	1460.60	5833 -	5853	5842.78	1.90E+02	14.96	9.59E+00	1.54

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	4.28E+00	3.84E-01
Tl-208	0.99	583.19	*	85.00	7.02E-02	1.36E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.60E-01	2.96E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.72E-01	2.86E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 10-Oct-19-10035

L1-10208A-FSGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.99E-01	5.58E-02
		351.93	*	35.60	2.02E-01	3.31E-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	2.04E-01	6.34E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.21E-01	5.10E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10035

L1-10208A-FSGS-004SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.992	4.28E+00	3.84E-01	
	Tl-208	0.998	7.02E-02	1.36E-02	
X	Bi-211	0.895			
	Pb-212	1.000	1.60E-01	2.96E-02	
	Bi-214	0.999	1.72E-01	2.86E-02	
	Pb-214	0.999	2.27E-01	2.85E-02	
	Ac-228	1.000	1.54E-01	3.97E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10035

L1-10208A-FSGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 12:42:48PM
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	7.92E-02	5.89E-02	5.89E-02
	BE-7	477.60		10.44	4.43E-02	3.88E-01	3.88E-01
+	K-40	1460.82	*	10.66	4.28E+00	5.04E-01	5.04E-01
	Mn-54	834.85		99.98	-3.06E-03	4.26E-02	4.26E-02
	Co-60	1173.23		99.85	2.38E-02	5.44E-02	6.18E-02
		1332.49		99.98	-2.57E-03		5.44E-02
	Nb-94	702.65		99.81	-7.32E-04	3.62E-02	3.72E-02
		871.09		99.89	-1.66E-02		3.62E-02
	Ag-108m	79.13		6.60	6.30E-01	3.45E-02	1.41E+00
		433.94		90.50	9.98E-04		3.45E-02
		614.28		89.80	8.80E-03		6.81E-02
		722.94		90.80	3.03E-02		5.51E-02
	Sb-125	176.31		6.84	2.24E-01	1.09E-01	4.92E-01
		380.45		1.52	9.73E-01		2.30E+00
		427.87		29.60	-6.98E-02		1.09E-01
		463.36		10.49	3.14E-02		3.58E-01
		600.60		17.65	1.61E-01		2.54E-01
		606.71		4.98	9.29E-01		1.28E+00
		635.95		11.22	-6.34E-02		3.76E-01

Analysis Report for 10-Oct-19-10035

L1-10208A-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.85E+00	1.09E-01	2.13E+00
Ba-133	79.61	2.65	1.92E+00	7.30E-02	3.40E+00
	81.00	32.90	-3.07E-01		2.32E-01
	276.40	7.16	5.03E-01		5.09E-01
	302.85	18.34	-2.49E-02		1.83E-01
	356.01	62.05	-3.59E-02		7.30E-02
	383.85	8.94	-3.53E-02		3.73E-01
Cs-134	475.36	1.48	-1.50E+00	5.42E-02	2.41E+00
	563.25	8.34	2.27E-02		3.84E-01
	569.33	15.37	-2.01E-02		2.34E-01
	604.72	97.62	-5.39E-03		6.39E-02
	795.86	85.46	1.21E-02		5.42E-02
	801.95	8.69	9.13E-02		4.67E-01
	1038.61	0.99	3.84E+00		4.67E+00
	1167.97	1.79	2.18E+00		3.39E+00
	1365.19	3.02	-4.03E-01		1.62E+00
Cs-137	661.66	85.10	6.38E-02	7.19E-02	7.19E-02
Eu-152	121.78	28.67	-4.42E-02	1.06E-01	1.28E-01
	244.70	7.61	4.35E-02		4.79E-01
	295.94	0.45	4.28E+00		9.88E+00
	344.28	26.60	-6.49E-02		1.06E-01
	367.79	0.86	2.83E+00		3.84E+00
	411.12	2.24	2.09E-02		1.66E+00
	443.96	2.83	5.35E-01		1.25E+00
	488.68	0.42	4.05E+00		8.85E+00
	563.99	0.49	-8.49E-01		6.65E+00
	586.26	0.46	6.93E+00		1.24E+01
	678.62	0.47	5.42E-01		7.20E+00
	688.67	0.86	4.87E+00		4.82E+00
	719.35	0.28	-2.96E+00		1.66E+01
	778.90	12.96	-4.10E-01		3.19E-01
	810.45	0.32	-6.18E-01		1.10E+01
	867.37	4.26	-7.63E-01		9.16E-01
	919.33	0.43	3.48E+00		1.14E+01
	964.08	14.65	3.90E-01		4.54E-01
	1085.87	10.24	8.11E-02		4.32E-01
	1089.74	1.73	-5.35E-01		2.87E+00
	1112.07	13.69	-2.86E-01		3.53E-01
	1212.95	1.43	2.20E+00		4.10E+00
	1249.94	0.19	1.05E+01		2.50E+01
	1299.14	1.63	1.65E-01		2.99E+00
	1408.01	21.07	3.04E-02		2.08E-01
	1457.64	0.50	9.41E+01		3.46E+01
	1528.10	0.28	-1.82E+00		1.37E+01
Eu-154	123.07	40.40	-4.55E-02	8.89E-02	8.89E-02
	247.93	6.89	-2.81E-01		4.66E-01
	591.76	4.95	4.61E-01		8.55E-01
	692.42	1.78	-8.00E-02		2.30E+00
	723.30	20.06	7.01E-02		2.41E-01
	756.80	4.52	1.19E-01		9.45E-01
	873.18	12.08	-5.66E-02		3.40E-01

Analysis Report for 10-Oct-19-10035

L1-10208A-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.13E-01	8.89E-02	4.82E-01
	1004.76	18.01	1.50E-01		2.91E-01
	1274.43	34.80	8.28E-02		1.48E-01
	1596.48	1.80	-1.27E+00		1.94E+00
Eu-155	45.30	1.31	-1.35E+00	2.00E-01	1.93E+01
	60.01	1.22	-1.46E+01		1.91E+01
	86.55	30.70	6.80E-02		2.19E-01
	105.31	21.10	-2.08E-01		2.00E-01
Ra-226	186.21	3.64	3.03E-01	9.97E-01	9.97E-01
Pa-231	27.36	10.30	1.95E+00	1.44E+00	2.30E+00
	283.69	1.70	-1.59E+00		1.74E+00
	300.07	2.47	8.39E-01		1.44E+00
	302.65	2.20	4.95E-01		1.54E+00
	330.06	1.40	2.68E-01		2.72E+00
U-235	143.76	10.96	-1.56E-01	6.22E-02	3.38E-01
	163.33	5.08	-3.41E-02		6.77E-01
	185.71	57.20	-3.23E-03		6.22E-02
	202.11	1.08	2.52E+00		3.42E+00
	205.31	5.01	-2.93E-01		7.13E-01
Am-241	59.54	35.90	-8.85E-02	6.89E-01	6.89E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10036
L1-10208A-FSGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10036
Sample Description	: L1-10208A-FSGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.338E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:08:00PM
Acquisition Started	: 10/10/2019 12:46:03PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80426
Fill Height	: 1337.50 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:01:06PM

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

Data Validated
0830 10/10/19

Analysis Report for 10-Oct-19-10036

L1-10208A-FSGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.66	473 -	481	477.50	1.53E+02	18.36	8.60E+01	1.17
2	351.83	698 -	708	703.60	9.93E+01	12.94	2.87E+01	1.32
3	583.21	1161 -	1170	1166.03	5.01E+01	9.15	1.49E+01	1.29
4	609.28	1212 -	1222	1218.15	6.56E+01	11.01	2.34E+01	1.53
5	911.18	1818 -	1827	1821.81	3.40E+01	7.97	1.30E+01	1.16
6	1460.59	2914 -	2928	2921.23	2.71E+02	16.79	3.75E+00	1.93

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	5.32E+00	4.02E-01
Tl-208	1.00	583.19	*	85.00	6.68E-02	1.29E-02
Bi-211	0.91	351.07	*	13.02	6.13E-01	9.40E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.20E-01	3.19E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.68E-01	3.00E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Oct-19-10036

L1-10208A-FSGS-005SS

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	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.24E-01	3.43E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.01E-01	4.79E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10036

L1-10208A-FSGS-005SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.991	5.32E+00	4.02E-01	
	Tl-208	1.000	6.68E-02	1.29E-02	
?	Bi-211	0.912	6.13E-01	9.40E-02	
	Pb-212	1.000	2.20E-01	3.19E-02	
	Bi-214	1.000	1.68E-01	3.00E-02	
?	Pb-214	0.512	2.24E-01	3.43E-02	
	Ac-228	1.000	2.01E-01	4.79E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10036

L1-10208A-FSGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:01:06PM
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	6.01E-02	4.76E-02	4.76E-02
	BE-7	477.60		10.44	1.55E-01	3.27E-01	3.27E-01
+	K-40	1460.82	*	10.66	5.32E+00	2.75E-01	2.75E-01
	Mn-54	834.85		99.98	1.12E-02	3.59E-02	3.59E-02
	Co-60	1173.23		99.85	1.26E-02	3.67E-02	5.24E-02
		1332.49		99.98	-1.84E-02		3.67E-02
	Nb-94	702.65		99.81	-1.21E-02	2.55E-02	3.39E-02
		871.09		99.89	-1.08E-02		2.55E-02
	Ag-108m	79.13		6.60	2.79E-01	3.53E-02	1.04E+00
		433.94		90.50	1.19E-02		3.53E-02
		614.28		89.80	-5.86E-02		5.11E-02
		722.94		90.80	1.80E-02		4.84E-02
	Sb-125	176.31		6.84	-5.44E-04	1.07E-01	4.65E-01
		380.45		1.52	6.66E-01		2.16E+00
		427.87		29.60	4.67E-02		1.07E-01
		463.36		10.49	-8.81E-03		3.08E-01
		600.60		17.65	-4.37E-02		1.88E-01
		606.71		4.98	6.09E-02		1.21E+00
		635.95		11.22	1.34E-02		2.88E-01

Analysis Report for 10-Oct-19-10036

L1-10208A-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.24E-01	1.07E-01	1.69E+00
Ba-133	79.61	2.65	-2.16E-01	6.33E-02	2.42E+00
	81.00	32.90	-1.88E-01		1.61E-01
	276.40	7.16	4.61E-02		4.64E-01
	302.85	18.34	2.01E-02		1.75E-01
	356.01	62.05	-3.25E-02		6.33E-02
	383.85	8.94	-7.53E-02		3.55E-01
Cs-134	475.36	1.48	1.09E+00	3.79E-02	2.35E+00
	563.25	8.34	4.30E-02		3.82E-01
	569.33	15.37	5.21E-02		2.18E-01
	604.72	97.62	-1.07E-02		5.26E-02
	795.86	85.46	-3.67E-03		3.79E-02
	801.95	8.69	7.67E-02		3.84E-01
	1038.61	0.99	7.98E-01		4.26E+00
	1167.97	1.79	7.81E-01		2.92E+00
	1365.19	3.02	-1.65E-02		9.65E-01
Cs-137	661.66	85.10	3.08E-02	5.08E-02	5.08E-02
Eu-152	121.78	28.67	5.33E-02	1.07E-01	1.07E-01
	244.70	7.61	-3.57E-04		4.15E-01
	295.94	0.45	5.10E+00		8.41E+00
	344.28	26.60	-8.14E-02		1.18E-01
	367.79	0.86	-6.59E-02		3.12E+00
	411.12	2.24	2.56E-01		1.45E+00
	443.96	2.83	5.90E-02		1.15E+00
	488.68	0.42	5.20E+00		8.06E+00
	563.99	0.49	2.15E+00		6.88E+00
	586.26	0.46	-5.97E+00		1.13E+01
	678.62	0.47	1.26E+00		6.32E+00
	688.67	0.86	2.36E+00		3.96E+00
	719.35	0.28	-2.34E+00		1.42E+01
	778.90	12.96	-1.24E-01		2.63E-01
	810.45	0.32	4.55E+00		1.11E+01
	867.37	4.26	-1.37E-01		6.24E-01
	919.33	0.43	-5.55E+00		7.91E+00
	964.08	14.65	-5.40E-03		3.42E-01
	1085.87	10.24	2.92E-02		4.86E-01
	1089.74	1.73	1.48E-01		2.80E+00
	1112.07	13.69	-1.24E-01		3.01E-01
	1212.95	1.43	5.07E-01		4.02E+00
	1249.94	0.19	-1.90E+00		2.35E+01
	1299.14	1.63	2.95E-02		2.81E+00
	1408.01	21.07	4.22E-02		1.88E-01
	1457.64	0.50	-1.24E+00		3.42E+01
	1528.10	0.28	1.60E+00		1.44E+01
Eu-154	123.07	40.40	1.62E-02	7.35E-02	7.35E-02
	247.93	6.89	-1.32E-02		4.05E-01
	591.76	4.95	-2.04E-02		6.75E-01
	692.42	1.78	-6.48E-02		1.78E+00
	723.30	20.06	1.01E-01		2.26E-01
	756.80	4.52	-3.60E-01		7.72E-01
	873.18	12.08	-4.10E-02		2.47E-01

Analysis Report for 10-Oct-19-10036

L1-10208A-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.10E-01	7.35E-02	4.22E-01
	1004.76	18.01	1.43E-01		2.38E-01
	1274.43	34.80	4.00E-03		1.23E-01
	1596.48	1.80	-1.14E-01		1.82E+00
Eu-155	45.30	1.31	3.88E+00	1.57E-01	1.06E+01
	60.01	1.22	1.68E+00		1.21E+01
	86.55	30.70	-1.89E-02		1.57E-01
	105.31	21.10	2.65E-02		1.70E-01
Ra-226	186.21	3.64	5.39E-01	9.92E-01	9.92E-01
Pa-231	27.36	10.30	4.57E-01	1.03E+00	1.03E+00
	283.69	1.70	-6.46E-02		1.71E+00
	300.07	2.47	-1.25E+00		1.27E+00
	302.65	2.20	1.68E-01		1.46E+00
	330.06	1.40	4.66E-03		2.34E+00
U-235	143.76	10.96	-1.33E-03	6.34E-02	2.58E-01
	163.33	5.08	-3.59E-01		6.21E-01
	185.71	57.20	3.88E-02		6.34E-02
	202.11	1.08	-1.55E-01		2.84E+00
	205.31	5.01	-3.54E-01		6.06E-01
Am-241	59.54	35.90	-2.18E-02	4.16E-01	4.16E-01

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

Analysis Report for 10-Oct-19-10037

L1-10208A-FSGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10037
Sample Description	: L1-10208A-FSGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.661E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:10:00PM
Acquisition Started	: 10/10/2019 12:46:09PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.2 seconds
Dead Time	: 0.13 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80427
Fill Height	: 1660.88 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:01:13PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 10/4/19

Analysis Report for 10-Oct-19-10037

L1-10208A-FSGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.77	949 -	960	955.17	1.11E+02	15.76	5.49E+01	0.74
2	295.25	1177 -	1186	1180.89	2.91E+01	8.98	2.19E+01	0.97
3	338.54	1349 -	1360	1353.94	3.24E+01	8.75	1.76E+01	0.53
4	351.95	1402 -	1412	1407.54	2.65E+01	9.61	2.75E+01	0.95
5	583.19	2326 -	2338	2331.97	4.82E+01	8.19	6.84E+00	0.94
6	609.32	2430 -	2443	2436.44	5.12E+01	8.53	7.75E+00	0.99
7	1460.91	5833 -	5854	5843.48	2.29E+02	15.45	2.59E+00	2.04

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	5.59E+00	4.48E-01
Tl-208	1.00	583.19	*	85.00	7.89E-02	1.42E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.96E-01	3.20E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.62E-01	2.86E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Oct-19-10037

L1-10208A-FSGS-006SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.36E-01	4.35E-02
		351.93	*	35.60	7.31E-02	2.71E-02
		785.96		1.06		
Ac-228	0.57	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.74E-01	7.74E-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 10-Oct-19-10037

L1-10208A-FSGS-006SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	5.59E+00	4.48E-01	
	Tl-208	1.000	7.89E-02	1.42E-02	
X	Bi-211	0.883			
	Pb-212	0.997	1.96E-01	3.20E-02	
	Bi-214	1.000	1.62E-01	2.86E-02	
	Pb-214	1.000	9.08E-02	2.30E-02	
	Ac-228	0.572	2.74E-01	7.74E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10037

L1-10208A-FSGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:01:13PM
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	4.01E-02	5.27E-02	5.27E-02
	BE-7	477.60		10.44	-5.82E-02	4.10E-01	4.10E-01
+	K-40	1460.82	*	10.66	5.59E+00	3.22E-01	3.22E-01
	Mn-54	834.85		99.98	1.74E-02	4.33E-02	4.33E-02
	Co-60	1173.23		99.85	4.87E-02	4.55E-02	6.79E-02
		1332.49		99.98	-9.04E-03		4.55E-02
	Nb-94	702.65		99.81	1.24E-02	4.03E-02	4.54E-02
		871.09		99.89	-1.19E-02		4.03E-02
	Ag-108m	79.13		6.60	3.62E-01	3.43E-02	1.74E+00
		433.94		90.50	-6.93E-03		3.43E-02
		614.28		89.80	-3.22E-02		5.86E-02
		722.94		90.80	-4.24E-02		5.61E-02
	Sb-125	176.31		6.84	1.32E-01	1.41E-01	5.87E-01
		380.45		1.52	-1.04E+00		2.35E+00
		427.87		29.60	8.50E-02		1.41E-01
		463.36		10.49	-9.65E-02		3.94E-01
		600.60		17.65	6.83E-02		2.74E-01
		606.71		4.98	2.31E+00		1.35E+00
		635.95		11.22	1.62E-01		3.35E-01

Analysis Report for 10-Oct-19-10037

L1-10208A-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	4.71E-01	1.41E-01	2.30E+00
Ba-133	79.61	2.65	7.29E-01	6.99E-02	4.10E+00
	81.00	32.90	-5.91E-02		2.83E-01
	276.40	7.16	-1.16E-01		4.87E-01
	302.85	18.34	1.81E-01		2.16E-01
	356.01	62.05	-5.60E-02		6.99E-02
	383.85	8.94	-8.95E-02		4.22E-01
Cs-134	475.36	1.48	-7.40E-01	5.60E-02	2.63E+00
	563.25	8.34	7.08E-02		4.62E-01
	569.33	15.37	-2.20E-02		2.60E-01
	604.72	97.62	-3.23E-02		6.22E-02
	795.86	85.46	3.53E-02		5.60E-02
	801.95	8.69	-6.05E-01		3.88E-01
	1038.61	0.99	1.80E+00		4.46E+00
	1167.97	1.79	-1.22E+00		3.78E+00
	1365.19	3.02	4.10E-01		1.11E+00
Cs-137	661.66	85.10	1.85E-02	5.12E-02	5.12E-02
Eu-152	121.78	28.67	1.32E-01	1.45E-01	1.65E-01
	244.70	7.61	4.80E-01		5.56E-01
	295.94	0.45	-7.23E-01		9.26E+00
	344.28	26.60	7.06E-02		1.45E-01
	367.79	0.86	-1.22E+00		4.03E+00
	411.12	2.24	-1.19E-01		1.63E+00
	443.96	2.83	-2.62E-01		1.26E+00
	488.68	0.42	4.49E+00		9.98E+00
	563.99	0.49	7.06E+00		8.08E+00
	586.26	0.46	-3.59E+00		1.35E+01
	678.62	0.47	4.66E+00		8.63E+00
	688.67	0.86	-2.51E+00		5.13E+00
	719.35	0.28	5.45E+00		1.70E+01
	778.90	12.96	1.19E-01		3.11E-01
	810.45	0.32	-1.99E+00		1.26E+01
	867.37	4.26	-2.78E-01		9.42E-01
	919.33	0.43	7.33E+00		1.12E+01
	964.08	14.65	6.20E-02		4.44E-01
	1085.87	10.24	3.28E-01		6.38E-01
	1089.74	1.73	1.79E+00		3.83E+00
	1112.07	13.69	1.97E-01		4.65E-01
	1212.95	1.43	-1.56E+00		4.44E+00
	1249.94	0.19	-3.38E+00		2.40E+01
	1299.14	1.63	-4.63E-02		3.49E+00
	1408.01	21.07	-6.90E-02		1.87E-01
	1457.64	0.50	1.16E+02		3.94E+01
	1528.10	0.28	-4.09E+00		1.49E+01
Eu-154	123.07	40.40	4.06E-02	1.12E-01	1.12E-01
	247.93	6.89	1.27E-01		5.40E-01
	591.76	4.95	2.09E-01		9.55E-01
	692.42	1.78	6.02E-01		2.64E+00
	723.30	20.06	-1.06E-01		2.58E-01
	756.80	4.52	-1.31E-01		8.54E-01
	873.18	12.08	-5.98E-02		3.68E-01

Analysis Report for 10-Oct-19-10037

L1-10208A-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.67E-01	1.12E-01	5.48E-01
	1004.76	18.01	-5.60E-02		2.95E-01
	1274.43	34.80	1.12E-01		1.75E-01
	1596.48	1.80	-7.20E-01		2.80E+00
Eu-155	45.30	1.31	3.98E+00	2.43E-01	3.14E+01
	60.01	1.22	-1.11E+00		2.99E+01
	86.55	30.70	7.87E-02		2.48E-01
	105.31	21.10	-2.09E-01		2.43E-01
Ra-226	186.21	3.64	1.31E+00	1.12E+00	1.12E+00
Pa-231	27.36	10.30	2.07E+00	1.55E+00	3.31E+00
	283.69	1.70	-6.25E-01		2.05E+00
	300.07	2.47	-2.65E-01		1.55E+00
	302.65	2.20	1.42E+00		1.81E+00
	330.06	1.40	-2.60E-01		2.88E+00
U-235	143.76	10.96	-3.00E-01	6.91E-02	3.55E-01
	163.33	5.08	2.10E-01		7.67E-01
	185.71	57.20	3.65E-02		6.91E-02
	202.11	1.08	1.06E+00		3.62E+00
	205.31	5.01	2.00E-01		7.53E-01
Am-241	59.54	35.90	5.19E-01	1.08E+00	1.08E+00

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

Apex-Gamma

Analysis Report for 10-Oct-19-10038
L1-10208A-FSGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10038
Sample Description	: L1-10208A-FSGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.728E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:12:00PM
Acquisition Started	: 10/10/2019 2:20:57PM
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80446
Fill Height	: 1728.10 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 2:36:00PM

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

Data Validated
0830 10-4179

Analysis Report for 10-Oct-19-10038

L1-10208A-FSGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	473 -	481	477.47	1.71E+02	21.39	1.32E+02	1.14
2	295.22	585 -	595	590.50	5.24E+01	14.31	6.16E+01	1.09
3	351.81	699 -	708	703.57	1.03E+02	14.06	4.21E+01	0.95
4	583.23	1161 -	1171	1166.06	5.91E+01	11.00	2.59E+01	1.31
5	609.04	1212 -	1223	1217.65	1.03E+02	12.18	1.79E+01	1.45
6	661.65	1317 -	1326	1322.83	1.80E+01	7.22	1.50E+01	1.18
7	911.17	1818 -	1826	1821.79	2.91E+01	8.77	2.19E+01	1.62
8	1120.15	2237 -	2243	2239.85	1.85E+01	6.20	1.05E+01	1.14
9	1460.59	2914 -	2928	2921.23	3.37E+02	18.91	7.32E+00	1.59

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.14E+00	4.36E-01
Cs-137	1.00	661.66	*	85.10	2.45E-02	9.96E-03
Tl-208	1.00	583.19	*	85.00	7.43E-02	1.45E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.35E-01	3.50E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.49E-01	3.30E-02
		768.36		4.89		

Analysis Report for 10-Oct-19-10038

L1-10208A-FSGS-007SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.02E-01	6.82E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.92E-01	5.47E-02
		351.93	*	35.60	2.21E-01	3.50E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.61E-01	4.91E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10038

L1-10208A-FSGS-007SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.991	6.14E+00	4.36E-01	
	Cs-137	1.000	2.45E-02	9.96E-03	
	Tl-208	1.000	7.43E-02	1.45E-02	
X	Bi-211	0.916			
	Pb-212	1.000	2.35E-01	3.50E-02	
	Bi-214	0.994	2.40E-01	2.97E-02	
	Pb-214	0.999	2.12E-01	2.95E-02	
	Ac-228	1.000	1.61E-01	4.91E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10038

L1-10208A-FSGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 2:36:00PM
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	7.28E-02	4.95E-02	4.95E-02
	BE-7	477.60		10.44	1.86E-02	2.99E-01	2.99E-01
+	K-40	1460.82	*	10.66	6.14E+00	3.34E-01	3.34E-01
	Mn-54	834.85		99.98	2.23E-02	4.12E-02	4.12E-02
	Co-60	1173.23		99.85	1.93E-03	3.54E-02	4.96E-02
		1332.49		99.98	-2.95E-03		3.54E-02
	Nb-94	702.65		99.81	1.44E-02	3.86E-02	4.37E-02
		871.09		99.89	-1.55E-03		3.86E-02
	Ag-108m	79.13		6.60	7.13E-01	3.34E-02	1.18E+00
		433.94		90.50	1.28E-03		3.34E-02
		614.28		89.80	-3.37E-02		5.19E-02
		722.94		90.80	-1.41E-02		4.60E-02
	Sb-125	176.31		6.84	-5.03E-02	1.11E-01	4.90E-01
		380.45		1.52	3.69E-01		2.38E+00
		427.87		29.60	2.16E-02		1.11E-01
		463.36		10.49	5.38E-04		3.32E-01
		600.60		17.65	-1.59E-01		1.63E-01
		606.71		4.98	1.91E-02		1.26E+00
		635.95		11.22	-8.80E-02		3.03E-01

Analysis Report for 10-Oct-19-10038

L1-10208A-FSGS-007SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-1.15E+00	1.11E-01	1.76E+00
	Ba-133	79.61		2.65	2.45E-01	7.07E-02	2.72E+00
		81.00		32.90	-2.65E-01		1.84E-01
		276.40		7.16	2.03E-01		4.24E-01
		302.85		18.34	-4.62E-02		1.67E-01
		356.01		62.05	-1.95E-02		7.07E-02
		383.85		8.94	1.50E-01		3.85E-01
	Cs-134	475.36		1.48	-2.78E-01	4.33E-02	1.96E+00
		563.25		8.34	-4.85E-02		3.71E-01
		569.33		15.37	-1.35E-01		1.97E-01
		604.72		97.62	-5.34E-03		5.60E-02
		795.86		85.46	1.76E-02		4.33E-02
		801.95		8.69	2.59E-02		3.92E-01
		1038.61		0.99	2.20E-01		3.82E+00
		1167.97		1.79	-3.87E-01		2.60E+00
		1365.19		3.02	8.32E-01		1.49E+00
+	Cs-137	661.66	*	85.10	2.45E-02	3.10E-02	3.10E-02
	Eu-152	121.78		28.67	5.50E-02	1.13E-01	1.19E-01
		244.70		7.61	6.83E-02		4.94E-01
		295.94		0.45	-6.10E-01		8.61E+00
		344.28		26.60	-6.84E-02		1.13E-01
		367.79		0.86	-8.25E-01		3.63E+00
		411.12		2.24	-4.01E-02		1.37E+00
		443.96		2.83	-1.80E-01		1.02E+00
		488.68		0.42	-4.08E+00		7.26E+00
		563.99		0.49	-1.47E+00		6.39E+00
		586.26		0.46	-4.21E-01		1.19E+01
		678.62		0.47	-6.69E-01		8.31E+00
		688.67		0.86	5.59E-02		4.10E+00
		719.35		0.28	9.66E-01		1.28E+01
		778.90		12.96	-1.13E-01		3.07E-01
		810.45		0.32	-1.31E+00		1.07E+01
		867.37		4.26	8.11E-02		9.46E-01
		919.33		0.43	-4.50E-01		1.02E+01
		964.08		14.65	1.16E-01		4.23E-01
		1085.87		10.24	-1.98E-01		4.41E-01
		1089.74		1.73	3.84E-01		2.74E+00
		1112.07		13.69	-3.37E-02		3.24E-01
		1212.95		1.43	-1.27E-01		3.55E+00
		1249.94		0.19	5.26E+00		2.77E+01
		1299.14		1.63	1.46E+00		3.30E+00
		1408.01		21.07	6.73E-02		2.18E-01
		1457.64		0.50	-3.86E-01		3.56E+01
		1528.10		0.28	1.78E-01		7.97E+00
	Eu-154	123.07		40.40	2.10E-02	8.17E-02	8.17E-02
		247.93		6.89	-1.36E-01		4.48E-01
		591.76		4.95	1.44E-01		7.33E-01
		692.42		1.78	-5.38E-01		1.96E+00
		723.30		20.06	1.01E-01		2.28E-01
		756.80		4.52	-1.16E-01		8.41E-01
		873.18		12.08	-5.81E-02		3.19E-01

Analysis Report for 10-Oct-19-10038

L1-10208A-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.14E-02	8.17E-02	3.81E-01
	1004.76	18.01	-1.42E-02		2.35E-01
	1274.43	34.80	6.68E-03		1.21E-01
	1596.48	1.80	-3.58E-01		1.57E+00
Eu-155	45.30	1.31	2.70E+00	1.77E-01	1.14E+01
	60.01	1.22	-9.05E+00		1.21E+01
	86.55	30.70	3.51E-02		1.77E-01
	105.31	21.10	-1.02E-02		1.85E-01
Ra-226	186.21	3.64	9.06E-01	1.01E+00	1.01E+00
Pa-231	27.36	10.30	9.07E-01	1.30E+00	1.30E+00
	283.69	1.70	-4.96E-01		1.53E+00
	300.07	2.47	5.56E-01		1.35E+00
	302.65	2.20	-3.85E-01		1.39E+00
	330.06	1.40	7.73E-01		2.44E+00
U-235	143.76	10.96	6.12E-02	6.42E-02	2.84E-01
	163.33	5.08	3.33E-01		7.04E-01
	185.71	57.20	4.91E-02		6.42E-02
	202.11	1.08	1.35E+00		3.23E+00
	205.31	5.01	-2.75E-01		6.49E-01
Am-241	59.54	35.90	-2.40E-01	4.17E-01	4.17E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10039
L1-10208A-FSGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10039
Sample Description	: L1-10208A-FSGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.550E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:14:00PM
Acquisition Started	: 10/10/2019 12:46:23PM
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80429
Fill Height	: 1550.27 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:01:34PM

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

Data Validated
0830 10-11-19

Analysis Report for 10-Oct-19-10039

L1-10208A-FSGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.56	948 -	962	954.72	1.52E+02	16.83	4.42E+01	0.88
2	295.19	1176 -	1186	1180.98	3.90E+01	8.64	1.50E+01	0.75
3	351.72	1400 -	1413	1406.86	5.41E+01	10.86	2.29E+01	1.29
4	583.15	2324 -	2338	2331.93	6.05E+01	9.07	7.49E+00	1.49
5	609.25	2431 -	2444	2436.26	3.76E+01	7.85	8.41E+00	1.01
6	969.20	3870 -	3881	3875.87	1.76E+01	6.61	1.04E+01	0.38
7	1460.68	5830 -	5855	5843.08	2.81E+02	17.13	3.08E+00	1.49

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	5.86E+00	4.39E-01
Tl-208	1.00	583.19	*	85.00	8.63E-02	1.39E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.37E-01	3.25E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.03E-01	2.24E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Oct-19-10039

L1-10208A-FSGS-008SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.62E-01	3.81E-02
		351.93	*	35.60	1.31E-01	2.84E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97	*	15.80	1.88E-01	7.12E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10039

L1-10208A-FSGS-008SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	5.86E+00	4.39E-01	
	Tl-208	1.000	8.63E-02	1.39E-02	
X	Bi-211	0.935			
	Pb-212	0.999	2.37E-01	3.25E-02	
	Bi-214	1.000	1.03E-01	2.24E-02	
	Pb-214	0.996	1.42E-01	2.28E-02	
	Ac-228	0.998	1.88E-01	7.12E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10039

L1-10208A-FSGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:01:34PM
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	6.19E-02	5.22E-02	5.22E-02
	BE-7	477.60		10.44	-6.59E-02	3.13E-01	3.13E-01
+	K-40	1460.82	*	10.66	5.86E+00	3.11E-01	3.11E-01
	Mn-54	834.85		99.98	1.83E-02	4.87E-02	4.87E-02
	Co-60	1173.23		99.85	-4.79E-04	4.83E-02	6.44E-02
		1332.49		99.98	-3.78E-02		4.83E-02
	Nb-94	702.65		99.81	-8.06E-03	3.38E-02	3.62E-02
		871.09		99.89	-1.86E-02		3.38E-02
	Ag-108m	79.13		6.60	-6.09E-01	3.49E-02	1.38E+00
		433.94		90.50	-1.30E-02		3.49E-02
		614.28		89.80	-3.14E-02		5.37E-02
		722.94		90.80	4.36E-02		5.33E-02
	Sb-125	176.31		6.84	1.29E-01	1.12E-01	4.29E-01
		380.45		1.52	1.02E+00		2.30E+00
		427.87		29.60	-2.67E-02		1.12E-01
		463.36		10.49	1.19E-01		3.52E-01
		600.60		17.65	-2.45E-02		2.38E-01
		606.71		4.98	6.82E-01		1.08E+00
		635.95		11.22	-5.60E-02		3.44E-01

Analysis Report for 10-Oct-19-10039

L1-10208A-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-8.64E-01	1.12E-01	2.26E+00
Ba-133	79.61	2.65	-1.12E-01	6.54E-02	3.41E+00
	81.00	32.90	-3.94E-01		2.26E-01
	276.40	7.16	1.91E-01		4.55E-01
	302.85	18.34	9.67E-02		1.76E-01
	356.01	62.05	-7.38E-03		6.54E-02
	383.85	8.94	-9.79E-02		3.53E-01
Cs-134	475.36	1.48	4.02E-01	4.92E-02	2.21E+00
	563.25	8.34	2.86E-01		3.82E-01
	569.33	15.37	1.73E-02		2.01E-01
	604.72	97.62	-2.80E-02		5.44E-02
	795.86	85.46	1.80E-02		4.92E-02
	801.95	8.69	-2.53E-01		4.28E-01
	1038.61	0.99	6.10E-02		4.54E+00
	1167.97	1.79	-5.60E-01		3.38E+00
	1365.19	3.02	9.70E-01		1.75E+00
Cs-137	661.66	85.10	2.90E-02	4.51E-02	4.51E-02
Eu-152	121.78	28.67	-3.15E-02	1.07E-01	1.19E-01
	244.70	7.61	4.18E-02		4.57E-01
	295.94	0.45	5.17E+00		8.69E+00
	344.28	26.60	-6.48E-02		1.07E-01
	367.79	0.86	1.04E+00		3.19E+00
	411.12	2.24	1.12E-01		1.52E+00
	443.96	2.83	2.06E-01		1.12E+00
	488.68	0.42	3.82E+00		8.63E+00
	563.99	0.49	3.32E+00		6.37E+00
	586.26	0.46	-3.89E+00		1.29E+01
	678.62	0.47	2.98E+00		8.64E+00
	688.67	0.86	1.02E+00		4.52E+00
	719.35	0.28	-4.77E+00		1.45E+01
	778.90	12.96	-1.82E-01		3.30E-01
	810.45	0.32	1.99E+00		1.03E+01
	867.37	4.26	2.59E-01		8.97E-01
	919.33	0.43	-1.51E+01		8.88E+00
	964.08	14.65	1.54E-01		4.78E-01
	1085.87	10.24	-4.29E-01		4.60E-01
	1089.74	1.73	5.27E-02		2.93E+00
	1112.07	13.69	-3.09E-02		3.94E-01
	1212.95	1.43	-1.19E+00		3.68E+00
	1249.94	0.19	2.18E+00		2.93E+01
	1299.14	1.63	-4.31E-01		2.92E+00
	1408.01	21.07	-1.49E-01		2.14E-01
	1457.64	0.50	1.17E+02		3.72E+01
	1528.10	0.28	-6.73E+00		1.27E+01
Eu-154	123.07	40.40	-1.76E-02	8.60E-02	8.60E-02
	247.93	6.89	-1.08E-01		4.28E-01
	591.76	4.95	-2.58E-01		7.83E-01
	692.42	1.78	4.20E-01		2.16E+00
	723.30	20.06	1.25E-01		2.44E-01
	756.80	4.52	1.87E-01		9.41E-01
	873.18	12.08	-3.15E-01		2.55E-01

Analysis Report for 10-Oct-19-10039

L1-10208A-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-7.54E-03	8.60E-02	4.34E-01
	1004.76	18.01	1.46E-02		2.63E-01
	1274.43	34.80	3.88E-02		1.44E-01
	1596.48	1.80	-1.22E+00		1.94E+00
Eu-155	45.30	1.31	7.18E+00	1.92E-01	2.00E+01
	60.01	1.22	1.17E+01		2.00E+01
	86.55	30.70	-1.66E-01		1.92E-01
	105.31	21.10	-1.30E-01		2.13E-01
Ra-226	186.21	3.64	4.58E-01	9.40E-01	9.40E-01
Pa-231	27.36	10.30	1.36E+00	1.33E+00	1.90E+00
	283.69	1.70	7.22E-01		1.82E+00
	300.07	2.47	4.27E-01		1.33E+00
	302.65	2.20	4.19E-01		1.45E+00
	330.06	1.40	8.17E-01		2.40E+00
U-235	143.76	10.96	-7.44E-02	5.99E-02	3.29E-01
	163.33	5.08	3.79E-01		6.38E-01
	185.71	57.20	2.68E-02		5.99E-02
	202.11	1.08	9.64E-02		3.06E+00
	205.31	5.01	-5.84E-01		6.37E-01
Am-241	59.54	35.90	8.18E-02	7.06E-01	7.06E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10040
L1-10208A-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10040
Sample Description	: L1-10208A-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.350E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:16:00PM
Acquisition Started	: 10/10/2019 1:04:48PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1800.6 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80430
Fill Height	: 1349.62 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:40:09PM

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

Data Validated
0830 10-11-19

Analysis Report for 10-Oct-19-10040

L1-10208A-FSGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.20	151 -	158	155.00	6.55E+01	23.06	2.27E+02	0.76
2	238.66	473 -	481	477.51	2.61E+02	24.91	1.66E+02	1.33
3	295.18	587 -	594	590.42	4.66E+01	15.62	9.84E+01	1.05
4	351.81	699 -	708	703.56	8.37E+01	16.68	8.63E+01	1.18
5	477.74	949 -	958	955.22	4.95E+01	12.28	4.45E+01	1.09
6	583.19	1160 -	1171	1165.99	1.17E+02	14.74	3.98E+01	1.51
7	609.20	1213 -	1223	1217.98	1.09E+02	13.43	3.01E+01	1.58
8	661.62	1319 -	1328	1322.77	8.21E+01	11.92	2.59E+01	1.57
9	910.90	1816 -	1827	1821.24	7.19E+01	12.41	3.21E+01	1.05
10	969.17	1933 -	1941	1937.80	3.26E+01	9.62	2.74E+01	1.45
11	1172.69	2340 -	2351	2344.99	4.31E+01	11.65	3.69E+01	1.33
12	1332.53	2660 -	2668	2664.87	2.94E+01	7.94	1.56E+01	1.56
13	1460.73	2914 -	2927	2921.52	5.66E+02	24.59	1.40E+01	1.64

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	2.42E-01	6.23E-02
K-40	0.99	1460.82	*	10.66	5.53E+00	3.40E-01
Co-60	0.97	1173.23	*	99.85	3.87E-02	1.06E-02
		1332.49	*	99.98	2.86E-02	7.81E-03

Analysis Report for 10-Oct-19-10040

L1-10208A-FSGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Cs-137	1.00	661.66	*	85.10	5.93E-02	9.33E-03
Tl-208	1.00	583.19	*	85.00	7.80E-02	1.09E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.88E-01	2.35E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.16E-01	7.94E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.39E-01	1.91E-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	8.96E-02	3.09E-02
		351.93	*	35.60	9.43E-02	2.03E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	3.82E-01	1.41E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.12E-01	3.77E-02
		964.77		4.99		
		968.97	*	15.80	1.63E-01	4.88E-02
		1588.20		3.22		

Analysis Report for 10-Oct-19-10040

L1-10208A-FSGS-009SS

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.997	2.42E-01	6.23E-02	
	K-40	0.999	5.53E+00	3.40E-01	
	Co-60	0.977	3.21E-02	6.29E-03	
	Cs-137	1.000	5.93E-02	9.33E-03	
	Tl-208	1.000	7.80E-02	1.09E-02	
X	Bi-211	0.917			
	Pb-212	1.000	1.88E-01	2.35E-02	
?	Pb212-XR	0.999	2.16E-01	7.94E-02	
	Bi-214	0.999	1.39E-01	1.91E-02	
	Pb-214	0.998	9.29E-02	1.69E-02	
?	Pb214-XR	0.999	3.82E-01	1.41E-01	
	Ac-228	0.994	1.94E-01	2.98E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10040

L1-10208A-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:40:09PM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	8.11E-02	3.92E-02	3.92E-02
+	BE-7	477.60	*	10.44	2.42E-01	1.81E-01	1.81E-01
+	K-40	1460.82	*	10.66	5.53E+00	2.34E-01	2.34E-01
	Mn-54	834.85		99.98	-4.71E-03	2.28E-02	2.28E-02
+	Co-60	1173.23	*	99.85	3.87E-02	2.20E-02	3.19E-02
		1332.49	*	99.98	2.86E-02		2.20E-02
	Nb-94	702.65		99.81	4.66E-03	2.29E-02	2.29E-02
		871.09		99.89	-1.19E-02		2.51E-02
	Ag-108m	79.13		6.60	-7.76E-02	2.55E-02	6.75E-01
		433.94		90.50	1.09E-02		2.55E-02
		614.28		89.80	-1.28E-02		3.36E-02
		722.94		90.80	-5.15E-03		2.96E-02
	Sb-125	176.31		6.84	-1.10E-01	7.21E-02	3.30E-01
		380.45		1.52	-6.49E-01		1.28E+00
		427.87		29.60	-1.39E-02		7.21E-02
		463.36		10.49	1.17E-01		2.23E-01
		600.60		17.65	-2.12E-02		1.26E-01
		606.71		4.98	-1.63E-01		7.38E-01
		635.95		11.22	4.77E-02		2.09E-01

Analysis Report for 10-Oct-19-10040

L1-10208A-FSGS-009SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-1.36E-01	7.21E-02	1.36E+00
	Ba-133	79.61		2.65	-4.29E-01	4.38E-02	1.57E+00
		81.00		32.90	-8.42E-02		1.09E-01
		276.40		7.16	5.79E-02		3.14E-01
		302.85		18.34	-2.93E-02		1.07E-01
		356.01		62.05	-8.10E-03		4.38E-02
		383.85		8.94	9.08E-02		2.48E-01
	Cs-134	475.36		1.48	-1.89E-01	3.00E-02	1.78E+00
		563.25		8.34	1.65E-01		2.64E-01
		569.33		15.37	-7.10E-02		1.46E-01
		604.72		97.62	-5.09E-03		3.30E-02
		795.86		85.46	-5.89E-03		3.00E-02
		801.95		8.69	5.24E-02		3.07E-01
		1038.61		0.99	1.56E+00		3.11E+00
		1167.97		1.79	-8.01E-01		2.42E+00
		1365.19		3.02	-1.78E-01		8.51E-01
+	Cs-137	661.66	*	85.10	5.93E-02	2.11E-02	2.11E-02
	Eu-152	121.78		28.67	6.67E-03	7.19E-02	7.19E-02
		244.70		7.61	-1.04E-01		3.00E-01
		295.94		0.45	1.70E+00		5.56E+00
		344.28		26.60	-4.79E-02		8.14E-02
		367.79		0.86	-4.13E-01		2.38E+00
		411.12		2.24	-1.33E-01		9.37E-01
		443.96		2.83	-1.90E-01		7.36E-01
		488.68		0.42	-1.34E+00		5.19E+00
		563.99		0.49	1.05E+00		4.37E+00
		586.26		0.46	-2.01E+00		8.01E+00
		678.62		0.47	1.28E+00		5.47E+00
		688.67		0.86	-7.23E-01		3.08E+00
		719.35		0.28	6.53E+00		9.33E+00
		778.90		12.96	-1.21E-01		1.76E-01
		810.45		0.32	3.03E+00		8.13E+00
		867.37		4.26	-7.64E-02		6.58E-01
		919.33		0.43	-1.78E+00		6.07E+00
		964.08		14.65	6.31E-02		2.54E-01
		1085.87		10.24	-4.13E-02		2.89E-01
		1089.74		1.73	-9.64E-01		1.60E+00
		1112.07		13.69	-9.26E-02		2.41E-01
		1212.95		1.43	9.94E-01		2.78E+00
		1249.94		0.19	-6.46E+00		1.52E+01
		1299.14		1.63	-1.56E+00		1.96E+00
		1408.01		21.07	1.05E-01		1.29E-01
		1457.64		0.50	-1.11E+00		2.47E+01
		1528.10		0.28	9.69E-01		7.96E+00
	Eu-154	123.07		40.40	-9.44E-03	4.97E-02	4.97E-02
		247.93		6.89	-7.86E-02		2.97E-01
		591.76		4.95	1.67E-01		4.62E-01
		692.42		1.78	1.02E+00		1.55E+00
		723.30		20.06	6.45E-02		1.44E-01
		756.80		4.52	-2.55E-02		5.62E-01
		873.18		12.08	8.82E-02		2.14E-01

Analysis Report for 10-Oct-19-10040

L1-10208A-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.23E-01	4.97E-02	2.75E-01
	1004.76	18.01	9.78E-03		1.46E-01
	1274.43	34.80	2.42E-02		9.61E-02
	1596.48	1.80	-1.08E+00		1.25E+00
Eu-155	45.30	1.31	1.04E+00	1.09E-01	7.58E+00
	60.01	1.22	1.92E+00		8.13E+00
	86.55	30.70	1.82E-02		1.09E-01
	105.31	21.10	4.86E-03		1.17E-01
Ra-226	186.21	3.64	4.79E-01	6.82E-01	6.82E-01
Pa-231	27.36	10.30	4.04E-01	6.87E-01	6.87E-01
	283.69	1.70	-2.56E-01		1.28E+00
	300.07	2.47	-3.95E-01		8.41E-01
	302.65	2.20	-2.44E-01		8.90E-01
	330.06	1.40	1.59E+00		1.74E+00
U-235	143.76	10.96	3.96E-03	4.29E-02	1.95E-01
	163.33	5.08	4.77E-02		4.44E-01
	185.71	57.20	2.47E-02		4.29E-02
	202.11	1.08	1.68E-01		2.08E+00
	205.31	5.01	-1.68E-01		4.53E-01
Am-241	59.54	35.90	7.54E-02	2.89E-01	2.89E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10041

L1-10208A-FSGS-010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10041
Sample Description	: L1-10208A-FSGS-010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.428E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:18:00PM
Acquisition Started	: 10/10/2019 1:04:55PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.2 seconds
Dead Time	: 0.13 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80431
Fill Height	: 1427.93 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:19:58PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 10-11-19

Analysis Report for 10-Oct-19-10041

L1-10208A-FSGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.71	948 -	961	954.93	1.17E+02	17.97	7.17E+01	1.07
2	352.02	1402 -	1412	1407.83	5.01E+01	9.64	1.79E+01	1.11
3	583.22	2326 -	2337	2332.11	4.25E+01	9.16	1.65E+01	0.51
4	609.22	2431 -	2441	2436.06	2.14E+01	6.84	1.06E+01	1.05
5	727.06	2903 -	2912	2907.29	1.25E+01	5.44	7.50E+00	0.87
6	911.53	3641 -	3650	3645.07	2.19E+01	5.64	4.06E+00	0.41
7	1461.02	5831 -	5854	5843.90	2.36E+02	16.47	8.86E+00	1.36

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.02E+00	4.94E-01
Tl-208	1.00	583.19	*	85.00	7.22E-02	1.62E-02
Bi-211	0.86	351.07	*	13.02	3.90E-01	8.13E-02
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	3.15E-01	1.38E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.13E-01	3.69E-02
		300.09		3.30		

Analysis Report for 10-Oct-19-10041

L1-10208A-FSGS-010SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	609.32	*	45.49	6.99E-02	2.28E-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		
		351.93	*	35.60	1.43E-01	2.97E-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	4.35E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10041

L1-10208A-FSGS-010SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.994	6.02E+00	4.94E-01	
	Tl-208	1.000	7.22E-02	1.62E-02	
?	Bi-211	0.864	3.90E-01	8.13E-02	
	Bi-212	0.993	3.15E-01	1.38E-01	
	Pb-212	0.999	2.13E-01	3.69E-02	
	Bi-214	0.999	6.99E-02	2.28E-02	
?	Pb-214	0.999	1.43E-01	2.97E-02	
	Ac-228	0.995	1.67E-01	4.35E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10041

L1-10208A-FSGS-010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:19:58PM
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	6.71E-02	5.70E-02	5.70E-02
	BE-7	477.60		10.44	1.11E-01	4.29E-01	4.29E-01
+	K-40	1460.82	*	10.66	6.02E+00	5.85E-01	5.85E-01
	Mn-54	834.85		99.98	-5.52E-03	5.06E-02	5.06E-02
	Co-60	1173.23		99.85	3.46E-02	5.91E-02	5.91E-02
		1332.49		99.98	2.88E-02		6.55E-02
	Nb-94	702.65		99.81	-4.50E-03	4.17E-02	4.17E-02
		871.09		99.89	-2.23E-02		4.82E-02
	Ag-108m	79.13		6.60	-3.03E-01	4.46E-02	1.81E+00
		433.94		90.50	-1.14E-02		4.46E-02
		614.28		89.80	-1.76E-02		5.28E-02
		722.94		90.80	-1.72E-02		6.05E-02
	Sb-125	176.31		6.84	-2.27E-01	1.26E-01	5.46E-01
		380.45		1.52	-1.30E-01		2.67E+00
		427.87		29.60	-2.69E-02		1.26E-01
		463.36		10.49	3.12E-01		3.90E-01
		600.60		17.65	1.08E-01		2.71E-01
		606.71		4.98	9.66E-01		1.16E+00
		635.95		11.22	4.45E-02		3.61E-01

Analysis Report for 10-Oct-19-10041

L1-10208A-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-5.78E-01	1.26E-01	2.12E+00
Ba-133	79.61	2.65	-2.03E+00	7.49E-02	4.27E+00
	81.00	32.90	-3.43E-01		3.00E-01
	276.40	7.16	1.67E-01		5.52E-01
	302.85	18.34	1.02E-01		2.20E-01
	356.01	62.05	-8.14E-02		7.49E-02
	383.85	8.94	1.83E-01		4.64E-01
Cs-134	475.36	1.48	-4.07E-01	5.84E-02	2.82E+00
	563.25	8.34	1.85E-01		4.55E-01
	569.33	15.37	-2.18E-01		2.53E-01
	604.72	97.62	-3.22E-02		5.84E-02
	795.86	85.46	3.93E-02		6.01E-02
	801.95	8.69	-6.78E-02		4.81E-01
	1038.61	0.99	-2.00E-01		4.78E+00
	1167.97	1.79	-1.00E-01		3.36E+00
	1365.19	3.02	6.28E-01		1.67E+00
Cs-137	661.66	85.10	3.01E-02	5.06E-02	5.06E-02
Eu-152	121.78	28.67	3.24E-02	1.39E-01	1.60E-01
	244.70	7.61	3.67E-01		5.69E-01
	295.94	0.45	-1.43E+00		9.64E+00
	344.28	26.60	1.73E-02		1.39E-01
	367.79	0.86	-6.37E-01		4.42E+00
	411.12	2.24	-5.32E-01		1.66E+00
	443.96	2.83	-4.37E-01		1.42E+00
	488.68	0.42	2.14E+00		8.87E+00
	563.99	0.49	1.62E-01		7.58E+00
	586.26	0.46	-1.21E+01		1.46E+01
	678.62	0.47	1.79E+00		8.45E+00
	688.67	0.86	-3.30E-01		5.07E+00
	719.35	0.28	-5.23E+00		1.52E+01
	778.90	12.96	1.59E-01		3.78E-01
	810.45	0.32	5.50E+00		1.51E+01
	867.37	4.26	-8.66E-01		1.19E+00
	919.33	0.43	5.06E+00		1.04E+01
	964.08	14.65	-9.49E-02		4.35E-01
	1085.87	10.24	3.98E-02		5.36E-01
	1089.74	1.73	1.42E-02		2.97E+00
	1112.07	13.69	1.28E-01		3.41E-01
	1212.95	1.43	-4.17E-01		4.23E+00
	1249.94	0.19	1.32E+01		2.91E+01
	1299.14	1.63	1.67E+00		3.38E+00
	1408.01	21.07	-1.98E-01		1.95E-01
	1457.64	0.50	1.29E+02		4.27E+01
	1528.10	0.28	2.99E+00		1.12E+01
Eu-154	123.07	40.40	-1.80E-02	1.11E-01	1.11E-01
	247.93	6.89	-1.60E-01		5.26E-01
	591.76	4.95	-6.57E-01		8.20E-01
	692.42	1.78	1.81E+00		2.67E+00
	723.30	20.06	-1.06E-01		2.71E-01
	756.80	4.52	-4.78E-01		8.88E-01
	873.18	12.08	1.43E-01		3.83E-01

Analysis Report for 10-Oct-19-10041

L1-10208A-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-8.34E-02	1.11E-01	4.01E-01
	1004.76	18.01	-2.54E-02		2.42E-01
	1274.43	34.80	-2.77E-02		1.47E-01
	1596.48	1.80	-8.81E-01		2.02E+00
Eu-155	45.30	1.31	5.89E+00	2.63E-01	3.01E+01
	60.01	1.22	-1.59E+01		2.73E+01
	86.55	30.70	9.86E-02		2.66E-01
	105.31	21.10	1.90E-02		2.63E-01
Ra-226	186.21	3.64	5.71E-01	1.16E+00	1.16E+00
Pa-231	27.36	10.30	2.55E+00	1.60E+00	3.12E+00
	283.69	1.70	4.40E-01		2.06E+00
	300.07	2.47	-1.12E+00		1.60E+00
	302.65	2.20	7.96E-01		1.83E+00
	330.06	1.40	3.99E-01		2.78E+00
U-235	143.76	10.96	3.88E-02	7.37E-02	3.92E-01
	163.33	5.08	-2.09E-02		7.53E-01
	185.71	57.20	7.02E-02		7.37E-02
	202.11	1.08	-7.70E-01		3.25E+00
	205.31	5.01	-2.12E-02		7.27E-01
Am-241	59.54	35.90	-5.70E-01	9.75E-01	9.75E-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

Analysis Report for 10-Oct-19-10042

L1-10208A-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10042
Sample Description	: L1-10208A-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.431E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:20:00PM
Acquisition Started	: 10/10/2019 1:05:03PM
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80432
Fill Height	: 1431.08 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:20:13PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 10-4-19

Analysis Report for 10-Oct-19-10042

L1-10208A-FSGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.43	306 -	316	310.27	3.55E+01	15.76	8.75E+01	0.36
2	125.84	501 -	506	503.60	1.43E+01	7.60	2.47E+01	0.62
3	238.82	948 -	961	954.84	1.57E+02	20.22	8.81E+01	1.33
4	351.81	1398 -	1414	1406.26	6.18E+01	11.32	2.12E+01	0.99
5	477.58	1901 -	1914	1908.80	5.77E+01	9.60	1.23E+01	0.77
6	583.09	2322 -	2338	2330.48	7.88E+01	9.59	4.25E+00	1.05
7	1460.02	5825 -	5849	5838.03	3.33E+02	18.91	6.06E+00	1.48

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	1.00	477.60	*	10.44	6.43E-01	1.17E-01
K-40	0.90	1460.82	*	10.66	7.62E+00	5.45E-01
Tl-208	0.99	583.19	*	85.00	1.21E-01	1.64E-02
Bi-211	0.91	351.07	*	13.02	4.32E-01	8.64E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.53E-01	3.84E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.50E-01	1.14E-01
		87.35		3.97		

Analysis Report for 10-Oct-19-10042

L1-10208A-FSGS-011SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	89.78		1.46		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.58E-01	3.16E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	4.40E-01	2.02E-01
		87.35		2.24		
		89.78		0.82		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	1.000	6.43E-01	1.17E-01	
	K-40	0.903	7.62E+00	5.45E-01	
	Tl-208	0.999	1.21E-01	1.64E-02	
?	Bi-211	0.916	4.32E-01	8.64E-02	
	Pb-212	0.995	2.53E-01	3.84E-02	
?	Pb212-XR	0.991	2.50E-01	1.14E-01	
?	Pb-214	0.999	1.58E-01	3.16E-02	
?	Pb214-XR	0.991	4.40E-01	2.02E-01	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10042

L1-10208A-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:20:13PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
2	125.84	1.59259E-02	52.99		

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	4.85E-02	5.52E-02	5.52E-02
+	BE-7	477.60	*	10.44	6.43E-01	2.55E-01	2.55E-01
+	K-40	1460.82	*	10.66	7.62E+00	4.50E-01	4.50E-01
	Mn-54	834.85		99.98	1.75E-02	4.94E-02	4.94E-02
	Co-60	1173.23		99.85	3.23E-02	4.89E-02	6.29E-02
		1332.49		99.98	-3.75E-02		4.89E-02
	Nb-94	702.65		99.81	-2.88E-03	4.34E-02	4.69E-02
		871.09		99.89	2.94E-02		4.34E-02
	Ag-108m	79.13		6.60	-4.05E-02	4.06E-02	1.20E+00
		433.94		90.50	-2.59E-02		4.06E-02
		614.28		89.80	-5.90E-02		5.43E-02
		722.94		90.80	7.87E-03		5.70E-02
	Sb-125	176.31		6.84	2.72E-02	1.28E-01	4.91E-01
		380.45		1.52	1.04E+00		2.40E+00
		427.87		29.60	9.22E-02		1.28E-01
		463.36		10.49	2.26E-01		3.97E-01
		600.60		17.65	3.39E-02		2.42E-01
		606.71		4.98	-1.83E-01		1.11E+00

Analysis Report for 10-Oct-19-10042

L1-10208A-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	635.95	11.22	-1.85E-01	1.28E-01	3.25E-01
	671.44	1.79	-1.48E+00		2.19E+00
Ba-133	79.61	2.65	-1.89E-01	6.10E-02	2.92E+00
	81.00	32.90	-1.14E-01		1.84E-01
	276.40	7.16	5.66E-02		4.98E-01
	302.85	18.34	2.14E-02		1.94E-01
	356.01	62.05	-1.52E-02		6.10E-02
	383.85	8.94	9.50E-02		3.99E-01
Cs-134	475.36	1.48	4.89E+00	5.31E-02	3.65E+00
	563.25	8.34	-1.03E-01		5.41E-01
	569.33	15.37	5.11E-02		2.71E-01
	604.72	97.62	-4.83E-02		5.31E-02
	795.86	85.46	-3.48E-02		6.61E-02
	801.95	8.69	-3.61E-02		5.44E-01
	1038.61	0.99	8.50E-01		4.96E+00
	1167.97	1.79	-2.26E+00		3.24E+00
	1365.19	3.02	2.79E-01		1.39E+00
Cs-137	661.66	85.10	4.92E-02	6.08E-02	6.08E-02
Eu-152	121.78	28.67	8.10E-02	1.22E-01	1.22E-01
	244.70	7.61	-9.57E-02		5.16E-01
	295.94	0.45	-8.40E-01		9.02E+00
	344.28	26.60	-7.29E-02		1.26E-01
	367.79	0.86	-5.46E+00		3.78E+00
	411.12	2.24	-1.64E-02		1.68E+00
	443.96	2.83	-9.06E-01		1.29E+00
	488.68	0.42	6.87E-02		9.53E+00
	563.99	0.49	-5.80E+00		8.71E+00
	586.26	0.46	-2.03E+00		1.48E+01
	678.62	0.47	5.24E+00		9.69E+00
	688.67	0.86	-3.07E+00		4.95E+00
	719.35	0.28	5.35E+00		1.45E+01
	778.90	12.96	-1.48E-02		3.51E-01
	810.45	0.32	-1.27E+00		1.18E+01
	867.37	4.26	-3.50E-01		1.02E+00
	919.33	0.43	-4.30E+00		9.65E+00
	964.08	14.65	5.81E-01		5.02E-01
	1085.87	10.24	-5.22E-01		5.12E-01
	1089.74	1.73	-2.91E+00		2.92E+00
	1112.07	13.69	-3.04E-01		4.43E-01
	1212.95	1.43	2.47E+00		5.20E+00
	1249.94	0.19	1.69E+00		3.15E+01
	1299.14	1.63	-1.04E+00		3.35E+00
	1408.01	21.07	1.24E-01		2.12E-01
	1457.64	0.50	1.66E+02		4.47E+01
	1528.10	0.28	-8.30E+00		1.12E+01
Eu-154	123.07	40.40	-2.49E-02	8.65E-02	8.65E-02
	247.93	6.89	-1.57E-01		4.55E-01
	591.76	4.95	7.80E-02		8.72E-01
	692.42	1.78	-4.30E-01		2.37E+00
	723.30	20.06	9.97E-02		2.61E-01
	756.80	4.52	1.72E-02		8.56E-01

Analysis Report for 10-Oct-19-10042

L1-10208A-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	8.36E-02	8.65E-02	3.67E-01
	996.29	10.48	-2.13E-01		4.98E-01
	1004.76	18.01	-5.27E-02		2.66E-01
	1274.43	34.80	1.33E-01		1.58E-01
	1596.48	1.80	5.10E-01		2.63E+00
Eu-155	45.30	1.31	-5.11E+00	1.90E-01	1.08E+01
	60.01	1.22	-7.47E+00		1.20E+01
	86.55	30.70	6.60E-02		2.01E-01
	105.31	21.10	-1.29E-01		1.90E-01
Ra-226	186.21	3.64	2.32E-01	8.64E-01	8.64E-01
Pa-231	27.36	10.30	1.31E+00	1.38E+00	1.42E+00
	283.69	1.70	-4.37E-02		1.94E+00
	300.07	2.47	-1.77E+00		1.38E+00
	302.65	2.20	1.18E-01		1.61E+00
	330.06	1.40	1.25E+00		2.75E+00
U-235	143.76	10.96	-3.26E-02	5.66E-02	3.23E-01
	163.33	5.08	1.32E-01		6.13E-01
	185.71	57.20	3.56E-02		5.66E-02
	202.11	1.08	-1.91E+00		2.76E+00
	205.31	5.01	4.94E-02		6.19E-01
Am-241	59.54	35.90	-1.63E-02	4.34E-01	4.34E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10043
L1-10208A-FSGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10043
Sample Description	: L1-10208A-FSGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.594E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:22:00PM
Acquisition Started	: 10/10/2019 1:05:11PM
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80433
Fill Height	: 1594.30 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:20:16PM

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

Data Validated
0830 10-11-19

Analysis Report for 10-Oct-19-10043

L1-10208A-FSGS-012SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.58	948 -	960	954.80	9.64E+01	14.53	4.36E+01	1.07
2	295.06	1176 -	1186	1180.46	3.18E+01	7.80	1.22E+01	0.94
3	351.77	1401 -	1413	1407.09	4.29E+01	10.87	2.81E+01	1.03
4	510.38	2036 -	2045	2041.00	1.62E+01	7.99	1.98E+01	0.68
5	583.26	2327 -	2337	2332.35	3.38E+01	8.32	1.42E+01	0.53
6	609.52	2431 -	2444	2437.35	3.16E+01	8.30	1.34E+01	0.76
7	911.43	3639 -	3653	3644.74	3.19E+01	7.42	8.14E+00	0.48
8	1460.66	5831 -	5854	5843.03	2.60E+02	16.48	2.93E+00	1.42

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.94	511.00	*	100.00	1.83E-02	9.15E-03
K-40	0.99	1460.82	*	10.66	5.38E+00	4.13E-01
Tl-208	0.99	583.19	*	85.00	4.79E-02	1.21E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.50E-01	2.56E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	8.63E-02	2.32E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 10-Oct-19-10043

L1-10208A-FSGS-012SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.31E-01	3.39E-02
		351.93	*	35.60	1.04E-01	2.75E-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	1.99E-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

Analysis Report for 10-Oct-19-10043

L1-10208A-FSGS-012SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.940	1.83E-02	9.15E-03	
	K-40	0.996	5.38E+00	4.13E-01	
	Tl-208	0.999	4.79E-02	1.21E-02	
X	Bi-211	0.924			
	Pb-212	1.000	1.50E-01	2.56E-02	
	Bi-214	0.997	8.63E-02	2.32E-02	
	Pb-214	0.996	1.15E-01	2.14E-02	
	Ac-228	0.998	1.99E-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 10-Oct-19-10043

L1-10208A-FSGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:20:16PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	1.83E-02	2.98E-02	2.98E-02
	BE-7	477.60		10.44	-8.94E-02	3.61E-01	3.61E-01
+	K-40	1460.82	*	10.66	5.38E+00	2.98E-01	2.98E-01
	Mn-54	834.85		99.98	4.24E-02	5.08E-02	5.08E-02
	Co-60	1173.23		99.85	1.81E-02	5.34E-02	6.10E-02
		1332.49		99.98	-1.07E-02		5.34E-02
	Nb-94	702.65		99.81	-4.86E-02	3.79E-02	3.79E-02
		871.09		99.89	-1.73E-02		3.81E-02
	Ag-108m	79.13		6.60	1.18E+00	3.38E-02	1.44E+00
		433.94		90.50	6.40E-03		3.38E-02
		614.28		89.80	-2.25E-02		5.64E-02
		722.94		90.80	1.26E-02		5.19E-02
	Sb-125	176.31		6.84	-3.08E-01	9.97E-02	4.57E-01
		380.45		1.52	1.49E+00		2.24E+00
		427.87		29.60	1.06E-02		9.97E-02
		463.36		10.49	1.42E-01		3.40E-01
		600.60		17.65	1.29E-01		2.29E-01
		606.71		4.98	1.35E+00		1.10E+00
		635.95		11.22	1.98E-01		3.51E-01

Analysis Report for 10-Oct-19-10043

L1-10208A-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.18E+00	9.97E-02	2.25E+00
Ba-133	79.61	2.65	1.95E+00	6.43E-02	3.47E+00
	81.00	32.90	-1.30E-01		2.48E-01
	276.40	7.16	6.94E-02		4.61E-01
	302.85	18.34	1.12E-01		1.75E-01
	356.01	62.05	-7.26E-03		6.43E-02
	383.85	8.94	-1.71E-01		3.54E-01
Cs-134	475.36	1.48	-6.54E-01	5.04E-02	2.48E+00
	563.25	8.34	2.68E-01		4.37E-01
	569.33	15.37	3.49E-03		2.11E-01
	604.72	97.62	-3.04E-03		5.11E-02
	795.86	85.46	-1.86E-02		5.04E-02
	801.95	8.69	-4.13E-01		4.59E-01
	1038.61	0.99	3.77E+00		4.94E+00
	1167.97	1.79	-1.69E+00		3.44E+00
	1365.19	3.02	8.71E-03		1.02E+00
Cs-137	661.66	85.10	-1.12E-02	5.34E-02	5.34E-02
Eu-152	121.78	28.67	-3.09E-02	1.10E-01	1.26E-01
	244.70	7.61	1.02E-01		4.18E-01
	295.94	0.45	4.26E+00		7.97E+00
	344.28	26.60	-2.03E-01		1.10E-01
	367.79	0.86	-3.75E-01		3.85E+00
	411.12	2.24	-9.50E-01		1.35E+00
	443.96	2.83	9.10E-03		1.23E+00
	488.68	0.42	-6.27E+00		8.20E+00
	563.99	0.49	4.19E+00		7.21E+00
	586.26	0.46	1.41E+01		1.16E+01
	678.62	0.47	4.24E+00		7.84E+00
	688.67	0.86	-4.30E-01		4.63E+00
	719.35	0.28	-3.24E+00		1.26E+01
	778.90	12.96	-1.82E-01		2.96E-01
	810.45	0.32	-5.70E+00		1.25E+01
	867.37	4.26	7.69E-02		8.91E-01
	919.33	0.43	4.85E+00		1.06E+01
	964.08	14.65	6.99E-02		3.93E-01
	1085.87	10.24	-5.74E-02		4.57E-01
	1089.74	1.73	-2.38E-01		2.71E+00
	1112.07	13.69	7.93E-02		3.73E-01
	1212.95	1.43	-2.25E+00		4.08E+00
	1249.94	0.19	-5.87E+00		2.71E+01
	1299.14	1.63	1.22E+00		3.29E+00
	1408.01	21.07	-3.85E-02		2.25E-01
	1457.64	0.50	1.13E+02		3.56E+01
	1528.10	0.28	-3.04E+00		9.05E+00
Eu-154	123.07	40.40	3.54E-02	8.83E-02	8.83E-02
	247.93	6.89	-2.34E-01		4.26E-01
	591.76	4.95	-3.78E-01		7.27E-01
	692.42	1.78	-9.67E-01		2.31E+00
	723.30	20.06	-7.31E-02		2.30E-01
	756.80	4.52	2.05E-01		8.34E-01
	873.18	12.08	1.27E-01		3.29E-01

Analysis Report for 10-Oct-19-10043

L1-10208A-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.33E-01	8.83E-02	4.54E-01
	1004.76	18.01	9.23E-02		2.74E-01
	1274.43	34.80	-3.05E-02		1.24E-01
	1596.48	1.80	-2.95E-01		1.92E+00
Eu-155	45.30	1.31	-8.44E+00	1.81E-01	1.73E+01
	60.01	1.22	-1.37E+01		1.84E+01
	86.55	30.70	1.24E-02		1.98E-01
	105.31	21.10	-1.48E-03		1.81E-01
Ra-226	186.21	3.64	3.21E-01	9.39E-01	9.39E-01
Pa-231	27.36	10.30	1.97E+00	1.28E+00	2.08E+00
	283.69	1.70	-4.40E-01		1.77E+00
	300.07	2.47	-4.02E-01		1.28E+00
	302.65	2.20	1.26E+00		1.47E+00
	330.06	1.40	8.28E-02		2.61E+00
U-235	143.76	10.96	-1.22E-01	5.99E-02	3.14E-01
	163.33	5.08	-1.09E-01		6.32E-01
	185.71	57.20	2.53E-02		5.99E-02
	202.11	1.08	1.72E+00		2.99E+00
	205.31	5.01	-2.32E-01		5.96E-01
Am-241	59.54	35.90	-3.07E-01	6.54E-01	6.54E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10044
L1-10208A-FSGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10044
Sample Description	: L1-10208A-FSGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.483E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:24:00PM
Acquisition Started	: 10/10/2019 1:25:17PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.1 seconds
Dead Time	: 0.12 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80434
Fill Height	: 1483.39 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:40:24PM

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

Data Validated
0830 10-4179

Analysis Report for 10-Oct-19-10044

L1-10208A-FSGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.61	946 -	960	954.53	1.10E+02	15.61	4.57E+01	0.74
2	338.19	1349 -	1359	1352.54	2.90E+01	8.52	1.80E+01	0.59
3	583.31	2328 -	2339	2332.45	3.13E+01	8.36	1.47E+01	0.36
4	609.34	2431 -	2443	2436.51	4.88E+01	8.70	1.02E+01	0.57
5	911.41	3639 -	3650	3644.60	3.39E+01	6.84	5.05E+00	0.72
6	1460.82	5833 -	5853	5843.10	2.17E+02	14.73	0.00E+00	2.03

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	5.46E+00	4.40E-01
Tl-208	0.99	583.19	*	85.00	5.26E-02	1.44E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.98E-01	3.23E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.58E-01	2.97E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 10-Oct-19-10044

L1-10208A-FSGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.51E-01	7.64E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.55E-01	5.26E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	1.000	5.46E+00	4.40E-01	
Tl-208	0.998	5.26E-02	1.44E-02	
Pb-212	1.000	1.98E-01	3.23E-02	

Analysis Report for 10-Oct-19-10044

L1-10208A-FSGS-013SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
Bi-214	1.000	1.58E-01	2.97E-02	
Ac-228	0.998	2.54E-01	4.33E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10044

L1-10208A-FSGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:40:24PM
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	4.07E-02	5.72E-02	5.72E-02
	BE-7	477.60		10.44	9.64E-02	4.54E-01	4.54E-01
+	K-40	1460.82	*	10.66	5.46E+00	7.24E-02	7.24E-02
	Mn-54	834.85		99.98	2.93E-02	4.65E-02	4.65E-02
	Co-60	1173.23		99.85	4.58E-02	5.37E-02	6.18E-02
		1332.49		99.98	-8.59E-03		5.37E-02
	Nb-94	702.65		99.81	2.66E-02	4.26E-02	4.52E-02
		871.09		99.89	-2.22E-02		4.26E-02
	Ag-108m	79.13		6.60	5.02E-01	4.02E-02	1.76E+00
		433.94		90.50	-3.38E-02		4.02E-02
		614.28		89.80	-1.49E-02		5.60E-02
		722.94		90.80	-2.44E-02		5.55E-02
	Sb-125	176.31		6.84	4.24E-02	1.46E-01	4.90E-01
		380.45		1.52	1.91E+00		2.43E+00
		427.87		29.60	9.77E-02		1.46E-01
		463.36		10.49	2.28E-01		4.40E-01
		600.60		17.65	3.38E-02		2.34E-01
		606.71		4.98	1.43E+00		1.38E+00
		635.95		11.22	2.08E-03		3.70E-01

Analysis Report for 10-Oct-19-10044

L1-10208A-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.30E+00	1.46E-01	2.05E+00
Ba-133	79.61	2.65	-1.82E+00	7.06E-02	4.03E+00
	81.00	32.90	-1.92E-01		2.91E-01
	276.40	7.16	-5.82E-02		5.06E-01
	302.85	18.34	1.37E-02		2.26E-01
	356.01	62.05	-5.78E-02		7.06E-02
	383.85	8.94	4.69E-02		4.02E-01
Cs-134	475.36	1.48	1.79E+00	5.04E-02	2.92E+00
	563.25	8.34	9.75E-02		4.74E-01
	569.33	15.37	-1.43E-01		2.23E-01
	604.72	97.62	-3.94E-02		6.55E-02
	795.86	85.46	6.99E-03		5.04E-02
	801.95	8.69	-6.22E-02		4.13E-01
	1038.61	0.99	-3.62E+00		3.52E+00
	1167.97	1.79	8.65E-01		3.05E+00
	1365.19	3.02	1.18E+00		1.76E+00
Cs-137	661.66	85.10	3.51E-02	5.58E-02	5.58E-02
Eu-152	121.78	28.67	-3.26E-02	1.16E-01	1.52E-01
	244.70	7.61	-2.30E-01		4.74E-01
	295.94	0.45	-2.28E+00		9.74E+00
	344.28	26.60	-1.39E-02		1.16E-01
	367.79	0.86	-6.55E-01		3.99E+00
	411.12	2.24	1.13E+00		1.72E+00
	443.96	2.83	-1.04E+00		1.14E+00
	488.68	0.42	-3.54E+00		8.51E+00
	563.99	0.49	4.23E+00		8.04E+00
	586.26	0.46	1.16E+01		1.35E+01
	678.62	0.47	-1.18E+00		7.42E+00
	688.67	0.86	1.35E+00		4.23E+00
	719.35	0.28	-1.13E+01		1.64E+01
	778.90	12.96	2.01E-01		2.88E-01
	810.45	0.32	4.35E-01		1.23E+01
	867.37	4.26	4.30E-01		9.95E-01
	919.33	0.43	4.26E+00		1.08E+01
	964.08	14.65	-2.66E-01		4.19E-01
	1085.87	10.24	2.12E-01		4.83E-01
	1089.74	1.73	-2.80E+00		2.55E+00
	1112.07	13.69	-3.08E-01		4.11E-01
	1212.95	1.43	-4.79E-01		4.18E+00
	1249.94	0.19	2.62E+01		3.58E+01
	1299.14	1.63	-2.04E+00		2.95E+00
	1408.01	21.07	-8.91E-02		1.68E-01
	1457.64	0.50	1.17E+02		3.93E+01
	1528.10	0.28	4.93E+00		1.34E+01
Eu-154	123.07	40.40	1.03E-02	1.07E-01	1.07E-01
	247.93	6.89	2.42E-01		4.98E-01
	591.76	4.95	6.85E-01		8.63E-01
	692.42	1.78	-6.71E-01		2.05E+00
	723.30	20.06	8.94E-02		2.61E-01
	756.80	4.52	0.00E+00		6.82E-01
	873.18	12.08	1.36E-01		3.79E-01

Analysis Report for 10-Oct-19-10044

L1-10208A-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.98E-01	1.07E-01	4.68E-01
	1004.76	18.01	-2.88E-03		2.16E-01
	1274.43	34.80	8.72E-03		1.45E-01
	1596.48	1.80	-2.50E+00		2.63E+00
Eu-155	45.30	1.31	-1.62E+01	2.37E-01	2.70E+01
	60.01	1.22	-9.17E+00		2.82E+01
	86.55	30.70	-8.20E-02		2.37E-01
	105.31	21.10	7.59E-02		2.53E-01
Ra-226	186.21	3.64	2.37E-01	9.78E-01	9.78E-01
Pa-231	27.36	10.30	1.86E+00	1.56E+00	3.43E+00
	283.69	1.70	-7.21E-01		1.96E+00
	300.07	2.47	-2.12E+00		1.56E+00
	302.65	2.20	1.04E+00		1.93E+00
	330.06	1.40	1.67E+00		2.59E+00
U-235	143.76	10.96	2.88E-01	6.27E-02	3.98E-01
	163.33	5.08	1.90E-01		6.86E-01
	185.71	57.20	2.54E-02		6.27E-02
	202.11	1.08	-2.53E+00		2.97E+00
	205.31	5.01	-2.62E-02		7.14E-01
Am-241	59.54	35.90	-1.07E-01	1.02E+00	1.02E+00

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

Apex-Gamma

Analysis Report for 10-Oct-19-10045
L1-10208A-FSGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10045
Sample Description	: L1-10208A-FSGS-014SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.741E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:26:00PM
Acquisition Started	: 10/10/2019 1:25:24PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80435
Fill Height	: 1741.05 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:40:40PM

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

Data Validated
0830 10-11-19

Analysis Report for 10-Oct-19-10045

L1-10208A-FSGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.78	946 -	961	954.71	1.48E+02	19.17	7.30E+01	1.10
2	295.32	1173 -	1188	1180.55	6.98E+01	13.41	3.62E+01	0.42
3	351.83	1399 -	1415	1406.34	1.15E+02	13.47	2.13E+01	0.93
4	582.99	2322 -	2337	2330.07	6.62E+01	9.45	7.78E+00	1.08
5	1460.11	5828 -	5850	5838.37	3.03E+02	18.20	7.70E+00	2.13

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.92	1460.82	*	10.66	6.58E+00	4.87E-01
Tl-208	0.99	583.19	*	85.00	9.70E-02	1.50E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.30E-01	3.52E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.92E-01	6.07E-02
		351.93	*	35.60	2.82E-01	4.01E-02
		785.96		1.06		

Analysis Report for 10-Oct-19-10045

L1-10208A-FSGS-014SS

* = 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	6.58E+00	4.87E-01	
	Tl-208	0.994	9.70E-02	1.50E-02	
X	Bi-211	0.911			
	Pb-212	0.997	2.30E-01	3.52E-02	
	Pb-214	0.999	2.85E-01	3.34E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10045

L1-10208A-FSGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:40:40PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	9.27E-02	5.85E-02	5.85E-02
	BE-7	477.60		10.44	2.04E-01	3.92E-01	3.92E-01
+	K-40	1460.82	*	10.66	6.58E+00	4.50E-01	4.50E-01
	Mn-54	834.85		99.98	2.20E-02	4.64E-02	4.64E-02
	Co-60	1173.23		99.85	-2.24E-04	3.73E-02	6.61E-02
		1332.49		99.98	4.80E-04		3.73E-02
	Nb-94	702.65		99.81	9.90E-03	4.22E-02	4.75E-02
		871.09		99.89	6.65E-03		4.22E-02
	Ag-108m	79.13		6.60	1.42E+00	3.77E-02	1.33E+00
		433.94		90.50	-3.09E-03		3.77E-02
		614.28		89.80	-1.22E-01		5.66E-02
		722.94		90.80	7.17E-03		5.14E-02
	Sb-125	176.31		6.84	1.60E-01	1.16E-01	4.68E-01
		380.45		1.52	-3.12E-01		2.37E+00
		427.87		29.60	2.38E-02		1.16E-01
		463.36		10.49	1.20E-01		3.48E-01
		600.60		17.65	-4.00E-02		2.31E-01
		606.71		4.98	2.26E+00		1.39E+00
		635.95		11.22	-2.95E-01		3.33E-01

Analysis Report for 10-Oct-19-10045

L1-10208A-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.33E+00	1.16E-01	2.54E+00
Ba-133	79.61	2.65	3.44E+00	6.55E-02	3.20E+00
	81.00	32.90	-1.95E-01		2.14E-01
	276.40	7.16	-2.40E-01		4.62E-01
	302.85	18.34	-1.36E-01		1.73E-01
	356.01	62.05	-3.30E-02		6.55E-02
	383.85	8.94	-6.07E-02		3.77E-01
Cs-134	475.36	1.48	5.32E-01	4.92E-02	2.72E+00
	563.25	8.34	-5.31E-01		4.96E-01
	569.33	15.37	-4.94E-02		2.14E-01
	604.72	97.62	-3.68E-02		6.20E-02
	795.86	85.46	9.89E-03		4.92E-02
	801.95	8.69	-1.17E-01		4.23E-01
	1038.61	0.99	9.28E-02		4.80E+00
	1167.97	1.79	4.23E-02		3.59E+00
	1365.19	3.02	9.80E-02		1.20E+00
Cs-137	661.66	85.10	1.42E-03	5.53E-02	5.53E-02
Eu-152	121.78	28.67	1.03E-01	1.25E-01	1.25E-01
	244.70	7.61	2.05E-01		4.99E-01
	295.94	0.45	6.54E+00		1.03E+01
	344.28	26.60	-4.17E-02		1.30E-01
	367.79	0.86	1.20E+00		3.60E+00
	411.12	2.24	2.74E-01		1.62E+00
	443.96	2.83	4.31E-01		1.32E+00
	488.68	0.42	-7.79E+00		7.99E+00
	563.99	0.49	-5.91E+00		7.65E+00
	586.26	0.46	-6.14E+00		1.35E+01
	678.62	0.47	7.63E+00		9.14E+00
	688.67	0.86	2.36E+00		4.58E+00
	719.35	0.28	-2.51E+00		1.50E+01
	778.90	12.96	-6.42E-02		2.50E-01
	810.45	0.32	2.05E-01		1.32E+01
	867.37	4.26	9.53E-02		9.87E-01
	919.33	0.43	-9.95E+00		1.10E+01
	964.08	14.65	-3.94E-02		4.22E-01
	1085.87	10.24	1.12E-01		4.86E-01
	1089.74	1.73	8.91E-01		2.99E+00
	1112.07	13.69	2.27E-01		3.96E-01
	1212.95	1.43	-1.03E+00		4.50E+00
	1249.94	0.19	-4.72E+00		3.19E+01
	1299.14	1.63	-2.55E+00		3.38E+00
	1408.01	21.07	-1.81E-01		1.84E-01
	1457.64	0.50	1.43E+02		4.05E+01
	1528.10	0.28	4.24E+00		1.15E+01
Eu-154	123.07	40.40	2.26E-02	8.34E-02	8.34E-02
	247.93	6.89	-9.33E-02		4.77E-01
	591.76	4.95	-2.77E-01		7.41E-01
	692.42	1.78	7.52E-01		2.43E+00
	723.30	20.06	3.61E-02		2.33E-01
	756.80	4.52	-2.38E-02		9.71E-01
	873.18	12.08	7.88E-03		3.56E-01

Analysis Report for 10-Oct-19-10045

L1-10208A-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.74E-02	8.34E-02	4.50E-01
	1004.76	18.01	1.17E-01		2.82E-01
	1274.43	34.80	-5.12E-02		1.36E-01
	1596.48	1.80	8.37E-02		2.15E+00
Eu-155	45.30	1.31	3.95E+00	1.91E-01	1.25E+01
	60.01	1.22	-6.39E-01		1.31E+01
	86.55	30.70	3.99E-02		1.91E-01
	105.31	21.10	7.08E-02		2.04E-01
Ra-226	186.21	3.64	-1.26E-01	9.44E-01	9.44E-01
Pa-231	27.36	10.30	7.39E-01	1.42E+00	1.43E+00
	283.69	1.70	-5.14E-04		2.09E+00
	300.07	2.47	1.50E-01		1.42E+00
	302.65	2.20	-9.90E-01		1.48E+00
	330.06	1.40	1.25E+00		2.78E+00
U-235	143.76	10.96	1.80E-02	5.95E-02	3.23E-01
	163.33	5.08	-5.78E-02		6.54E-01
	185.71	57.20	-1.64E-02		5.95E-02
	202.11	1.08	-7.23E-01		2.97E+00
	205.31	5.01	-2.79E-01		6.57E-01
Am-241	59.54	35.90	5.43E-02	4.70E-01	4.70E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10046

L1-10208A-FSGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10046
Sample Description	: L1-10208A-FSGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.430E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:28:00PM
Acquisition Started	: 10/10/2019 1:25:31PM
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80436
Fill Height	: 1430.13 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:40:39PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 10/10/19

Analysis Report for 10-Oct-19-10046

L1-10208A-FSGS-015SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	76.97	307 -	314	309.20	2.21E+01	9.51	3.29E+01	0.66
2	238.66	948 -	961	955.13	1.21E+02	15.23	4.02E+01	1.04
3	338.30	1346 -	1359	1353.26	4.80E+01	9.30	1.40E+01	0.96
4	351.80	1401 -	1415	1407.18	4.41E+01	10.57	2.29E+01	0.50
5	583.10	2325 -	2339	2331.71	5.38E+01	9.29	1.13E+01	1.21
6	609.20	2428 -	2443	2436.08	4.31E+01	10.15	1.99E+01	0.61
7	911.30	3638 -	3652	3644.23	3.54E+01	7.15	5.59E+00	1.22
8	1460.48	5832 -	5853	5842.29	2.27E+02	16.32	1.06E+01	1.51

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	4.85E+00	4.07E-01
Tl-208	0.99	583.19	*	85.00	7.82E-02	1.43E-02
Bi-211	0.91	351.07	*	13.02	2.97E-01	7.52E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.92E-01	2.87E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.09E-01	9.24E-02
		87.35		3.97		

Analysis Report for 10-Oct-19-10046

L1-10208A-FSGS-015SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.20E-01	2.93E-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		
		351.93	*	35.60	1.09E-01	2.75E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	3.69E-01	1.64E-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	3.64E-01	7.65E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.28E-01	4.71E-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 10-Oct-19-10046

L1-10208A-FSGS-015SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.981	4.85E+00	4.07E-01	
	Tl-208	0.999	7.82E-02	1.43E-02	
?	Bi-211	0.919	2.97E-01	7.52E-02	
	Pb-212	1.000	1.92E-01	2.87E-02	
?	Pb212-XR	0.998	2.09E-01	9.24E-02	
	Bi-214	0.999	1.20E-01	2.93E-02	
?	Pb-214	0.998	1.09E-01	2.75E-02	
?	Pb214-XR	0.998	3.69E-01	1.64E-01	
	Ac-228	1.000	2.65E-01	4.01E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10046

L1-10208A-FSGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:40:39PM
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	4.87E-02	5.22E-02	5.22E-02
	BE-7	477.60		10.44	-3.75E-02	3.69E-01	3.69E-01
+	K-40	1460.82	*	10.66	4.85E+00	5.12E-01	5.12E-01
	Mn-54	834.85		99.98	3.65E-02	4.91E-02	4.91E-02
	Co-60	1173.23		99.85	-3.46E-02	4.82E-02	5.54E-02
		1332.49		99.98	3.62E-02		4.82E-02
	Nb-94	702.65		99.81	-7.90E-03	3.62E-02	3.62E-02
		871.09		99.89	-7.49E-03		4.00E-02
	Ag-108m	79.13		6.60	-2.79E-01	3.27E-02	1.23E+00
		433.94		90.50	1.31E-04		3.27E-02
		614.28		89.80	-3.39E-02		6.12E-02
		722.94		90.80	3.06E-02		5.32E-02
	Sb-125	176.31		6.84	1.77E-01	9.91E-02	4.61E-01
		380.45		1.52	-1.67E+00		1.96E+00
		427.87		29.60	-9.44E-02		9.91E-02
		463.36		10.49	4.50E-02		3.28E-01
		600.60		17.65	-2.04E-01		2.17E-01
		606.71		4.98	1.26E+00		1.23E+00
		635.95		11.22	-8.58E-02		3.25E-01

Analysis Report for 10-Oct-19-10046

L1-10208A-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.47E-01	9.91E-02	2.37E+00
Ba-133	79.61	2.65	-4.14E-01	6.18E-02	3.04E+00
	81.00	32.90	-4.10E-02		2.11E-01
	276.40	7.16	-3.42E-02		5.19E-01
	302.85	18.34	-9.33E-03		1.68E-01
	356.01	62.05	-3.20E-02		6.18E-02
	383.85	8.94	7.13E-02		3.43E-01
Cs-134	475.36	1.48	1.63E+00	4.13E-02	2.61E+00
	563.25	8.34	-3.99E-02		4.10E-01
	569.33	15.37	5.11E-02		2.38E-01
	604.72	97.62	4.49E-03		5.87E-02
	795.86	85.46	7.40E-04		4.13E-02
	801.95	8.69	-5.71E-02		3.66E-01
	1038.61	0.99	2.24E+00		4.91E+00
	1167.97	1.79	8.14E-01		3.50E+00
	1365.19	3.02	1.08E-01		1.18E+00
Cs-137	661.66	85.10	3.59E-02	5.12E-02	5.12E-02
Eu-152	121.78	28.67	-1.27E-01	1.15E-01	1.21E-01
	244.70	7.61	1.39E-01		4.65E-01
	295.94	0.45	4.62E+00		8.33E+00
	344.28	26.60	-1.35E-01		1.15E-01
	367.79	0.86	7.62E-01		3.29E+00
	411.12	2.24	-3.95E-02		1.55E+00
	443.96	2.83	-7.19E-01		1.04E+00
	488.68	0.42	-2.36E+00		7.96E+00
	563.99	0.49	-6.73E-01		6.96E+00
	586.26	0.46	1.55E+01		1.24E+01
	678.62	0.47	-3.34E+00		8.18E+00
	688.67	0.86	2.73E-01		4.75E+00
	719.35	0.28	1.21E+01		1.59E+01
	778.90	12.96	-2.44E-01		3.15E-01
	810.45	0.32	3.60E+00		1.19E+01
	867.37	4.26	6.23E-02		1.03E+00
	919.33	0.43	1.38E+00		9.90E+00
	964.08	14.65	3.28E-01		4.08E-01
	1085.87	10.24	-9.99E-02		4.42E-01
	1089.74	1.73	4.77E-01		2.84E+00
	1112.07	13.69	-2.47E-01		3.50E-01
	1212.95	1.43	-1.46E+00		3.70E+00
	1249.94	0.19	2.15E+00		2.84E+01
	1299.14	1.63	6.11E-01		3.06E+00
	1408.01	21.07	-6.21E-02		1.97E-01
	1457.64	0.50	1.12E+02		3.54E+01
	1528.10	0.28	1.33E+00		1.37E+01
Eu-154	123.07	40.40	-5.55E-03	8.74E-02	8.74E-02
	247.93	6.89	1.27E-02		4.45E-01
	591.76	4.95	-3.13E-02		6.77E-01
	692.42	1.78	6.62E-01		2.30E+00
	723.30	20.06	1.77E-01		2.41E-01
	756.80	4.52	1.01E-01		9.74E-01
	873.18	12.08	1.17E-01		3.32E-01

Analysis Report for 10-Oct-19-10046

L1-10208A-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.22E-01	8.74E-02	4.43E-01
	1004.76	18.01	1.87E-01		2.34E-01
	1274.43	34.80	-3.19E-02		1.70E-01
	1596.48	1.80	8.13E-01		1.98E+00
Eu-155	45.30	1.31	-1.87E+00	2.10E-01	1.93E+01
	60.01	1.22	-9.16E+00		1.88E+01
	86.55	30.70	8.83E-02		2.14E-01
	105.31	21.10	3.70E-02		2.10E-01
Ra-226	186.21	3.64	1.43E+00	1.05E+00	1.05E+00
Pa-231	27.36	10.30	1.51E+00	1.28E+00	2.02E+00
	283.69	1.70	-3.54E-01		1.88E+00
	300.07	2.47	-1.73E+00		1.28E+00
	302.65	2.20	-1.20E-01		1.38E+00
	330.06	1.40	-9.87E-01		2.21E+00
U-235	143.76	10.96	1.49E-03	6.76E-02	3.13E-01
	163.33	5.08	1.11E-01		6.15E-01
	185.71	57.20	6.27E-02		6.76E-02
	202.11	1.08	1.14E+00		2.86E+00
	205.31	5.01	3.38E-01		6.43E-01
Am-241	59.54	35.90	-3.20E-01	6.72E-01	6.72E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10047

L1-10208A-FSGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10047
Sample Description	: L1-10208A-FSGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.346E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:30:00PM
Acquisition Started	: 10/10/2019 1:43:07PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80437
Fill Height	: 1346.29 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:58:10PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated

0830 10-4-19

Analysis Report for 10-Oct-19-10047

L1-10208A-FSGS-016SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.74	473 -	482	477.65	1.42E+02	19.26	9.93E+01	0.91
2	351.99	699 -	708	703.91	8.80E+01	12.20	2.70E+01	0.98
3	477.50	952 -	960	954.74	2.48E+01	8.37	2.03E+01	0.65
4	583.33	1161 -	1170	1166.27	4.07E+01	9.43	2.13E+01	1.02
5	609.12	1212 -	1223	1217.81	6.66E+01	9.23	7.38E+00	1.57
6	911.31	1817 -	1826	1822.07	3.68E+01	7.87	1.12E+01	1.83
7	1460.60	2915 -	2928	2921.26	2.16E+02	15.16	5.09E+00	2.19

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	2.42E-01	8.35E-02
K-40	0.99	1460.82	*	10.66	4.22E+00	3.48E-01
Tl-208	0.99	583.19	*	85.00	5.43E-02	1.30E-02
Bi-211	0.87	351.07	*	13.02	5.43E-01	8.70E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.04E-01	3.23E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.71E-01	2.58E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 10-Oct-19-10047

L1-10208A-FSGS-016SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.99E-01	3.18E-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	2.17E-01	4.74E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10047

L1-10208A-FSGS-016SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.998	2.42E-01	8.35E-02	
	K-40	0.992	4.22E+00	3.48E-01	
	Tl-208	0.997	5.43E-02	1.30E-02	
?	Bi-211	0.875	5.43E-01	8.70E-02	
	Pb-212	0.998	2.04E-01	3.23E-02	
	Bi-214	0.997	1.71E-01	2.58E-02	
?	Pb-214	0.513	1.99E-01	3.18E-02	
	Ac-228	0.999	2.17E-01	4.74E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10047

L1-10208A-FSGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:58:10PM
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	5.90E-02	5.07E-02	5.07E-02
+	BE-7	477.60	*	10.44	2.42E-01	2.51E-01	2.51E-01
+	K-40	1460.82	*	10.66	4.22E+00	3.03E-01	3.03E-01
	Mn-54	834.85		99.98	2.51E-02	4.07E-02	4.07E-02
	Co-60	1173.23		99.85	-4.16E-02	4.91E-02	4.91E-02
		1332.49		99.98	2.20E-02		5.14E-02
	Nb-94	702.65		99.81	7.24E-03	3.68E-02	3.68E-02
		871.09		99.89	1.19E-02		3.97E-02
	Ag-108m	79.13		6.60	8.60E-01	3.53E-02	1.11E+00
		433.94		90.50	-7.89E-03		3.53E-02
		614.28		89.80	-2.11E-02		4.58E-02
		722.94		90.80	3.94E-02		4.72E-02
	Sb-125	176.31		6.84	2.44E-01	1.02E-01	4.97E-01
		380.45		1.52	-1.25E+00		1.66E+00
		427.87		29.60	2.62E-02		1.02E-01
		463.36		10.49	1.76E-01		3.32E-01
		600.60		17.65	1.02E-01		1.82E-01
		606.71		4.98	-8.01E-02		1.06E+00
		635.95		11.22	6.70E-02		3.07E-01

Analysis Report for 10-Oct-19-10047

L1-10208A-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-4.04E-01	1.02E-01	2.03E+00
Ba-133	79.61	2.65	9.05E-01	6.45E-02	2.59E+00
	81.00	32.90	-3.01E-01		1.55E-01
	276.40	7.16	1.15E-01		4.19E-01
	302.85	18.34	6.74E-02		1.72E-01
	356.01	62.05	-3.97E-02		6.45E-02
	383.85	8.94	1.75E-03		3.21E-01
Cs-134	475.36	1.48	-1.94E+00	4.82E-02	2.71E+00
	563.25	8.34	5.98E-02		3.88E-01
	569.33	15.37	-8.84E-02		1.92E-01
	604.72	97.62	4.60E-03		4.84E-02
	795.86	85.46	2.75E-03		4.82E-02
	801.95	8.69	-1.91E-01		4.17E-01
	1038.61	0.99	1.68E-01		4.42E+00
	1167.97	1.79	1.30E+00		2.91E+00
	1365.19	3.02	3.84E-02		1.28E+00
Cs-137	661.66	85.10	2.27E-02	5.47E-02	5.47E-02
Eu-152	121.78	28.67	-9.40E-03	1.02E-01	1.02E-01
	244.70	7.61	-1.89E-01		4.30E-01
	295.94	0.45	5.18E+00		8.28E+00
	344.28	26.60	-4.02E-02		1.14E-01
	367.79	0.86	-1.87E+00		3.60E+00
	411.12	2.24	-4.82E-01		1.30E+00
	443.96	2.83	-9.91E-01		9.58E-01
	488.68	0.42	5.18E+00		8.50E+00
	563.99	0.49	2.98E+00		6.77E+00
	586.26	0.46	-6.10E+00		1.08E+01
	678.62	0.47	1.46E+00		7.74E+00
	688.67	0.86	6.81E-01		4.02E+00
	719.35	0.28	-2.80E+00		1.30E+01
	778.90	12.96	-1.68E-01		2.40E-01
	810.45	0.32	-5.39E-01		1.20E+01
	867.37	4.26	1.19E-01		8.94E-01
	919.33	0.43	-1.03E+00		8.71E+00
	964.08	14.65	1.44E-01		3.97E-01
	1085.87	10.24	-1.68E-01		4.63E-01
	1089.74	1.73	1.19E+00		2.70E+00
	1112.07	13.69	-4.71E-02		3.52E-01
	1212.95	1.43	9.75E-01		3.91E+00
	1249.94	0.19	-1.48E+01		2.35E+01
	1299.14	1.63	-1.42E+00		2.80E+00
	1408.01	21.07	8.66E-03		1.74E-01
	1457.64	0.50	-3.62E+00		3.09E+01
	1528.10	0.28	5.30E+00		1.38E+01
Eu-154	123.07	40.40	-2.99E-02	7.14E-02	7.14E-02
	247.93	6.89	6.07E-02		4.54E-01
	591.76	4.95	6.42E-03		6.42E-01
	692.42	1.78	-1.14E+00		1.78E+00
	723.30	20.06	1.34E-01		2.14E-01
	756.80	4.52	-2.70E-01		6.00E-01
	873.18	12.08	-1.16E-01		3.04E-01

Analysis Report for 10-Oct-19-10047

L1-10208A-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-6.19E-03	7.14E-02	3.99E-01
	1004.76	18.01	9.18E-03		2.51E-01
	1274.43	34.80	-3.05E-02		1.26E-01
	1596.48	1.80	-1.63E-01		2.04E+00
Eu-155	45.30	1.31	2.06E+00	1.58E-01	1.08E+01
	60.01	1.22	-2.08E+00		1.15E+01
	86.55	30.70	-3.08E-02		1.58E-01
	105.31	21.10	7.90E-02		1.76E-01
Ra-226	186.21	3.64	3.96E-01	9.56E-01	9.56E-01
Pa-231	27.36	10.30	8.42E-01	1.11E+00	1.11E+00
	283.69	1.70	-5.90E-01		1.60E+00
	300.07	2.47	-1.57E+00		1.23E+00
	302.65	2.20	5.61E-01		1.44E+00
	330.06	1.40	9.72E-01		2.30E+00
U-235	143.76	10.96	6.36E-02	6.07E-02	2.80E-01
	163.33	5.08	-2.41E-01		6.29E-01
	185.71	57.20	2.46E-02		6.07E-02
	202.11	1.08	4.95E-01		3.06E+00
	205.31	5.01	-8.42E-02		6.72E-01
Am-241	59.54	35.90	-2.38E-01	3.86E-01	3.86E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10048

L1-10208A-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10048
Sample Description	: L1-10208A-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.578E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:32:00PM
Acquisition Started	: 10/10/2019 1:43:15PM
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80438
Fill Height	: 1577.80 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:58:20PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 10-11-19

Analysis Report for 10-Oct-19-10048

L1-10208A-FSGS-017SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	948 -	961	954.68	1.17E+02	18.32	7.91E+01	0.61
2	295.09	1174 -	1188	1180.28	6.63E+01	12.07	2.77E+01	0.71
3	351.98	1401 -	1414	1407.67	6.06E+01	12.90	3.84E+01	0.59
4	583.20	2325 -	2338	2331.99	4.65E+01	8.68	1.05E+01	0.72
5	609.33	2430 -	2441	2436.48	4.54E+01	9.89	2.06E+01	1.21
6	911.38	3638 -	3652	3644.50	4.22E+01	7.46	4.80E+00	1.17
7	1460.83	5833 -	5855	5843.17	2.23E+02	15.26	2.59E+00	1.02

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	5.52E+00	4.47E-01
Tl-208	1.00	583.19	*	85.00	7.71E-02	1.51E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.08E-01	3.66E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.45E-01	3.27E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Oct-19-10048

L1-10208A-FSGS-017SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	3.14E-01	6.25E-02
		351.93	*	35.60	1.69E-01	3.83E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.12E-01	5.68E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10048

L1-10208A-FSGS-017SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	5.52E+00	4.47E-01	
	Tl-208	1.000	7.71E-02	1.51E-02	
X	Bi-211	0.875			
	Pb-212	1.000	2.08E-01	3.66E-02	
	Bi-214	1.000	1.45E-01	3.27E-02	
	Pb-214	0.999	2.08E-01	3.27E-02	
	Ac-228	0.998	3.12E-01	5.68E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10048

L1-10208A-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:58:20PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	1.43E-02	5.83E-02	5.83E-02
	BE-7	477.60		10.44	8.75E-02	4.48E-01	4.48E-01
+	K-40	1460.82	*	10.66	5.52E+00	3.27E-01	3.27E-01
	Mn-54	834.85		99.98	2.63E-02	5.63E-02	5.63E-02
	Co-60	1173.23		99.85	4.86E-02	5.42E-02	8.01E-02
		1332.49		99.98	2.72E-02		5.42E-02
	Nb-94	702.65		99.81	-4.21E-02	4.19E-02	4.30E-02
		871.09		99.89	1.69E-03		4.19E-02
	Ag-108m	79.13		6.60	1.27E+00	4.63E-02	2.07E+00
		433.94		90.50	-1.99E-02		4.63E-02
		614.28		89.80	-9.40E-02		6.75E-02
		722.94		90.80	-1.92E-03		6.23E-02
	Sb-125	176.31		6.84	-2.40E-01	1.20E-01	5.68E-01
		380.45		1.52	-8.66E-01		2.54E+00
		427.87		29.60	-1.78E-02		1.20E-01
		463.36		10.49	1.59E-01		4.02E-01
		600.60		17.65	1.71E-01		2.86E-01
		606.71		4.98	1.49E+00		1.46E+00
		635.95		11.22	-9.96E-02		3.95E-01

Analysis Report for 10-Oct-19-10048

L1-10208A-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.28E+00	1.20E-01	2.49E+00
Ba-133	79.61	2.65	1.04E+00	7.91E-02	4.86E+00
	81.00	32.90	-3.74E-01		3.24E-01
	276.40	7.16	-1.71E-01		5.38E-01
	302.85	18.34	1.89E-03		2.00E-01
	356.01	62.05	-5.72E-02		7.91E-02
	383.85	8.94	4.37E-02		4.46E-01
Cs-134	475.36	1.48	1.39E+00	5.85E-02	3.24E+00
	563.25	8.34	1.53E-01		5.30E-01
	569.33	15.37	3.57E-02		2.55E-01
	604.72	97.62	-2.93E-02		6.62E-02
	795.86	85.46	4.90E-02		5.85E-02
	801.95	8.69	-2.35E-01		6.04E-01
	1038.61	0.99	9.23E-01		5.45E+00
	1167.97	1.79	4.09E-01		4.18E+00
	1365.19	3.02	-7.34E-01		1.56E+00
Cs-137	661.66	85.10	2.39E-02	6.45E-02	6.45E-02
Eu-152	121.78	28.67	1.36E-01	1.42E-01	1.70E-01
	244.70	7.61	-9.65E-02		5.75E-01
	295.94	0.45	1.18E+01		1.12E+01
	344.28	26.60	2.52E-03		1.42E-01
	367.79	0.86	1.75E+00		4.20E+00
	411.12	2.24	2.39E-01		1.73E+00
	443.96	2.83	-1.53E+00		1.46E+00
	488.68	0.42	-1.03E+00		8.91E+00
	563.99	0.49	8.06E+00		9.10E+00
	586.26	0.46	-2.59E+00		1.35E+01
	678.62	0.47	2.01E+00		9.65E+00
	688.67	0.86	2.43E+00		4.75E+00
	719.35	0.28	5.97E+00		1.84E+01
	778.90	12.96	3.02E-02		3.85E-01
	810.45	0.32	1.44E+00		1.60E+01
	867.37	4.26	-1.72E+00		1.00E+00
	919.33	0.43	-1.12E+00		1.09E+01
	964.08	14.65	-3.62E-02		4.79E-01
	1085.87	10.24	6.66E-02		5.92E-01
	1089.74	1.73	-1.19E+00		3.40E+00
	1112.07	13.69	-3.86E-01		2.99E-01
	1212.95	1.43	1.21E+00		4.86E+00
	1249.94	0.19	1.06E+01		3.84E+01
	1299.14	1.63	7.59E-01		3.85E+00
	1408.01	21.07	7.29E-02		1.78E-01
	1457.64	0.50	1.21E+02		3.97E+01
	1528.10	0.28	2.14E+00		1.51E+01
Eu-154	123.07	40.40	5.89E-02	1.19E-01	1.19E-01
	247.93	6.89	-1.19E-01		5.87E-01
	591.76	4.95	-3.54E-02		8.13E-01
	692.42	1.78	1.58E+00		2.52E+00
	723.30	20.06	-1.15E-01		2.73E-01
	756.80	4.52	-1.31E-01		1.03E+00
	873.18	12.08	1.97E-01		3.64E-01

Analysis Report for 10-Oct-19-10048

L1-10208A-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.64E-01	1.19E-01	5.72E-01
	1004.76	18.01	-1.30E-02		3.20E-01
	1274.43	34.80	-1.34E-01		1.70E-01
	1596.48	1.80	6.63E-01		2.71E+00
Eu-155	45.30	1.31	5.56E+00	2.74E-01	3.06E+01
	60.01	1.22	6.22E-01		3.03E+01
	86.55	30.70	7.60E-02		2.82E-01
	105.31	21.10	2.08E-01		2.74E-01
Ra-226	186.21	3.64	4.78E-01	1.25E+00	1.25E+00
Pa-231	27.36	10.30	3.34E+00	1.49E+00	3.89E+00
	283.69	1.70	7.49E-02		2.38E+00
	300.07	2.47	-5.76E-01		1.49E+00
	302.65	2.20	2.72E-01		1.67E+00
	330.06	1.40	-9.82E-01		2.96E+00
U-235	143.76	10.96	-2.37E-01	7.93E-02	4.23E-01
	163.33	5.08	4.31E-01		8.24E-01
	185.71	57.20	3.23E-02		7.93E-02
	202.11	1.08	-2.07E-01		3.72E+00
	205.31	5.01	2.13E-01		8.32E-01
Am-241	59.54	35.90	6.63E-02	1.10E+00	1.10E+00

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

Apex-Gamma

Analysis Report for 10-Oct-19-10049

L1-10208A-FSGS-018SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10049
Sample Description	: L1-10208A-FSGS-018SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.525E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:34:00PM
Acquisition Started	: 10/10/2019 1:43:24PM
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80439
Fill Height	: 1525.06 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:58:39PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 10-11-19

Analysis Report for 10-Oct-19-10049

L1-10208A-FSGS-018SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.75	946 -	959	954.57	1.02E+02	17.17	6.96E+01	1.37
2	295.45	1174 -	1186	1181.10	3.40E+01	11.46	3.70E+01	0.31
3	351.97	1402 -	1413	1406.89	6.61E+01	10.65	1.89E+01	0.63
4	582.90	2324 -	2337	2329.73	5.17E+01	8.52	7.28E+00	0.92
5	609.05	2429 -	2441	2434.23	5.30E+01	8.27	6.00E+00	0.54
6	1459.97	5827 -	5848	5837.82	2.45E+02	16.28	5.50E+00	0.79

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.89	1460.82	*	10.66	5.49E+00	4.36E-01
Tl-208	0.98	583.19	*	85.00	7.79E-02	1.37E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.63E-01	3.03E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.54E-01	2.57E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 10-Oct-19-10049

L1-10208A-FSGS-018SS

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	1.45E-01	5.04E-02
		351.93	*	35.60	1.66E-01	2.99E-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	0.891	5.49E+00	4.36E-01	
	Tl-208	0.987	7.79E-02	1.37E-02	
X	Bi-211	0.878			
	Pb-212	0.998	1.63E-01	3.03E-02	
	Bi-214	0.995	1.54E-01	2.57E-02	
	Pb-214	0.997	1.61E-01	2.57E-02	

Analysis Report for 10-Oct-19-10049

L1-10208A-FSGS-018SS

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10049

L1-10208A-FSGS-018SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:58:39PM
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	8.72E-02	5.68E-02	5.68E-02
	BE-7	477.60		10.44	2.27E-01	3.60E-01	3.60E-01
+	K-40	1460.82	*	10.66	5.49E+00	4.10E-01	4.10E-01
	Mn-54	834.85		99.98	2.31E-02	4.41E-02	4.41E-02
	Co-60	1173.23		99.85	2.70E-02	4.78E-02	4.78E-02
		1332.49		99.98	2.90E-02		5.31E-02
	Nb-94	702.65		99.81	-1.66E-02	3.77E-02	3.77E-02
		871.09		99.89	6.07E-03		4.09E-02
	Ag-108m	79.13		6.60	9.78E-01	3.25E-02	1.17E+00
		433.94		90.50	8.11E-03		3.25E-02
		614.28		89.80	-1.23E-02		4.91E-02
		722.94		90.80	-1.39E-02		4.46E-02
	Sb-125	176.31		6.84	1.08E-01	1.22E-01	4.44E-01
		380.45		1.52	2.90E-01		2.33E+00
		427.87		29.60	9.20E-02		1.22E-01
		463.36		10.49	9.45E-03		3.79E-01
		600.60		17.65	2.07E-01		2.62E-01
		606.71		4.98	1.52E+00		1.23E+00
		635.95		11.22	9.05E-02		3.98E-01

Analysis Report for 10-Oct-19-10049

L1-10208A-FSGS-018SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-5.37E-01	1.22E-01	1.79E+00
Ba-133	79.61	2.65	1.70E+00	5.93E-02	2.78E+00
	81.00	32.90	-4.64E-01		1.70E-01
	276.40	7.16	5.38E-01		4.73E-01
	302.85	18.34	2.11E-02		1.72E-01
	356.01	62.05	-2.10E-02		5.93E-02
	383.85	8.94	1.68E-01		4.04E-01
Cs-134	475.36	1.48	-6.11E-01	5.24E-02	2.44E+00
	563.25	8.34	-1.09E-01		5.21E-01
	569.33	15.37	-3.82E-02		2.28E-01
	604.72	97.62	-5.21E-02		5.94E-02
	795.86	85.46	-3.24E-03		5.24E-02
	801.95	8.69	-1.40E-01		4.26E-01
	1038.61	0.99	-2.20E+00		4.23E+00
	1167.97	1.79	-1.55E+00		2.46E+00
	1365.19	3.02	-2.52E-02		1.10E+00
Cs-137	661.66	85.10	4.54E-02	5.57E-02	5.57E-02
Eu-152	121.78	28.67	8.15E-02	1.11E-01	1.11E-01
	244.70	7.61	-5.52E-03		4.59E-01
	295.94	0.45	6.91E+00		9.45E+00
	344.28	26.60	3.92E-02		1.23E-01
	367.79	0.86	2.96E+00		3.57E+00
	411.12	2.24	1.01E+00		1.46E+00
	443.96	2.83	2.15E-01		1.24E+00
	488.68	0.42	3.77E+00		8.31E+00
	563.99	0.49	-1.05E+01		8.17E+00
	586.26	0.46	-7.51E+00		1.20E+01
	678.62	0.47	6.50E-02		7.64E+00
	688.67	0.86	-2.27E+00		3.88E+00
	719.35	0.28	-1.85E+00		1.20E+01
	778.90	12.96	-2.36E-01		2.58E-01
	810.45	0.32	3.86E+00		1.16E+01
	867.37	4.26	3.49E-02		9.98E-01
	919.33	0.43	6.03E+00		9.93E+00
	964.08	14.65	3.74E-01		4.40E-01
	1085.87	10.24	2.67E-01		3.97E-01
	1089.74	1.73	-5.54E-01		2.28E+00
	1112.07	13.69	-3.68E-02		3.28E-01
	1212.95	1.43	8.23E-01		3.81E+00
	1249.94	0.19	-1.33E+01		3.04E+01
	1299.14	1.63	7.46E-01		2.63E+00
	1408.01	21.07	1.97E-02		1.72E-01
	1457.64	0.50	1.20E+02		3.78E+01
	1528.10	0.28	-1.31E+01		1.10E+01
Eu-154	123.07	40.40	-1.77E-03	7.60E-02	7.60E-02
	247.93	6.89	1.04E-01		4.37E-01
	591.76	4.95	-3.08E-01		7.62E-01
	692.42	1.78	-3.07E-01		2.01E+00
	723.30	20.06	7.26E-03		2.09E-01
	756.80	4.52	-1.04E-01		9.56E-01
	873.18	12.08	2.58E-01		3.68E-01

Analysis Report for 10-Oct-19-10049

L1-10208A-FSGS-018SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.99E-01	7.60E-02	3.99E-01
	1004.76	18.01	1.31E-01		2.72E-01
	1274.43	34.80	2.08E-02		1.37E-01
	1596.48	1.80	1.28E+00		2.47E+00
Eu-155	45.30	1.31	-3.30E+00	1.72E-01	1.07E+01
	60.01	1.22	2.47E+00		1.20E+01
	86.55	30.70	5.07E-02		1.74E-01
	105.31	21.10	3.41E-02		1.72E-01
Ra-226	186.21	3.64	5.29E-01	8.88E-01	8.88E-01
Pa-231	27.36	10.30	8.52E-01	1.15E+00	1.15E+00
	283.69	1.70	-1.38E+00		1.60E+00
	300.07	2.47	3.21E-02		1.29E+00
	302.65	2.20	-3.19E-01		1.41E+00
	330.06	1.40	-1.87E-01		2.35E+00
U-235	143.76	10.96	4.37E-02	5.60E-02	3.00E-01
	163.33	5.08	1.35E-01		6.11E-01
	185.71	57.20	3.83E-02		5.60E-02
	202.11	1.08	5.29E-01		2.75E+00
	205.31	5.01	1.41E-01		6.28E-01
Am-241	59.54	35.90	2.45E-01	4.24E-01	4.24E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10050
L1-10208A-FSGS-019SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10050
Sample Description	: L1-10208A-FSGS-019SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.459E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:36:00PM
Acquisition Started	: 10/10/2019 1:43:33PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80440
Fill Height	: 1458.94 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 1:58:42PM

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

Data Validated
0830 10-11-19

Analysis Report for 10-Oct-19-10050

L1-10208A-FSGS-019SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.08	306 -	313	309.63	3.58E+01	12.06	5.42E+01	0.73
	2	220.84	880 -	889	883.93	1.65E+01	9.50	3.25E+01	0.71
M	3	238.67	949 -	974	955.17	1.89E+02	14.35	4.51E+01	1.06
m	4	241.21	949 -	974	965.32	6.32E+01	8.98	4.27E+01	1.07
	5	295.10	1173 -	1185	1180.64	8.04E+01	13.77	4.16E+01	1.25
	6	338.31	1348 -	1359	1353.28	2.68E+01	10.67	3.42E+01	0.35
	7	351.91	1400 -	1413	1407.63	1.15E+02	14.73	3.68E+01	0.97
	8	582.90	2325 -	2340	2330.91	6.17E+01	10.94	1.93E+01	1.36
	9	609.31	2428 -	2443	2436.50	1.06E+02	13.13	2.21E+01	1.18
	10	661.60	2639 -	2652	2645.57	2.44E+01	9.31	2.26E+01	0.82
	11	968.83	3869 -	3880	3874.39	2.56E+01	7.18	1.04E+01	0.50
	12	1460.71	5830 -	5856	5843.22	4.21E+02	22.22	1.67E+01	1.51

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.94E+00	6.11E-01
Cs-137	0.99	661.66	*	85.10	3.84E-02	1.48E-02
Tl-208	0.98	583.19	*	85.00	8.91E-02	1.67E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.99E-01	3.31E-02

Analysis Report for 10-Oct-19-10050

L1-10208A-FSGS-019SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	1.00	300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	3.35E-01	1.18E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	2.95E-01	4.06E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.98	241.99	*	7.25	6.03E-01	9.84E-02
		295.22	*	18.42	3.37E-01	6.38E-02
		351.93	*	35.60	2.83E-01	4.27E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	5.91E-01	2.10E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.02E-01	8.22E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97	*	15.80	2.79E-01	7.91E-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

Analysis Report for 10-Oct-19-10050

L1-10208A-FSGS-019SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	8.94E+00	6.11E-01	
	Cs-137	0.999	3.84E-02	1.48E-02	
	Tl-208	0.987	8.91E-02	1.67E-02	
X	Bi-211	0.893			
	Pb-212	1.000	2.99E-01	3.31E-02	
?	Pb212-XR	1.000	3.35E-01	1.18E-01	
	Bi-214	1.000	2.95E-01	4.06E-02	
	Pb-214	0.988	3.35E-01	3.34E-02	
?	Pb214-XR	1.000	5.91E-01	2.10E-01	
	Ac-228	0.999	2.42E-01	5.70E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10050

L1-10208A-FSGS-019SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 1:58:42PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
2	220.84	1.83333E-02	57.56		

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	8.67E-02	6.40E-02	6.40E-02
	BE-7	477.60		10.44	2.03E-01	4.40E-01	4.40E-01
+	K-40	1460.82	*	10.66	8.94E+00	6.74E-01	6.74E-01
	Mn-54	834.85		99.98	-5.31E-04	5.13E-02	5.13E-02
	Co-60	1173.23		99.85	5.18E-02	6.07E-02	7.74E-02
		1332.49		99.98	6.13E-02		6.07E-02
	Nb-94	702.65		99.81	-5.63E-02	4.18E-02	4.18E-02
		871.09		99.89	-2.76E-02		5.56E-02
	Ag-108m	79.13		6.60	9.31E-01	4.73E-02	1.63E+00
		433.94		90.50	-8.61E-04		4.73E-02
		614.28		89.80	-8.86E-02		8.81E-02
		722.94		90.80	2.96E-02		5.63E-02
	Sb-125	176.31		6.84	2.23E-01	1.48E-01	5.51E-01
		380.45		1.52	-1.41E+00		2.59E+00
		427.87		29.60	1.13E-01		1.48E-01
		463.36		10.49	-1.97E-01		3.80E-01
		600.60		17.65	2.62E-03		2.69E-01
		606.71		4.98	2.83E+00		1.64E+00

Analysis Report for 10-Oct-19-10050

L1-10208A-FSGS-019SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	635.95		11.22	2.24E-01	1.48E-01	3.90E-01
		671.44		1.79	2.51E-02		2.80E+00
	Ba-133	79.61		2.65	-3.82E+00	8.84E-02	3.93E+00
		81.00		32.90	-2.89E-01		2.77E-01
		276.40		7.16	-4.62E-01		5.68E-01
		302.85		18.34	1.38E-01		2.31E-01
		356.01		62.05	-6.14E-02		8.84E-02
		383.85		8.94	-6.80E-02		4.95E-01
	Cs-134	475.36		1.48	-7.46E-01	6.13E-02	2.87E+00
		563.25		8.34	1.91E-01		5.01E-01
		569.33		15.37	-1.09E-01		2.79E-01
		604.72		97.62	-1.58E-03		7.57E-02
		795.86		85.46	4.39E-03		6.13E-02
		801.95		8.69	-1.70E-01		5.17E-01
		1038.61		0.99	-2.73E-01		4.80E+00
		1167.97		1.79	1.36E+00		4.34E+00
		1365.19		3.02	-9.64E-01		1.53E+00
+	Cs-137	661.66	*	85.10	3.84E-02	4.65E-02	4.65E-02
	Eu-152	121.78		28.67	7.41E-02	1.35E-01	1.59E-01
		244.70		7.61	-4.04E-01		6.12E-01
		295.94		0.45	9.99E+00		1.22E+01
		344.28		26.60	-3.41E-02		1.35E-01
		367.79		0.86	-3.22E+00		4.71E+00
		411.12		2.24	-1.27E+00		1.92E+00
		443.96		2.83	-1.08E+00		1.37E+00
		488.68		0.42	7.19E+00		1.02E+01
		563.99		0.49	4.90E-01		8.41E+00
		586.26		0.46	1.78E+01		1.45E+01
		678.62		0.47	-5.39E+00		9.99E+00
		688.67		0.86	-2.25E+00		5.48E+00
		719.35		0.28	1.08E+00		1.62E+01
		778.90		12.96	-2.19E-01		3.54E-01
		810.45		0.32	-2.42E+00		1.41E+01
		867.37		4.26	-9.27E-01		1.34E+00
		919.33		0.43	-7.30E+00		1.13E+01
		964.08		14.65	4.80E-02		5.13E-01
		1085.87		10.24	-1.49E-01		5.79E-01
		1089.74		1.73	-5.61E-01		3.39E+00
		1112.07		13.69	-2.62E-01		4.00E-01
		1212.95		1.43	-1.78E+00		5.08E+00
		1249.94		0.19	-1.74E+00		3.52E+01
		1299.14		1.63	1.38E-01		3.84E+00
		1408.01		21.07	-9.53E-02		2.04E-01
		1457.64		0.50	1.97E+02		4.71E+01
		1528.10		0.28	-1.83E+00		1.21E+01
	Eu-154	123.07		40.40	1.18E-02	1.10E-01	1.10E-01
		247.93		6.89	-2.42E-01		5.59E-01
		591.76		4.95	6.56E-01		9.89E-01
		692.42		1.78	-9.52E-02		2.72E+00
		723.30		20.06	9.36E-02		2.53E-01
		756.80		4.52	-6.40E-02		1.06E+00

Analysis Report for 10-Oct-19-10050

L1-10208A-FSGS-019SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	-8.58E-02	1.10E-01	4.60E-01
	996.29	10.48	-2.68E-01		5.61E-01
	1004.76	18.01	-1.22E-02		3.13E-01
	1274.43	34.80	-1.25E-02		1.77E-01
	1596.48	1.80	-2.01E+00		2.72E+00
Eu-155	45.30	1.31	-6.42E+00	2.36E-01	2.20E+01
	60.01	1.22	-5.61E+00		2.48E+01
	86.55	30.70	-1.08E-01		2.70E-01
	105.31	21.10	-2.26E-01		2.36E-01
Ra-226	186.21	3.64	7.44E-01	1.27E+00	1.27E+00
Pa-231	27.36	10.30	1.63E+00	1.84E+00	2.50E+00
	283.69	1.70	-1.47E-01		2.25E+00
	300.07	2.47	-2.58E+00		1.84E+00
	302.65	2.20	1.30E+00		1.93E+00
	330.06	1.40	1.11E+00		3.07E+00
U-235	143.76	10.96	2.62E-01	8.13E-02	4.05E-01
	163.33	5.08	-6.23E-01		7.83E-01
	185.71	57.20	8.86E-02		8.13E-02
	202.11	1.08	5.31E-01		3.88E+00
	205.31	5.01	-6.72E-01		8.15E-01
Am-241	59.54	35.90	1.54E-01	8.90E-01	8.90E-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

Analysis Report for 10-Oct-19-10051

L1-10208A-FQGS-019SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10051
Sample Description	: L1-10208A-FQGS-019SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.366E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:36:00PM
Acquisition Started	: 10/10/2019 2:01:47PM
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80441
Fill Height	: 1366.23 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 2:16:50PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 10-11-19

Analysis Report for 10-Oct-19-10051

L1-10208A-FQGS-019SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.20	306 -	313	310.09	3.06E+01	12.66	6.44E+01	0.89
2	238.69	949 -	961	955.23	1.60E+02	20.29	9.49E+01	0.86
3	295.21	1174 -	1188	1181.07	7.15E+01	13.18	3.55E+01	1.32
4	338.33	1348 -	1358	1353.37	4.42E+01	9.74	2.08E+01	0.72
5	351.90	1399 -	1415	1407.61	1.34E+02	16.55	4.46E+01	1.24
6	582.93	2325 -	2339	2331.03	6.44E+01	10.60	1.66E+01	1.07
7	609.26	2428 -	2443	2436.29	8.10E+01	13.09	3.00E+01	0.93
8	661.40	2639 -	2649	2644.79	2.86E+01	7.72	1.24E+01	0.80
9	911.18	3636 -	3651	3643.76	6.19E+01	10.81	1.81E+01	0.43
10	1460.60	5830 -	5855	5842.76	4.36E+02	21.49	6.28E+00	2.06

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.44E+00	6.20E-01
Cs-137	0.99	661.66	*	85.10	4.57E-02	1.26E-02
Tl-208	0.98	583.19	*	85.00	9.47E-02	1.66E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.56E-01	3.85E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		

Analysis Report for 10-Oct-19-10051

L1-10208A-FQGS-019SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	77.11	*	17.10	2.89E-01	1.23E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	2.29E-01	3.95E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	3.05E-01	6.12E-02
		351.93	*	35.60	3.35E-01	4.92E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	5.09E-01	2.18E-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	3.38E-01	7.96E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	4.03E-01	7.26E-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 10-Oct-19-10051

L1-10208A-FQGS-019SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.992	9.44E+00	6.20E-01	
	Cs-137	0.990	4.57E-02	1.26E-02	
	Tl-208	0.989	9.47E-02	1.66E-02	
X	Bi-211	0.895			
	Pb-212	1.000	2.56E-01	3.85E-02	
?	Pb212-XR	0.999	2.89E-01	1.23E-01	
	Bi-214	1.000	2.29E-01	3.95E-02	
	Pb-214	1.000	3.23E-01	3.84E-02	
?	Pb214-XR	0.999	5.09E-01	2.18E-01	
	Ac-228	1.000	3.74E-01	5.36E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10051

L1-10208A-FQGS-019SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 2:16:50PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.61E-02	6.22E-02	6.22E-02
	BE-7	477.60		10.44	1.96E-01	5.07E-01	5.07E-01
+	K-40	1460.82	*	10.66	9.44E+00	4.38E-01	4.38E-01
	Mn-54	834.85		99.98	3.98E-02	5.97E-02	5.97E-02
	Co-60	1173.23		99.85	3.52E-02	6.92E-02	7.44E-02
		1332.49		99.98	1.83E-02		6.92E-02
	Nb-94	702.65		99.81	1.73E-02	5.23E-02	5.26E-02
		871.09		99.89	4.04E-02		5.23E-02
	Ag-108m	79.13		6.60	3.72E-01	4.61E-02	1.59E+00
		433.94		90.50	1.10E-03		4.61E-02
		614.28		89.80	-4.23E-02		8.14E-02
		722.94		90.80	5.48E-02		6.21E-02
	Sb-125	176.31		6.84	-1.30E-01	1.33E-01	5.45E-01
		380.45		1.52	1.02E+00		2.70E+00
		427.87		29.60	1.55E-02		1.33E-01
		463.36		10.49	-1.26E-01		4.13E-01
		600.60		17.65	-8.45E-02		2.59E-01
		606.71		4.98	2.25E+00		1.58E+00
		635.95		11.22	-1.66E-01		4.47E-01

Analysis Report for 10-Oct-19-10051

L1-10208A-FQGS-019SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-1.45E+00	1.33E-01	2.64E+00
	Ba-133	79.61		2.65	-2.24E+00	9.76E-02	3.87E+00
		81.00		32.90	-5.11E-01		2.58E-01
		276.40		7.16	-4.76E-01		5.50E-01
		302.85		18.34	8.71E-02		2.16E-01
		356.01		62.05	-4.88E-03		9.76E-02
		383.85		8.94	1.52E-01		4.66E-01
	Cs-134	475.36		1.48	2.36E+00	6.68E-02	3.52E+00
		563.25		8.34	2.85E-01		5.04E-01
		569.33		15.37	-1.06E-01		2.69E-01
		604.72		97.62	1.91E-02		7.46E-02
		795.86		85.46	4.79E-02		6.68E-02
		801.95		8.69	-6.12E-03		5.91E-01
		1038.61		0.99	3.45E+00		5.57E+00
		1167.97		1.79	1.35E+00		4.18E+00
		1365.19		3.02	1.28E-01		1.61E+00
+	Cs-137	661.66	*	85.10	4.57E-02	3.48E-02	3.48E-02
	Eu-152	121.78		28.67	6.46E-02	1.47E-01	1.57E-01
		244.70		7.61	-1.44E-02		5.73E-01
		295.94		0.45	1.35E+01		1.12E+01
		344.28		26.60	-1.06E-01		1.47E-01
		367.79		0.86	1.44E+00		4.32E+00
		411.12		2.24	-1.16E-01		1.85E+00
		443.96		2.83	-2.18E+00		1.45E+00
		488.68		0.42	6.47E-01		1.05E+01
		563.99		0.49	1.80E+00		8.46E+00
		586.26		0.46	1.92E+01		1.48E+01
		678.62		0.47	-7.77E+00		1.02E+01
		688.67		0.86	2.19E+00		5.93E+00
		719.35		0.28	-6.50E+00		1.67E+01
		778.90		12.96	-8.15E-02		3.88E-01
		810.45		0.32	5.25E-01		1.53E+01
		867.37		4.26	-6.57E-01		1.13E+00
		919.33		0.43	-1.58E+01		1.20E+01
		964.08		14.65	4.63E-01		4.95E-01
		1085.87		10.24	2.36E-01		5.53E-01
		1089.74		1.73	-2.08E+00		3.37E+00
		1112.07		13.69	-2.33E-01		5.10E-01
		1212.95		1.43	5.18E-01		5.03E+00
		1249.94		0.19	-1.86E+01		3.24E+01
		1299.14		1.63	3.26E-01		3.86E+00
		1408.01		21.07	9.27E-02		2.65E-01
		1457.64		0.50	2.01E+02		4.79E+01
		1528.10		0.28	3.33E-01		1.32E+01
	Eu-154	123.07		40.40	4.09E-02	1.11E-01	1.11E-01
		247.93		6.89	-1.71E-01		5.34E-01
		591.76		4.95	2.97E-01		9.56E-01
		692.42		1.78	-1.57E+00		2.53E+00
		723.30		20.06	1.60E-01		2.79E-01
		756.80		4.52	6.24E-01		1.09E+00
		873.18		12.08	-1.13E-01		4.11E-01

Analysis Report for 10-Oct-19-10051

L1-10208A-FQGS-019SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	5.12E-02	1.11E-01	5.04E-01
	1004.76	18.01	1.79E-02		3.27E-01
	1274.43	34.80	2.09E-02		1.95E-01
	1596.48	1.80	1.38E+00		2.48E+00
Eu-155	45.30	1.31	5.36E+00	2.44E-01	2.17E+01
	60.01	1.22	6.38E+00		2.42E+01
	86.55	30.70	1.84E-01		2.69E-01
	105.31	21.10	5.19E-02		2.44E-01
Ra-226	186.21	3.64	1.48E+00	1.23E+00	1.23E+00
Pa-231	27.36	10.30	2.42E-01	1.72E+00	2.27E+00
	283.69	1.70	-1.26E+00		2.29E+00
	300.07	2.47	-1.72E-01		1.72E+00
	302.65	2.20	-2.60E-01		1.77E+00
	330.06	1.40	1.14E+00		2.96E+00
U-235	143.76	10.96	-2.17E-02	7.98E-02	4.02E-01
	163.33	5.08	2.37E-01		8.46E-01
	185.71	57.20	1.33E-01		7.98E-02
	202.11	1.08	7.87E-03		3.81E+00
	205.31	5.01	-1.67E+00		7.38E-01
Am-241	59.54	35.90	-2.96E-01	8.30E-01	8.30E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10052
L1-10208A-FSGS-020SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10052
Sample Description	: L1-10208A-FSGS-020SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.506E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:38:00PM
Acquisition Started	: 10/10/2019 2:01:57PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80442
Fill Height	: 1505.73 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 2:17:00PM

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

Data Validated
0830 10-11-19

Analysis Report for 10-Oct-19-10052

L1-10208A-FSGS-020SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	473 -	481	477.48	1.51E+02	18.96	9.56E+01	1.19
2	338.30	672 -	681	676.58	4.25E+01	11.86	4.35E+01	0.96
3	352.07	699 -	708	704.09	8.31E+01	12.96	3.69E+01	1.12
4	583.14	1160 -	1169	1165.88	4.30E+01	9.38	2.00E+01	1.36
5	609.21	1212 -	1223	1217.99	5.81E+01	10.86	2.39E+01	0.76
6	911.16	1816 -	1827	1821.77	4.00E+01	8.82	1.50E+01	1.67
7	969.05	1933 -	1944	1937.57	2.22E+01	7.58	1.38E+01	1.38
8	1460.70	2913 -	2928	2921.45	2.21E+02	15.67	8.13E+00	1.88

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	4.17E+00	3.47E-01
Tl-208	1.00	583.19	*	85.00	5.56E-02	1.26E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.13E-01	3.17E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.45E-01	2.84E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 10-Oct-19-10052

L1-10208A-FSGS-020SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.83E-01	3.20E-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	2.87E-01	8.35E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.28E-01	5.14E-02
		964.77		4.99		
		968.97	*	15.80	2.15E-01	7.42E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10052

L1-10208A-FSGS-020SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.997	4.17E+00	3.47E-01	
Tl-208	1.000	5.56E-02	1.26E-02	
Pb-212	1.000	2.13E-01	3.17E-02	
Bi-214	0.999	1.45E-01	2.84E-02	
Pb-214	0.998	1.83E-01	3.20E-02	
Ac-228	1.000	2.37E-01	3.77E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10052

L1-10208A-FSGS-020SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 2:17:00PM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.59E-02	4.87E-02	4.87E-02
	BE-7	477.60		10.44	2.08E-01	3.55E-01	3.55E-01
+	K-40	1460.82	*	10.66	4.17E+00	3.73E-01	3.73E-01
	Mn-54	834.85		99.98	-3.49E-04	3.47E-02	3.47E-02
	Co-60	1173.23		99.85	9.11E-03	4.58E-02	5.35E-02
		1332.49		99.98	1.91E-02		4.58E-02
	Nb-94	702.65		99.81	-3.34E-04	3.46E-02	3.46E-02
		871.09		99.89	-2.45E-03		3.56E-02
	Ag-108m	79.13		6.60	8.67E-01	3.08E-02	1.13E+00
		433.94		90.50	-3.49E-03		3.08E-02
		614.28		89.80	-2.11E-02		4.53E-02
		722.94		90.80	4.55E-03		4.19E-02
	Sb-125	176.31		6.84	-1.17E-01	9.08E-02	4.41E-01
		380.45		1.52	-7.58E-01		1.93E+00
		427.87		29.60	-3.31E-02		9.08E-02
		463.36		10.49	2.13E-01		3.49E-01
		600.60		17.65	1.44E-02		2.18E-01
		606.71		4.98	3.86E-02		1.16E+00
		635.95		11.22	4.50E-02		3.07E-01

Analysis Report for 10-Oct-19-10052

L1-10208A-FSGS-020SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	9.72E-01	9.08E-02	2.05E+00
Ba-133	79.61	2.65	1.56E+00	6.68E-02	2.64E+00
	81.00	32.90	-1.80E-01		1.68E-01
	276.40	7.16	-4.69E-03		4.06E-01
	302.85	18.34	5.66E-02		1.75E-01
	356.01	62.05	-5.61E-02		6.68E-02
	383.85	8.94	1.08E-01		3.46E-01
Cs-134	475.36	1.48	4.56E-01	3.93E-02	2.44E+00
	563.25	8.34	1.01E-01		3.71E-01
	569.33	15.37	3.50E-02		2.09E-01
	604.72	97.62	1.56E-03		5.47E-02
	795.86	85.46	-1.94E-02		3.93E-02
	801.95	8.69	2.26E-01		4.20E-01
	1038.61	0.99	8.58E-01		3.86E+00
	1167.97	1.79	-6.04E-01		2.98E+00
	1365.19	3.02	2.86E-02		1.15E+00
Cs-137	661.66	85.10	7.25E-02	6.16E-02	6.16E-02
Eu-152	121.78	28.67	-1.24E-02	1.11E-01	1.11E-01
	244.70	7.61	-2.93E-01		4.28E-01
	295.94	0.45	5.33E+00		8.50E+00
	344.28	26.60	-8.67E-02		1.17E-01
	367.79	0.86	-1.32E+00		3.41E+00
	411.12	2.24	2.64E-01		1.49E+00
	443.96	2.83	-1.33E-01		1.16E+00
	488.68	0.42	5.39E+00		8.08E+00
	563.99	0.49	4.03E+00		6.48E+00
	586.26	0.46	-8.60E+00		1.08E+01
	678.62	0.47	7.08E-01		7.39E+00
	688.67	0.86	-2.47E+00		4.04E+00
	719.35	0.28	1.81E+00		1.17E+01
	778.90	12.96	-1.69E-01		2.55E-01
	810.45	0.32	-6.13E+00		8.85E+00
	867.37	4.26	6.69E-02		8.32E-01
	919.33	0.43	-6.24E+00		7.44E+00
	964.08	14.65	-1.70E-02		3.35E-01
	1085.87	10.24	-2.32E-02		4.33E-01
	1089.74	1.73	-8.22E-01		2.43E+00
	1112.07	13.69	1.31E-01		3.72E-01
	1212.95	1.43	1.97E-01		3.62E+00
	1249.94	0.19	2.72E+00		2.42E+01
	1299.14	1.63	-1.61E+00		2.37E+00
	1408.01	21.07	-8.58E-02		1.61E-01
	1457.64	0.50	-5.33E-01		3.05E+01
	1528.10	0.28	2.12E+00		1.21E+01
Eu-154	123.07	40.40	-1.57E-02	7.81E-02	7.81E-02
	247.93	6.89	-5.14E-03		4.50E-01
	591.76	4.95	-1.80E-01		7.02E-01
	692.42	1.78	-9.77E-01		2.05E+00
	723.30	20.06	7.11E-02		1.97E-01
	756.80	4.52	3.95E-01		8.16E-01
	873.18	12.08	1.48E-01		3.01E-01

Analysis Report for 10-Oct-19-10052

L1-10208A-FSGS-020SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	4.32E-02	7.81E-02	4.08E-01
	1004.76	18.01	7.85E-02		2.54E-01
	1274.43	34.80	-1.08E-01		1.22E-01
	1596.48	1.80	1.08E+00		2.07E+00
Eu-155	45.30	1.31	-2.00E+00	1.68E-01	1.08E+01
	60.01	1.22	-3.00E+00		1.17E+01
	86.55	30.70	9.84E-03		1.68E-01
	105.31	21.10	-1.99E-02		1.73E-01
Ra-226	186.21	3.64	4.86E-01	9.69E-01	9.69E-01
Pa-231	27.36	10.30	5.71E-01	1.06E+00	1.06E+00
	283.69	1.70	-5.73E-01		1.64E+00
	300.07	2.47	-1.40E+00		1.21E+00
	302.65	2.20	4.71E-01		1.46E+00
	330.06	1.40	6.97E-01		2.44E+00
U-235	143.76	10.96	6.13E-02	6.12E-02	2.68E-01
	163.33	5.08	-5.26E-02		6.38E-01
	185.71	57.20	2.36E-02		6.12E-02
	202.11	1.08	-7.44E-01		2.98E+00
	205.31	5.01	1.85E-01		6.86E-01
Am-241	59.54	35.90	-9.95E-02	4.00E-01	4.00E-01

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

Apex-Gamma

Analysis Report for 10-Oct-19-10053
L1-10208A-FSGS-021SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10053
Sample Description	: L1-10208A-FSGS-021SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.453E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:40:00PM
Acquisition Started	: 10/10/2019 2:02:11PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.6 seconds
Dead Time	: 0.18 %
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80443
Fill Height	: 1452.72 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 2:17:25PM

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

Data Validated
0830 10/4/19

Analysis Report for 10-Oct-19-10053

L1-10208A-FSGS-021SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.69	950 -	960	954.87	1.38E+02	17.75	7.43E+01	0.85
2	295.22	1174 -	1188	1180.80	7.95E+01	13.92	3.95E+01	0.61
3	338.34	1348 -	1358	1353.14	4.59E+01	10.77	2.91E+01	0.86
4	352.11	1399 -	1413	1408.19	1.14E+02	15.06	3.93E+01	0.80
5	583.33	2325 -	2340	2332.54	6.00E+01	10.96	2.00E+01	1.53
6	609.27	2428 -	2444	2436.26	9.18E+01	12.34	1.92E+01	1.61
7	661.66	2641 -	2652	2645.73	4.74E+01	8.29	8.55E+00	1.29
8	1461.05	5832 -	5855	5844.02	3.68E+02	19.18	0.00E+00	1.74

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	9.32E+00	6.33E-01
Cs-137	1.00	661.66	*	85.10	8.74E-02	1.62E-02
Tl-208	0.99	583.19	*	85.00	1.01E-01	1.95E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.49E-01	3.79E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.99E-01	4.40E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 10-Oct-19-10053

L1-10208A-FSGS-021SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	3.83E-01	7.37E-02
		351.93	*	35.60	3.22E-01	4.98E-02
		785.96		1.06		
Ac-228	0.57	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.99E-01	9.91E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10053

L1-10208A-FSGS-021SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.992	9.32E+00	6.33E-01	
Cs-137	1.000	8.74E-02	1.62E-02	
Tl-208	0.997	1.01E-01	1.95E-02	
Pb-212	0.999	2.49E-01	3.79E-02	
Bi-214	1.000	2.99E-01	4.40E-02	
Pb-214	0.997	3.41E-01	4.13E-02	
Ac-228	0.574	3.99E-01	9.91E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10053

L1-10208A-FSGS-021SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 2:17:25PM
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	7.10E-02	6.88E-02	6.88E-02
	BE-7	477.60		10.44	-1.41E-01	4.09E-01	4.09E-01
+	K-40	1460.82	*	10.66	9.32E+00	7.29E-02	7.29E-02
	Mn-54	834.85		99.98	2.37E-02	5.98E-02	5.98E-02
	Co-60	1173.23		99.85	1.07E-02	6.13E-02	7.24E-02
		1332.49		99.98	3.54E-02		6.13E-02
	Nb-94	702.65		99.81	8.18E-03	5.43E-02	5.43E-02
		871.09		99.89	-1.59E-02		5.67E-02
	Ag-108m	79.13		6.60	2.12E+00	5.01E-02	2.16E+00
		433.94		90.50	4.73E-03		5.01E-02
		614.28		89.80	-1.40E-02		7.64E-02
		722.94		90.80	-5.46E-02		6.87E-02
	Sb-125	176.31		6.84	-6.69E-01	1.49E-01	6.55E-01
		380.45		1.52	2.32E+00		3.11E+00
		427.87		29.60	-4.02E-02		1.49E-01
		463.36		10.49	3.36E-01		5.13E-01
		600.60		17.65	-1.10E-01		2.63E-01
		606.71		4.98	3.21E+00		1.73E+00
		635.95		11.22	1.13E-01		4.68E-01

Analysis Report for 10-Oct-19-10053

L1-10208A-FSGS-021SS

	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	1.49E-01	2.69E+00
	Ba-133	79.61		2.65	-8.22E-01	9.47E-02	4.96E+00
		81.00		32.90	-5.47E-01		3.34E-01
		276.40		7.16	1.49E-01		6.46E-01
		302.85		18.34	6.39E-02		2.53E-01
		356.01		62.05	-3.25E-02		9.47E-02
		383.85		8.94	3.02E-01		5.30E-01
	Cs-134	475.36		1.48	-1.24E+00	5.59E-02	2.61E+00
		563.25		8.34	3.37E-02		5.54E-01
		569.33		15.37	-2.89E-02		3.10E-01
		604.72		97.62	-4.86E-03		7.58E-02
		795.86		85.46	-1.52E-03		5.59E-02
		801.95		8.69	1.39E-01		5.91E-01
		1038.61		0.99	-1.76E+00		6.19E+00
		1167.97		1.79	-1.05E+00		4.03E+00
		1365.19		3.02	1.02E+00		1.66E+00
+	Cs-137	661.66	*	85.10	8.74E-02	3.41E-02	3.41E-02
	Eu-152	121.78		28.67	-1.28E-01	1.66E-01	1.66E-01
		244.70		7.61	6.20E-01		6.79E-01
		295.94		0.45	2.73E+00		1.26E+01
		344.28		26.60	-8.06E-02		1.80E-01
		367.79		0.86	-1.61E+00		5.06E+00
		411.12		2.24	2.38E-01		1.99E+00
		443.96		2.83	-3.78E-01		1.70E+00
		488.68		0.42	-5.25E-02		1.10E+01
		563.99		0.49	1.47E+00		9.61E+00
		586.26		0.46	-1.61E+00		1.67E+01
		678.62		0.47	-8.35E+00		1.03E+01
		688.67		0.86	-1.55E+00		5.13E+00
		719.35		0.28	-5.85E+00		1.86E+01
		778.90		12.96	8.76E-02		4.59E-01
		810.45		0.32	-1.61E+01		1.42E+01
		867.37		4.26	-5.35E-01		1.36E+00
		919.33		0.43	4.48E+00		1.28E+01
		964.08		14.65	5.19E-02		5.54E-01
		1085.87		10.24	3.33E-01		6.53E-01
		1089.74		1.73	-2.48E+00		3.87E+00
		1112.07		13.69	1.06E-01		5.03E-01
		1212.95		1.43	5.81E-01		5.93E+00
		1249.94		0.19	7.31E+00		4.14E+01
		1299.14		1.63	2.32E+00		4.30E+00
		1408.01		21.07	4.67E-02		2.60E-01
		1457.64		0.50	2.02E+02		5.15E+01
		1528.10		0.28	6.94E+00		1.54E+01
	Eu-154	123.07		40.40	1.74E-02	1.26E-01	1.26E-01
		247.93		6.89	3.25E-02		6.35E-01
		591.76		4.95	6.49E-01		1.12E+00
		692.42		1.78	4.55E-01		2.73E+00
		723.30		20.06	3.95E-02		3.22E-01
		756.80		4.52	-5.04E-01		1.23E+00
		873.18		12.08	-5.87E-02		4.56E-01

Analysis Report for 10-Oct-19-10053

L1-10208A-FSGS-021SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.01E-01	1.26E-01	5.59E-01
	1004.76	18.01	-1.08E-01		3.33E-01
	1274.43	34.80	-4.69E-02		1.67E-01
	1596.48	1.80	-8.56E-01		2.65E+00
Eu-155	45.30	1.31	-8.85E+00	2.99E-01	3.45E+01
	60.01	1.22	2.26E+00		3.37E+01
	86.55	30.70	5.42E-02		3.24E-01
	105.31	21.10	-3.85E-02		2.99E-01
Ra-226	186.21	3.64	5.54E-01	1.45E+00	1.45E+00
Pa-231	27.36	10.30	2.01E+00	1.94E+00	3.84E+00
	283.69	1.70	-2.26E-01		2.53E+00
	300.07	2.47	3.32E-01		1.94E+00
	302.65	2.20	6.51E-01		2.11E+00
	330.06	1.40	7.72E-01		3.33E+00
U-235	143.76	10.96	5.13E-02	9.36E-02	4.55E-01
	163.33	5.08	-1.27E-01		8.52E-01
	185.71	57.20	7.44E-02		9.36E-02
	202.11	1.08	5.68E-01		4.02E+00
	205.31	5.01	-3.68E-02		8.69E-01
Am-241	59.54	35.90	1.89E-01	1.20E+00	1.20E+00

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

Apex-Gamma

Analysis Report for 10-Oct-19-10054
L1-10208A-FQGS-021SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10054
Sample Description	: L1-10208A-FQGS-021SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.503E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:40:00PM
Acquisition Started	: 10/10/2019 2:20:51PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.6 seconds
Dead Time	: 0.18 %
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80445
Fill Height	: 1502.94 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 2:35:55PM

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

Data Validated
0830 10/11/19

Analysis Report for 10-Oct-19-10054

L1-10208A-FQGS-021SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.64	950 -	962	954.67	1.51E+02	23.05	1.30E+02	0.87
2	295.36	1175 -	1186	1181.33	7.67E+01	12.75	3.43E+01	1.16
3	338.34	1348 -	1359	1353.14	2.92E+01	11.14	3.68E+01	1.13
4	351.95	1400 -	1413	1407.55	1.32E+02	14.63	2.97E+01	1.12
5	583.27	2327 -	2339	2332.27	4.69E+01	10.27	2.21E+01	0.37
6	609.34	2428 -	2445	2436.51	1.13E+02	11.91	8.87E+00	0.87
7	661.81	2642 -	2651	2646.32	3.03E+01	8.65	1.97E+01	0.82
8	911.26	3636 -	3651	3644.02	4.91E+01	9.52	1.39E+01	1.57
9	968.96	3869 -	3881	3874.80	3.23E+01	8.01	1.17E+01	0.33
10	1120.22	4474 -	4485	4479.99	1.64E+01	6.19	7.60E+00	0.61
11	1461.04	5832 -	5855	5844.01	3.59E+02	18.95	0.00E+00	1.54

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.00E+00	6.15E-01
Cs-137	0.99	661.66	*	85.10	5.53E-02	1.61E-02
Tl-208	0.99	583.19	*	85.00	7.86E-02	1.79E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.71E-01	4.68E-02
		300.09		3.30		

Analysis Report for 10-Oct-19-10054

L1-10208A-FQGS-021SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	609.32	*	45.49	3.65E-01	4.43E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.44E-01	9.27E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	3.67E-01	6.77E-02
		351.93	*	35.60	3.72E-01	5.07E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.52E-01	9.83E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.68E-01	7.30E-02
		964.77		4.99		
		968.97	*	15.80	4.12E-01	1.04E-01
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Oct-19-10054

L1-10208A-FQGS-021SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.992	9.00E+00	6.15E-01	
	Cs-137	0.996	5.53E-02	1.61E-02	
	Tl-208	0.999	7.86E-02	1.79E-02	
X	Bi-211	0.882			
	Pb-212	1.000	2.71E-01	4.68E-02	
	Bi-214	1.000	3.43E-01	3.99E-02	
	Pb-214	0.999	3.70E-01	4.06E-02	
	Ac-228	1.000	3.47E-01	5.10E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10054

L1-10208A-FQGS-021SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 2:35:55PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	9.14E-02	6.53E-02	6.53E-02
	BE-7	477.60		10.44	3.00E-01	4.57E-01	4.57E-01
+	K-40	1460.82	*	10.66	9.00E+00	7.21E-02	7.21E-02
	Mn-54	834.85		99.98	4.78E-03	5.56E-02	5.56E-02
	Co-60	1173.23		99.85	4.01E-02	5.03E-02	7.78E-02
		1332.49		99.98	-3.11E-02		5.03E-02
	Nb-94	702.65		99.81	1.23E-02	5.56E-02	5.56E-02
		871.09		99.89	-1.40E-02		5.77E-02
	Ag-108m	79.13		6.60	2.17E+00	4.85E-02	2.37E+00
		433.94		90.50	-1.48E-03		4.85E-02
		614.28		89.80	-1.60E-02		8.40E-02
		722.94		90.80	-4.82E-02		6.68E-02
	Sb-125	176.31		6.84	1.41E-01	1.51E-01	6.31E-01
		380.45		1.52	8.10E-01		2.90E+00
		427.87		29.60	-2.08E-02		1.51E-01
		463.36		10.49	4.44E-02		4.68E-01
		600.60		17.65	5.37E-02		3.12E-01
		606.71		4.98	-9.01E-02		1.79E+00
		635.95		11.22	5.67E-01		4.58E-01

Analysis Report for 10-Oct-19-10054

L1-10208A-FQGS-021SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	8.60E-01	1.51E-01	3.04E+00
	Ba-133	79.61		2.65	3.07E+00	9.67E-02	5.60E+00
		81.00		32.90	-5.58E-01		3.59E-01
		276.40		7.16	4.69E-01		6.44E-01
		302.85		18.34	1.05E-01		2.39E-01
		356.01		62.05	-6.57E-02		9.67E-02
		383.85		8.94	-1.31E-01		5.16E-01
	Cs-134	475.36		1.48	-1.51E+00	7.45E-02	2.94E+00
		563.25		8.34	4.44E-02		5.22E-01
		569.33		15.37	1.17E-01		2.89E-01
		604.72		97.62	2.59E-02		8.31E-02
		795.86		85.46	2.58E-02		7.45E-02
		801.95		8.69	-6.12E-01		5.57E-01
		1038.61		0.99	3.46E-01		6.93E+00
		1167.97		1.79	1.71E+00		4.47E+00
		1365.19		3.02	5.23E-01		2.09E+00
+	Cs-137	661.66	*	85.10	5.53E-02	4.66E-02	4.66E-02
	Eu-152	121.78		28.67	2.57E-02	1.75E-01	1.92E-01
		244.70		7.61	2.41E-01		7.08E-01
		295.94		0.45	7.14E+00		1.22E+01
		344.28		26.60	9.17E-02		1.75E-01
		367.79		0.86	-1.63E+00		4.94E+00
		411.12		2.24	-1.14E+00		2.12E+00
		443.96		2.83	8.46E-01		1.78E+00
		488.68		0.42	-3.46E+00		1.10E+01
		563.99		0.49	-3.42E+00		8.63E+00
		586.26		0.46	1.68E+01		1.54E+01
		678.62		0.47	1.79E+00		1.11E+01
		688.67		0.86	-2.38E+00		6.10E+00
		719.35		0.28	-2.32E+01		1.82E+01
		778.90		12.96	2.51E-01		3.84E-01
		810.45		0.32	1.43E+01		1.62E+01
		867.37		4.26	-8.57E-01		1.30E+00
		919.33		0.43	-7.09E+00		1.44E+01
		964.08		14.65	-2.12E-01		5.65E-01
		1085.87		10.24	3.10E-01		5.91E-01
		1089.74		1.73	2.64E+00		3.50E+00
		1112.07		13.69	2.30E-01		4.41E-01
		1212.95		1.43	2.67E-01		5.98E+00
		1249.94		0.19	-1.36E+01		4.38E+01
		1299.14		1.63	-1.61E+00		3.50E+00
		1408.01		21.07	-9.25E-03		2.40E-01
		1457.64		0.50	1.94E+02		5.01E+01
		1528.10		0.28	1.08E+01		1.84E+01
	Eu-154	123.07		40.40	1.07E-01	1.39E-01	1.39E-01
		247.93		6.89	3.62E-01		6.65E-01
		591.76		4.95	-5.12E-01		9.77E-01
		692.42		1.78	4.36E-02		3.19E+00
		723.30		20.06	-1.12E-01		3.14E-01
		756.80		4.52	-4.32E-01		1.24E+00
		873.18		12.08	1.94E-01		4.85E-01

Analysis Report for 10-Oct-19-10054

L1-10208A-FQGS-021SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	8.73E-02	1.39E-01	4.97E-01
	1004.76	18.01	2.73E-01		3.29E-01
	1274.43	34.80	1.04E-02		1.93E-01
	1596.48	1.80	1.16E+00		2.99E+00
Eu-155	45.30	1.31	1.89E+01	3.04E-01	3.56E+01
	60.01	1.22	-1.43E+01		3.65E+01
	86.55	30.70	2.68E-01		3.35E-01
	105.31	21.10	4.30E-02		3.04E-01
Ra-226	186.21	3.64	1.03E+00	1.36E+00	1.36E+00
Pa-231	27.36	10.30	4.02E+00	1.76E+00	4.01E+00
	283.69	1.70	-8.49E-01		2.48E+00
	300.07	2.47	-1.58E+00		1.76E+00
	302.65	2.20	1.72E+00		2.01E+00
	330.06	1.40	1.24E+00		3.47E+00
U-235	143.76	10.96	3.46E-02	8.77E-02	4.61E-01
	163.33	5.08	4.66E-01		9.19E-01
	185.71	57.20	8.94E-02		8.77E-02
	202.11	1.08	-2.05E-01		3.93E+00
	205.31	5.01	2.25E-01		8.92E-01
Am-241	59.54	35.90	2.18E-01	1.35E+00	1.35E+00

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

Apex-Gamma

Analysis Report for 10-Oct-19-10055

L1-10208A-FJGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Oct-19-10055
Sample Description	: L1-10208A-FJGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.472E+03 grams
Facility	: Default
Sample Taken On	: 10/8/2019 1:42:00PM
Acquisition Started	: 10/10/2019 2:02:21PM
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	: 10/10/2019
Efficiency Calibration Description	:
Sample Number	: 80444
Fill Height	: 1472.48 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/10/2019 2:17:25PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0830 10-11-19

Analysis Report for 10-Oct-19-10055

L1-10208A-FJGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.30	305 -	316	309.73	3.35E+01	14.79	7.35E+01	0.77
2	238.74	949 -	962	954.56	1.55E+02	16.26	3.95E+01	1.03
3	338.43	1346 -	1359	1352.78	2.14E+01	9.86	2.66E+01	0.91
4	352.01	1401 -	1412	1407.05	6.62E+01	11.97	3.08E+01	1.14
5	583.05	2323 -	2337	2330.33	6.38E+01	9.50	9.23E+00	1.01
6	609.21	2429 -	2442	2434.90	5.56E+01	9.31	1.14E+01	1.10
7	968.38	3865 -	3877	3870.95	2.98E+01	6.20	3.25E+00	0.38
8	1460.12	5825 -	5849	5838.41	2.94E+02	17.53	3.18E+00	1.97

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.92	1460.82	*	10.66	6.67E+00	4.92E-01
Tl-208	0.99	583.19	*	85.00	9.69E-02	1.56E-02
Bi-211	0.86	351.07	*	13.02	4.60E-01	9.10E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.49E-01	3.29E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.36E-01	1.07E-01
		87.35		3.97		

Analysis Report for 10-Oct-19-10055

L1-10208A-FJGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.63E-01	2.89E-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		
		351.93	*	35.60	1.68E-01	3.32E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	4.17E-01	1.90E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.67E-01	7.80E-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	3.44E-01	7.32E-02
		1588.20		3.22		

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

Analysis Report for 10-Oct-19-10055

L1-10208A-FJGS-001SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.924	6.67E+00	4.92E-01	
	Tl-208	0.997	9.69E-02	1.56E-02	
?	Bi-211	0.868	4.60E-01	9.10E-02	
	Pb-212	0.998	2.49E-01	3.29E-02	
?	Pb212-XR	0.997	2.36E-01	1.07E-01	
	Bi-214	0.999	1.63E-01	2.89E-02	
?	Pb-214	0.999	1.68E-01	3.32E-02	
?	Pb214-XR	0.997	4.17E-01	1.90E-01	
	Ac-228	0.990	2.61E-01	5.34E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Oct-19-10055

L1-10208A-FJGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/10/2019 2:17:25PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.95E-02	5.94E-02	5.94E-02
	BE-7	477.60		10.44	1.52E-01	3.67E-01	3.67E-01
+	K-40	1460.82	*	10.66	6.67E+00	3.46E-01	3.46E-01
	Mn-54	834.85		99.98	-7.59E-03	4.90E-02	4.90E-02
	Co-60	1173.23		99.85	-2.19E-02	4.84E-02	5.68E-02
		1332.49		99.98	-1.92E-02		4.84E-02
	Nb-94	702.65		99.81	-7.05E-03	3.06E-02	4.35E-02
		871.09		99.89	9.72E-03		3.06E-02
	Ag-108m	79.13		6.60	6.19E-02	3.77E-02	1.11E+00
		433.94		90.50	-2.34E-03		3.77E-02
		614.28		89.80	-3.64E-02		5.01E-02
		722.94		90.80	3.97E-02		5.28E-02
	Sb-125	176.31		6.84	-1.81E-02	1.28E-01	4.13E-01
		380.45		1.52	-4.69E-01		2.37E+00
		427.87		29.60	4.74E-02		1.28E-01
		463.36		10.49	2.62E-01		3.93E-01
		600.60		17.65	-3.93E-02		2.08E-01
		606.71		4.98	2.22E+00		1.31E+00
		635.95		11.22	-5.78E-02		3.51E-01

Analysis Report for 10-Oct-19-10055

L1-10208A-FJGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.10E+00	1.28E-01	2.21E+00
Ba-133	79.61	2.65	1.08E-01	7.00E-02	2.71E+00
	81.00	32.90	-5.13E-02		1.81E-01
	276.40	7.16	2.03E-01		4.83E-01
	302.85	18.34	1.61E-01		1.81E-01
	356.01	62.05	-5.62E-02		7.00E-02
	383.85	8.94	1.94E-01		4.00E-01
Cs-134	475.36	1.48	5.69E-01	5.81E-02	2.49E+00
	563.25	8.34	-4.43E-01		5.03E-01
	569.33	15.37	3.66E-03		2.26E-01
	604.72	97.62	-5.24E-02		5.81E-02
	795.86	85.46	5.59E-03		5.85E-02
	801.95	8.69	1.28E-01		5.14E-01
	1038.61	0.99	6.41E-01		4.71E+00
	1167.97	1.79	-7.23E-01		3.11E+00
	1365.19	3.02	1.53E-01		1.25E+00
Cs-137	661.66	85.10	-2.93E-02	5.18E-02	5.18E-02
Eu-152	121.78	28.67	5.98E-02	1.11E-01	1.11E-01
	244.70	7.61	2.37E-01		4.74E-01
	295.94	0.45	3.55E+00		8.86E+00
	344.28	26.60	-2.72E-03		1.21E-01
	367.79	0.86	2.07E+00		3.72E+00
	411.12	2.24	4.70E-01		1.68E+00
	443.96	2.83	-7.01E-01		1.32E+00
	488.68	0.42	2.56E+00		8.04E+00
	563.99	0.49	-6.48E+00		7.93E+00
	586.26	0.46	-3.41E+00		1.30E+01
	678.62	0.47	-4.09E+00		8.58E+00
	688.67	0.86	1.71E+00		4.91E+00
	719.35	0.28	6.68E-01		1.49E+01
	778.90	12.96	3.34E-02		2.45E-01
	810.45	0.32	3.96E+00		1.30E+01
	867.37	4.26	1.27E-01		7.74E-01
	919.33	0.43	-3.04E+00		9.09E+00
	964.08	14.65	-2.07E-01		4.86E-01
	1085.87	10.24	-5.28E-01		4.13E-01
	1089.74	1.73	1.88E+00		2.90E+00
	1112.07	13.69	-3.22E-01		3.93E-01
	1212.95	1.43	4.17E+00		4.65E+00
	1249.94	0.19	-5.80E+00		3.13E+01
	1299.14	1.63	5.80E-01		3.09E+00
	1408.01	21.07	-1.27E-01		1.63E-01
	1457.64	0.50	1.45E+02		4.14E+01
	1528.10	0.28	9.26E-01		1.30E+01
Eu-154	123.07	40.40	-1.86E-02	7.57E-02	7.57E-02
	247.93	6.89	-1.74E-02		4.50E-01
	591.76	4.95	4.13E-01		6.56E-01
	692.42	1.78	9.28E-01		2.27E+00
	723.30	20.06	2.59E-01		2.45E-01
	756.80	4.52	2.90E-01		9.80E-01
	873.18	12.08	-6.19E-02		2.54E-01

Analysis Report for 10-Oct-19-10055

L1-10208A-FJGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.67E-01	7.57E-02	4.86E-01
	1004.76	18.01	5.20E-03		2.69E-01
	1274.43	34.80	-6.31E-02		1.27E-01
	1596.48	1.80	-9.74E-01		2.25E+00
Eu-155	45.30	1.31	2.92E+00	1.75E-01	1.07E+01
	60.01	1.22	7.61E+00		1.34E+01
	86.55	30.70	8.37E-02		1.75E-01
	105.31	21.10	-4.87E-02		1.79E-01
Ra-226	186.21	3.64	8.39E-01	9.82E-01	9.82E-01
Pa-231	27.36	10.30	8.51E-01	1.27E+00	1.29E+00
	283.69	1.70	-5.05E-01		1.85E+00
	300.07	2.47	-2.12E+00		1.27E+00
	302.65	2.20	1.11E+00		1.51E+00
	330.06	1.40	1.81E+00		2.56E+00
U-235	143.76	10.96	1.61E-01	6.24E-02	3.08E-01
	163.33	5.08	2.34E-02		5.98E-01
	185.71	57.20	5.35E-02		6.24E-02
	202.11	1.08	5.45E-01		2.77E+00
	205.31	5.01	-4.80E-01		6.38E-01
Am-241	59.54	35.90	3.56E-02	4.59E-01	4.59E-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-19-10007

L1-10208A-FSGS-005SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Oct-19-10007
Sample Description	: L1-10208A-FSGS-005SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.594E+03 grams
Facility	: Default
Sample Taken On	: 10/9/2019 2:15:00PM
Acquisition Started	: 10/14/2019 9:24:39AM
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	: 80461
Fill Height	: 1594.04 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/14/2019 9:39:51AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 10/14/19 - 1500

J Graham

Analysis Report for 14-Oct-19-10007

L1-10208A-FSGS-005SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.99	739 -	751	743.85	3.72E+01	13.66	5.68E+01	0.55
2	238.82	947 -	963	954.85	7.77E+01	20.36	1.04E+02	0.75
3	295.24	1175 -	1184	1180.25	3.03E+01	10.42	3.47E+01	1.08
4	338.46	1347 -	1358	1352.93	3.17E+01	9.65	2.33E+01	0.65
5	351.80	1399 -	1413	1406.19	1.09E+02	13.24	2.23E+01	0.45
6	582.92	2322 -	2337	2329.81	5.80E+01	9.06	8.00E+00	1.34
7	609.27	2430 -	2442	2435.14	3.86E+01	10.30	2.54E+01	0.73
8	910.69	3636 -	3645	3640.21	2.66E+01	6.43	6.39E+00	0.78
9	1460.02	5826 -	5850	5838.03	3.03E+02	18.42	8.98E+00	1.84

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	6.72E+00	5.02E-01
Tl-208	0.98	583.19	*	85.00	8.65E-02	1.45E-02
Bi-211	0.91	351.07	*	13.02	7.42E-01	1.08E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.22E-01	3.36E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.11E-01	3.03E-02
		768.36		4.89		

Analysis Report for 14-Oct-19-10007

L1-10208A-FSGS-005SB

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	1.29E-01	4.54E-02
		351.93	*	35.60	2.71E-01	3.95E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	6.15E-01	2.31E-01
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.43E-01	7.65E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.77E-01	4.34E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.91E-02	1.47E-02
		202.11		1.08		
		205.31		5.01		

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

Analysis Report for 14-Oct-19-10007

L1-10208A-FSGS-005SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.903	6.72E+00	5.02E-01	
	Tl-208	0.989	8.65E-02	1.45E-02	
	Bi-211	0.919	3.90E-01	1.65E-01	
	Pb-212	0.995	1.22E-01	3.36E-02	
	Bi-214	1.000	1.11E-01	3.03E-02	
	Pb-214	0.998	1.29E-01	4.54E-02	
?	Ra-226	0.993	6.15E-01	2.31E-01	
	Ac-228	0.987	1.93E-01	3.78E-02	
?	U-235	0.991	3.91E-02	1.47E-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-19-10007

L1-10208A-FSGS-005SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/14/2019 9:39:51AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.97E-02	5.70E-02	5.70E-02
	BE-7	477.60		10.44	-2.29E-01	3.56E-01	3.56E-01
+	K-40	1460.82	*	10.66	6.72E+00	5.16E-01	5.16E-01
	Mn-54	834.85		99.98	-7.24E-02	4.14E-02	4.14E-02
	Co-60	1173.23		99.85	-5.37E-03	4.15E-02	5.65E-02
		1332.49		99.98	-3.86E-03		4.15E-02
	Nb-94	702.65		99.81	-2.51E-02	3.94E-02	3.94E-02
		871.09		99.89	-2.07E-02		4.30E-02
	Ag-108m	79.13		6.60	1.39E-01	4.20E-02	1.26E+00
		433.94		90.50	7.67E-03		4.20E-02
		614.28		89.80	-8.57E-03		5.85E-02
		722.94		90.80	-1.54E-02		5.24E-02
	Sb-125	176.31		6.84	2.51E-01	1.14E-01	4.74E-01
		380.45		1.52	-9.82E-01		1.97E+00
		427.87		29.60	-1.47E-03		1.14E-01
		463.36		10.49	7.76E-02		3.69E-01
		600.60		17.65	-8.61E-02		2.27E-01
		606.71		4.98	1.24E+00		1.31E+00
		635.95		11.22	1.67E-01		3.90E-01

Analysis Report for 14-Oct-19-10007

L1-10208A-FSGS-005SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.06E+00	1.14E-01	2.31E+00
Ba-133	79.61	2.65	7.58E-01	6.92E-02	3.05E+00
	81.00	32.90	-2.58E-01		2.02E-01
	276.40	7.16	-3.75E-02		4.83E-01
	302.85	18.34	9.27E-02		1.92E-01
	356.01	62.05	-2.26E-02		6.92E-02
	383.85	8.94	1.06E-01		3.64E-01
Cs-134	475.36	1.48	7.08E-01	5.02E-02	2.54E+00
	563.25	8.34	-5.51E-01		4.66E-01
	569.33	15.37	2.36E-02		2.55E-01
	604.72	97.62	-2.11E-02		5.94E-02
	795.86	85.46	1.59E-03		5.02E-02
	801.95	8.69	1.80E-01		4.88E-01
	1038.61	0.99	-2.22E+00		4.82E+00
	1167.97	1.79	-2.01E-01		3.10E+00
	1365.19	3.02	-9.91E-01		1.09E+00
Cs-137	661.66	85.10	-3.46E-02	4.87E-02	4.87E-02
Eu-152	121.78	28.67	3.81E-02	1.11E-01	1.21E-01
	244.70	7.61	1.31E-01		4.84E-01
	295.94	0.45	1.07E+00		9.80E+00
	344.28	26.60	-9.68E-02		1.11E-01
	367.79	0.86	2.07E+00		3.88E+00
	411.12	2.24	9.70E-01		1.65E+00
	443.96	2.83	1.40E-01		1.29E+00
	488.68	0.42	2.94E+00		9.46E+00
	563.99	0.49	-1.33E+00		7.68E+00
	586.26	0.46	-1.35E+00		1.30E+01
	678.62	0.47	-1.71E+00		8.94E+00
	688.67	0.86	-2.96E+00		4.60E+00
	719.35	0.28	-6.05E+00		1.50E+01
	778.90	12.96	5.69E-02		3.42E-01
	810.45	0.32	4.38E+00		1.39E+01
	867.37	4.26	-3.45E-01		9.87E-01
	919.33	0.43	2.11E+00		1.02E+01
	964.08	14.65	-6.11E-02		4.40E-01
	1085.87	10.24	-2.64E-01		4.97E-01
	1089.74	1.73	-1.30E-01		3.40E+00
	1112.07	13.69	-9.32E-02		4.17E-01
	1212.95	1.43	-1.09E+00		5.50E+00
	1249.94	0.19	-1.41E+01		3.31E+01
	1299.14	1.63	3.34E-02		2.69E+00
	1408.01	21.07	1.31E-01		2.13E-01
	1457.64	0.50	1.42E+02		4.17E+01
	1528.10	0.28	-3.04E+00		8.39E+00
Eu-154	123.07	40.40	8.46E-02	8.52E-02	8.52E-02
	247.93	6.89	3.23E-02		4.73E-01
	591.76	4.95	8.17E-02		7.77E-01
	692.42	1.78	-9.95E-01		1.99E+00
	723.30	20.06	-2.32E-02		2.40E-01
	756.80	4.52	4.94E-01		8.99E-01
	873.18	12.08	-2.56E-02		3.77E-01

Analysis Report for 14-Oct-19-10007

L1-10208A-FSGS-005SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-9.89E-03	8.52E-02	4.42E-01
		1004.76		18.01	-1.44E-01		2.74E-01
		1274.43		34.80	2.85E-02		1.59E-01
		1596.48		1.80	7.67E-01		2.32E+00
	Eu-155	45.30		1.31	4.22E+00	1.80E-01	1.20E+01
		60.01		1.22	-8.67E+00		1.18E+01
		86.55		30.70	8.46E-02		1.97E-01
		105.31		21.10	-9.30E-03		1.80E-01
+	Ra-226	186.21	*	3.64	6.15E-01	7.33E-01	7.33E-01
	Pa-231	27.36		10.30	4.28E-01	1.20E+00	1.20E+00
		283.69		1.70	-4.33E-01		1.93E+00
		300.07		2.47	-1.94E+00		1.47E+00
		302.65		2.20	9.25E-01		1.61E+00
		330.06		1.40	1.35E+00		2.66E+00
+	U-235	143.76		10.96	1.29E-01	4.66E-02	3.10E-01
		163.33		5.08	-3.47E-01		5.61E-01
		185.71	*	57.20	3.91E-02		4.66E-02
		202.11		1.08	-1.00E-01		2.96E+00
		205.31		5.01	-3.81E-01		6.13E-01
	Am-241	59.54		35.90	4.54E-02	4.26E-01	4.26E-01

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

Apex-Gamma

Analysis Report for 14-Oct-19-10008

L1-10208A-FSGS-010SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Oct-19-10008
Sample Description	: L1-10208A-FSGS-010SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.551E+03 grams
Facility	: Default
Sample Taken On	: 10/9/2019 2:00:00PM
Acquisition Started	: 10/14/2019 9:24:47AM
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	: 10/14/2019
Efficiency Calibration Description	:
Sample Number	: 80462
Fill Height	: 1550.85 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/14/2019 9:39:49AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/14/19 - 1500

J Graham

Analysis Report for 14-Oct-19-10008

L1-10208A-FSGS-010SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.55	947 -	960	954.68	1.13E+02	17.90	7.51E+01	1.22
2	295.12	1173 -	1187	1180.69	5.47E+01	11.70	2.83E+01	1.01
3	338.32	1347 -	1358	1353.31	3.11E+01	9.14	2.09E+01	1.36
4	351.81	1402 -	1415	1407.22	8.05E+01	12.75	2.95E+01	1.08
5	583.09	2325 -	2338	2331.69	3.26E+01	7.48	8.37E+00	0.54
6	609.11	2428 -	2444	2435.70	7.02E+01	12.57	2.78E+01	0.43
7	911.07	3637 -	3650	3643.33	3.50E+01	7.37	7.00E+00	1.05
8	1460.58	5832 -	5854	5842.67	2.60E+02	18.39	2.10E+01	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	0.99	1460.82	*	10.66	5.42E+00	4.50E-01
Tl-208	0.99	583.19	*	85.00	4.66E-02	1.10E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.76E-01	3.14E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.92E-01	3.64E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 14-Oct-19-10008

L1-10208A-FSGS-010SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.27E-01	5.18E-02
		351.93	*	35.60	1.95E-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	2.32E-01	7.07E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.20E-01	4.74E-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 14-Oct-19-10008

L1-10208A-FSGS-010SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.990	5.42E+00	4.50E-01	
	Tl-208	0.999	4.66E-02	1.10E-02	
X	Bi-211	0.917			
	Pb-212	0.999	1.76E-01	3.14E-02	
	Bi-214	0.997	1.92E-01	3.64E-02	
	Pb-214	0.998	2.05E-01	2.88E-02	
	Ac-228	0.999	2.24E-01	3.94E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 14-Oct-19-10008

L1-10208A-FSGS-010SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/14/2019 9:39:49AM
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	4.53E-02	5.54E-02	5.54E-02
	BE-7	477.60		10.44	-7.45E-02	3.47E-01	3.47E-01
+	K-40	1460.82	*	10.66	5.42E+00	6.86E-01	6.86E-01
	Mn-54	834.85		99.98	-1.49E-03	4.65E-02	4.65E-02
	Co-60	1173.23		99.85	-1.31E-02	4.59E-02	5.42E-02
		1332.49		99.98	1.25E-02		4.59E-02
	Nb-94	702.65		99.81	-2.04E-02	3.28E-02	4.00E-02
		871.09		99.89	-3.59E-02		3.28E-02
	Ag-108m	79.13		6.60	-3.46E-01	4.30E-02	1.54E+00
		433.94		90.50	8.58E-03		4.30E-02
		614.28		89.80	-6.15E-02		7.43E-02
		722.94		90.80	-3.72E-03		5.05E-02
	Sb-125	176.31		6.84	-2.88E-01	1.17E-01	4.71E-01
		380.45		1.52	-3.75E-01		2.11E+00
		427.87		29.60	-1.28E-02		1.17E-01
		463.36		10.49	3.31E-01		3.42E-01
		600.60		17.65	2.80E-02		2.46E-01
		606.71		4.98	2.69E+00		1.46E+00
		635.95		11.22	-3.02E-01		4.10E-01

Analysis Report for 14-Oct-19-10008

L1-10208A-FSGS-010SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.08E+00	1.17E-01	2.45E+00
Ba-133	79.61	2.65	1.60E+00	7.63E-02	3.75E+00
	81.00	32.90	-3.26E-01		2.53E-01
	276.40	7.16	8.75E-02		5.27E-01
	302.85	18.34	6.19E-02		1.89E-01
	356.01	62.05	-1.51E-02		7.63E-02
	383.85	8.94	-4.18E-01		3.71E-01
Cs-134	475.36	1.48	-5.59E-01	5.60E-02	2.10E+00
	563.25	8.34	-3.09E-01		4.58E-01
	569.33	15.37	5.48E-03		2.65E-01
	604.72	97.62	-1.40E-02		6.79E-02
	795.86	85.46	-5.27E-03		5.60E-02
	801.95	8.69	-1.93E-01		5.18E-01
	1038.61	0.99	2.63E+00		4.46E+00
	1167.97	1.79	-2.54E+00		2.87E+00
	1365.19	3.02	2.59E-01		1.32E+00
Cs-137	661.66	85.10	4.69E-02	4.90E-02	4.90E-02
Eu-152	121.78	28.67	-5.24E-02	1.26E-01	1.34E-01
	244.70	7.61	-6.88E-02		4.99E-01
	295.94	0.45	1.47E+01		9.70E+00
	344.28	26.60	-5.12E-02		1.26E-01
	367.79	0.86	-2.62E-01		3.59E+00
	411.12	2.24	9.35E-04		1.52E+00
	443.96	2.83	-4.54E-01		1.20E+00
	488.68	0.42	-6.81E+00		8.53E+00
	563.99	0.49	-4.23E+00		7.94E+00
	586.26	0.46	8.31E+00		1.11E+01
	678.62	0.47	-8.06E-01		8.76E+00
	688.67	0.86	3.84E+00		4.59E+00
	719.35	0.28	-5.36E+00		1.29E+01
	778.90	12.96	-2.09E-01		2.93E-01
	810.45	0.32	1.11E+01		1.39E+01
	867.37	4.26	-4.88E-01		8.36E-01
	919.33	0.43	-1.85E+01		9.89E+00
	964.08	14.65	1.76E-01		4.47E-01
	1085.87	10.24	-2.57E-01		5.18E-01
	1089.74	1.73	4.20E-01		3.17E+00
	1112.07	13.69	-6.73E-01		3.36E-01
	1212.95	1.43	-7.20E-01		4.06E+00
	1249.94	0.19	-3.20E+00		3.07E+01
	1299.14	1.63	2.03E-01		2.92E+00
	1408.01	21.07	-5.56E-03		1.50E-01
	1457.64	0.50	1.20E+02		3.75E+01
	1528.10	0.28	1.56E+00		1.34E+01
Eu-154	123.07	40.40	1.88E-02	9.42E-02	9.42E-02
	247.93	6.89	1.36E-01		5.11E-01
	591.76	4.95	4.20E-01		7.93E-01
	692.42	1.78	1.07E+00		2.26E+00
	723.30	20.06	4.25E-02		2.31E-01
	756.80	4.52	-4.73E-01		9.42E-01
	873.18	12.08	-1.08E-01		3.18E-01

Analysis Report for 14-Oct-19-10008

L1-10208A-FSGS-010SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	9.00E-02	9.42E-02	4.42E-01
	1004.76	18.01	9.35E-02		2.76E-01
	1274.43	34.80	2.44E-02		1.59E-01
	1596.48	1.80	-1.65E-01		2.76E+00
Eu-155	45.30	1.31	-4.38E+00	1.97E-01	2.05E+01
	60.01	1.22	-4.79E+00		1.97E+01
	86.55	30.70	2.08E-02		2.27E-01
	105.31	21.10	-3.80E-02		1.97E-01
Ra-226	186.21	3.64	5.86E-02	1.01E+00	1.01E+00
Pa-231	27.36	10.30	1.88E+00	1.43E+00	2.29E+00
	283.69	1.70	-1.95E+00		2.05E+00
	300.07	2.47	5.84E-01		1.43E+00
	302.65	2.20	-5.08E-02		1.54E+00
	330.06	1.40	-7.08E-01		2.33E+00
U-235	143.76	10.96	9.04E-02	6.52E-02	3.30E-01
	163.33	5.08	2.01E-01		6.88E-01
	185.71	57.20	8.13E-03		6.52E-02
	202.11	1.08	1.26E+00		3.43E+00
	205.31	5.01	-5.82E-01		7.16E-01
Am-241	59.54	35.90	5.23E-03	6.90E-01	6.90E-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-19-10009

L1-10208A-FSGS-012SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Oct-19-10009
Sample Description	: L1-10208A-FSGS-012SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.640E+03 grams
Facility	: Default
Sample Taken On	: 10/9/2019 1:49:00PM
Acquisition Started	: 10/14/2019 9:43:28AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/14/2019
Efficiency Calibration Description	:
Sample Number	: 80463
Fill Height	: 1640.14 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/14/2019 9:58:31AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 10/14/19 - 1500

J Graham

Analysis Report for 14-Oct-19-10009

L1-10208A-FSGS-012SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.61	472 -	481	477.40	1.05E+02	18.55	1.03E+02	1.24
2	294.99	585 -	594	590.03	5.47E+01	13.39	5.43E+01	1.11
3	351.86	698 -	708	703.65	1.07E+02	15.09	5.06E+01	1.22
4	583.04	1160 -	1170	1165.68	5.32E+01	10.61	2.48E+01	1.63
5	609.13	1213 -	1223	1217.84	5.48E+01	10.38	2.22E+01	1.74
6	1460.46	2913 -	2928	2920.98	2.69E+02	16.40	0.00E+00	2.24

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	4.96E+00	3.72E-01
Tl-208	0.99	583.19	*	85.00	6.76E-02	1.41E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.45E-01	2.82E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.34E-01	2.66E-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-19-10009

L1-10208A-FSGS-012SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.02E-01	5.21E-02
		351.93	*	35.60	2.32E-01	3.76E-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	0.980	4.96E+00	3.72E-01	
	Tl-208	0.996	6.76E-02	1.41E-02	
X	Bi-211	0.906			
	Pb-212	1.000	1.45E-01	2.82E-02	
	Bi-214	0.998	1.34E-01	2.66E-02	
	Pb-214	0.997	2.22E-01	3.05E-02	

Analysis Report for 14-Oct-19-10009

L1-10208A-FSGS-012SB

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

Errors quoted at 1.000sigma

Analysis Report for 14-Oct-19-10009

L1-10208A-FSGS-012SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/14/2019 9:58:31AM
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	6.63E-02	5.33E-02	5.33E-02
	BE-7	477.60		10.44	8.91E-03	3.17E-01	3.17E-01
+	K-40	1460.82	*	10.66	4.96E+00	5.31E-02	5.31E-02
	Mn-54	834.85		99.98	2.08E-02	3.83E-02	3.83E-02
	Co-60	1173.23		99.85	1.78E-02	4.17E-02	5.17E-02
		1332.49		99.98	-2.19E-02		4.17E-02
	Nb-94	702.65		99.81	7.31E-03	3.33E-02	3.56E-02
		871.09		99.89	9.78E-03		3.33E-02
	Ag-108m	79.13		6.60	4.00E-01	2.77E-02	1.10E+00
		433.94		90.50	2.24E-03		2.77E-02
		614.28		89.80	4.63E-03		4.53E-02
		722.94		90.80	1.36E-02		4.27E-02
	Sb-125	176.31		6.84	4.94E-02	9.44E-02	4.55E-01
		380.45		1.52	-6.22E-01		1.88E+00
		427.87		29.60	4.76E-03		9.44E-02
		463.36		10.49	6.55E-02		3.04E-01
		600.60		17.65	1.25E-02		2.08E-01
		606.71		4.98	-3.01E-01		1.11E+00
		635.95		11.22	4.39E-02		3.11E-01

Analysis Report for 14-Oct-19-10009

L1-10208A-FSGS-012SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	7.18E-02	9.44E-02	1.84E+00
Ba-133	79.61	2.65	5.46E-01	6.69E-02	2.58E+00
	81.00	32.90	-1.32E-01		1.73E-01
	276.40	7.16	6.59E-02		4.13E-01
	302.85	18.34	5.83E-02		1.67E-01
	356.01	62.05	-2.26E-02		6.69E-02
	383.85	8.94	1.14E-02		3.31E-01
Cs-134	475.36	1.48	-1.07E-01	4.02E-02	2.06E+00
	563.25	8.34	-9.31E-02		3.76E-01
	569.33	15.37	3.07E-02		1.80E-01
	604.72	97.62	-2.10E-02		5.21E-02
	795.86	85.46	-3.83E-03		4.02E-02
	801.95	8.69	-1.96E-01		3.57E-01
	1038.61	0.99	-5.73E-01		4.64E+00
	1167.97	1.79	2.67E-01		2.68E+00
	1365.19	3.02	6.14E-01		1.34E+00
Cs-137	661.66	85.10	2.66E-02	4.63E-02	4.63E-02
Eu-152	121.78	28.67	1.87E-02	1.09E-01	1.11E-01
	244.70	7.61	-7.02E-02		4.12E-01
	295.94	0.45	-1.53E+00		8.68E+00
	344.28	26.60	-9.91E-02		1.09E-01
	367.79	0.86	7.08E-01		3.23E+00
	411.12	2.24	1.36E-01		1.29E+00
	443.96	2.83	-2.19E-02		9.56E-01
	488.68	0.42	9.15E-01		7.42E+00
	563.99	0.49	-7.09E-01		6.55E+00
	586.26	0.46	-2.05E+00		1.18E+01
	678.62	0.47	6.88E-01		7.26E+00
	688.67	0.86	1.36E+00		4.15E+00
	719.35	0.28	2.87E+00		1.19E+01
	778.90	12.96	-1.31E-01		1.96E-01
	810.45	0.32	1.63E+00		1.01E+01
	867.37	4.26	-1.09E-01		7.62E-01
	919.33	0.43	-7.73E+00		7.08E+00
	964.08	14.65	-1.25E-01		3.51E-01
	1085.87	10.24	-2.18E-01		3.84E-01
	1089.74	1.73	-1.14E+00		2.28E+00
	1112.07	13.69	-1.26E-01		3.22E-01
	1212.95	1.43	-1.83E+00		2.82E+00
	1249.94	0.19	1.28E+01		2.51E+01
	1299.14	1.63	2.78E-01		2.39E+00
	1408.01	21.07	3.85E-02		1.83E-01
	1457.64	0.50	-3.39E+00		3.20E+01
	1528.10	0.28	-2.26E+00		1.06E+01
Eu-154	123.07	40.40	2.03E-02	7.88E-02	7.88E-02
	247.93	6.89	1.06E-03		3.91E-01
	591.76	4.95	3.80E-02		7.15E-01
	692.42	1.78	2.28E-01		1.95E+00
	723.30	20.06	8.83E-02		2.01E-01
	756.80	4.52	3.81E-01		7.61E-01
	873.18	12.08	-4.97E-02		2.63E-01

Analysis Report for 14-Oct-19-10009

L1-10208A-FSGS-012SB

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	7.88E-02	2.85E-01
	1004.76	18.01	8.37E-02		1.99E-01
	1274.43	34.80	1.26E-01		1.59E-01
	1596.48	1.80	-1.72E-01		2.02E+00
Eu-155	45.30	1.31	2.36E+00	1.73E-01	1.03E+01
	60.01	1.22	-1.75E+00		1.15E+01
	86.55	30.70	7.47E-02		1.73E-01
	105.31	21.10	1.05E-01		1.80E-01
Ra-226	186.21	3.64	7.30E-01	9.67E-01	9.67E-01
Pa-231	27.36	10.30	6.70E-01	1.05E+00	1.05E+00
	283.69	1.70	-6.51E-01		1.54E+00
	300.07	2.47	-1.06E-01		1.30E+00
	302.65	2.20	4.85E-01		1.39E+00
	330.06	1.40	3.56E-01		2.26E+00
U-235	143.76	10.96	-9.92E-02	6.01E-02	2.68E-01
	163.33	5.08	-1.88E-02		6.11E-01
	185.71	57.20	2.34E-02		6.01E-02
	202.11	1.08	-5.53E-01		2.74E+00
	205.31	5.01	-4.00E-01		6.12E-01
Am-241	59.54	35.90	1.90E-02	4.11E-01	4.11E-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 CORPORATION
601 SCARBORO ROAD
OAK RIDGE, TENNESSEE 37830
PHONE (865) 481-0683
FAX (865) 483-4621

EBS-OR-46449

December 13, 2019

Patricia Giza
Zion Solutions, LLC
2701 Deborah Avenue
Zion, IL 60099

CASE NARRATIVE
Work Order # 19-11030-OR

SAMPLE RECEIPT

This work order contains eleven soil samples received 11/08/2019. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-10207-A-FIGS-005-SS-A	19-11030-04	L1-10208-A-FSGS-009-SS-A	19-11030-10
L1-10207-A-FIGS-003-SS-A	19-11030-05	L1-10207-A-FIGS-014-SS-A	19-11030-11
L1-10207-A-FIGS-002-SS-A	19-11030-06	L1-10208-C-FSGS-017-SS-A	19-11030-12
L1-10208-C-QIGS-004-SS-A	19-11030-07	L1-10208-B-FSGS-016-SS-A	19-11030-13
L1-10207-A-FIGS-006-SS-A	19-11030-08	L1-10208-C-FIGS-002-SS-A	19-11030-14
L1-10208-A-FSGS-021-SS-A	19-11030-09		

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 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 assuming secular equilibrium. Chemical recovery was acceptable for all samples. The Total Strontium method blank demonstrated an acceptable result. Results for the Total Strontium duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Total Strontium laboratory control sample demonstrated an acceptable percent recovery.

TRITIUM

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

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

NICKEL-63

A representative aliquot of each sample was placed into an appropriately sized beaker and leached with acids. 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 an acceptable relative percent difference and normalized difference. Results for the Nickel-63 laboratory control sample demonstrated an acceptable percent recovery.

GAMMA SPECTROSCOPY

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

ANALYTICAL RESULTS CONTINUED

GAMMA SPECTROSCOPY CONTINUED

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

CERTIFICATION OF ACCURACY

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

M.R. McDougall
Laboratory Manager

Date: 12/13/2019

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: 19-11030
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
19-11030-01	LCS	KNOWN	11/08/19 00:00	11/8/2019	11/19/2019	19-11030	Tritium	LANL ER-210 Modified	2.04E+02	7.33E+00				pCi/g
19-11030-01	LCS	SPIKE	11/08/19 00:00	11/8/2019	11/19/2019	19-11030	Tritium	LANL ER-210 Modified	1.92E+02	7.62E+00	1.32E+01	5.69E+00		pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/19/2019	19-11030	Tritium	LANL ER-210 Modified	2.26E+00	3.31E+00	3.31E+00	5.60E+00	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/19/2019	19-11030	Tritium	LANL ER-210 Modified	1.06E+00	3.06E+00	3.06E+00	5.25E+00	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/19/2019	19-11030	Tritium	LANL ER-210 Modified	7.11E-01	3.06E+00	3.06E+00	5.27E+00	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/19/2019	19-11030	Tritium	LANL ER-210 Modified	5.50E-01	3.15E+00	3.15E+00	5.44E+00	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/19/2019	19-11030	Tritium	LANL ER-210 Modified	1.82E-01	3.12E+00	3.12E+00	5.40E+00	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/19/2019	19-11030	Tritium	LANL ER-210 Modified	-1.46E+00	3.07E+00	3.07E+00	5.43E+00	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/19/2019	19-11030	Tritium	LANL ER-210 Modified	1.83E-01	3.13E+00	3.13E+00	5.43E+00	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/20/2019	19-11030	Tritium	LANL ER-210 Modified	3.66E+00	3.27E+00	3.27E+00	5.44E+00	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/20/2019	19-11030	Tritium	LANL ER-210 Modified	1.28E+00	3.17E+00	3.17E+00	5.43E+00	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/20/2019	19-11030	Tritium	LANL ER-210 Modified	5.48E-01	3.14E+00	3.14E+00	5.42E+00	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/20/2019	19-11030	Tritium	LANL ER-210 Modified	-1.30E+00	3.12E+00	3.12E+00	5.51E+00	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/20/2019	19-11030	Tritium	LANL ER-210 Modified	1.82E+00	3.18E+00	3.18E+00	5.40E+00	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/20/2019	19-11030	Tritium	LANL ER-210 Modified	-1.83E-01	3.12E+00	3.12E+00	5.43E+00	U	pCi/g
19-11030-01	LCS	KNOWN	11/08/19 00:00	11/8/2019	11/18/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	1.51E+03	4.52E+01				pCi/g
19-11030-01	LCS	SPIKE	11/08/19 00:00	11/8/2019	11/18/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	1.50E+03	1.30E+01	8.94E+01	3.14E+00		pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/18/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	-7.83E-01	1.80E+00	1.80E+00	3.15E+00	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/18/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	1.73E+00	2.06E+00	2.07E+00	3.47E+00	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/18/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	1.51E+00	2.03E+00	2.03E+00	3.42E+00	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/19/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	2.19E+00	1.83E+00	1.84E+00	3.05E+00	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/19/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	4.70E-01	1.99E+00	1.99E+00	3.40E+00	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/19/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	1.02E+00	1.97E+00	1.97E+00	3.35E+00	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/19/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	1.71E+00	1.94E+00	1.94E+00	3.26E+00	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/19/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	5.98E-01	1.81E+00	1.81E+00	3.09E+00	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/19/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	-2.58E-01	1.80E+00	1.80E+00	3.11E+00	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/19/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	1.97E+00	2.03E+00	2.03E+00	3.40E+00	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/19/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	9.00E-01	1.92E+00	1.92E+00	3.26E+00	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/19/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	9.95E-01	1.64E+00	1.64E+00	2.77E+00	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/19/2019	19-11030	Nickel-63	ASTM 3500-Ni Modified	-3.57E-01	1.86E+00	1.86E+00	3.23E+00	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-11030
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
19-11030-01	LCS	KNOWN	11/08/19 00:00	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	5.00E+01	2.80E-01				pCi/g
19-11030-01	LCS	SPIKE	11/08/19 00:00	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	5.29E+01	1.46E+00	1.85E+01	7.26E-01		pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	3.55E-01	3.51E-01	3.72E-01	7.08E-01	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	-3.05E-01	3.82E-01	3.96E-01	8.49E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	3.64E-01	3.73E-01	3.94E-01	7.55E-01	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	2.03E-01	2.97E-01	3.06E-01	6.13E-01	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	6.44E-02	3.25E-01	3.26E-01	6.86E-01	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	2.70E-02	2.99E-01	2.99E-01	6.39E-01	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	-2.05E-01	3.23E-01	3.31E-01	7.13E-01	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	5.22E-02	2.37E-01	2.38E-01	5.03E-01	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	5.80E-02	2.86E-01	2.87E-01	6.07E-01	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	2.61E-01	2.76E-01	2.90E-01	5.59E-01	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	-1.19E-01	2.58E-01	2.61E-01	5.69E-01	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	1.65E-01	2.37E-01	2.43E-01	4.88E-01	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/19/2019	19-11030	Strontium-90	ElChroM SRW01 Modified	1.52E-01	2.22E-01	2.29E-01	4.59E-01	U	pCi/g
19-11030-01	LCS	KNOWN	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
19-11030-01	LCS	KNOWN	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
19-11030-01	LCS	SPIKE	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Cobalt-60	EPA 901.1 Modified	1.31E+02	7.97E+00	1.04E+01	1.56E+00		pCi/g
19-11030-01	LCS	SPIKE	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Cesium-137	EPA 901.1 Modified	8.70E+01	7.81E+00	8.99E+00	1.95E+00		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: 19-11030
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
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Actinium-228	EPA 901.1 Modified	-2.83E-03	6.04E-02	6.04E-02	9.86E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Silver-108m	EPA 901.1 Modified	-1.76E-02	2.16E-02	2.16E-02	2.52E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Americium-241	EPA 901.1 Modified	-4.67E-03	3.96E-02	3.96E-02	5.23E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Barium-133	EPA 901.1 Modified	-1.74E-02	2.91E-02	2.91E-02	3.43E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Bismuth-214	EPA 901.1 Modified	7.26E-02	4.21E-02	4.23E-02	8.41E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Cobalt-60	EPA 901.1 Modified	-1.69E-02	2.17E-02	2.18E-02	2.32E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Cesium-134	EPA 901.1 Modified	-2.05E-02	2.43E-02	2.44E-02	2.98E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Cesium-137	EPA 901.1 Modified	3.88E-02	3.91E-02	3.91E-02	6.44E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Europium-152	EPA 901.1 Modified	7.89E-02	6.64E-02	6.65E-02	7.44E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Europium-154	EPA 901.1 Modified	-5.83E-03	5.17E-02	5.17E-02	3.85E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Europium-155	EPA 901.1 Modified	-1.57E-02	4.70E-02	4.70E-02	5.89E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Holmium-166m	EPA 901.1 Modified	-2.16E-02	3.28E-02	3.28E-02	3.55E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Iodine-129	EPA 901.1 Modified	2.68E-01	1.29E-01	1.30E-01	1.91E-01	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Potassium-40	EPA 901.1 Modified	1.85E-01	1.72E-01	1.73E-01	2.58E-01	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Manganese-54	EPA 901.1 Modified	3.17E-03	2.00E-02	2.00E-02	3.28E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	-3.35E-03	1.69E-02	1.69E-02	2.61E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Niobium-94	EPA 901.1 Modified	7.26E-03	1.72E-02	1.72E-02	3.14E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Lead-210	EPA 901.1 Modified	3.23E-01	4.75E-01	4.75E-01	6.84E-01	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Lead-212	EPA 901.1 Modified	1.87E-02	4.06E-02	4.06E-02	5.71E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Lead-214	EPA 901.1 Modified	-2.25E-02	4.48E-02	4.48E-02	5.39E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Promethium-145	EPA 901.1 Modified	7.80E-02	7.89E-02	7.90E-02	1.15E-01	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Radium-226	EPA 901.1 Modified	7.26E-02	4.21E-02	4.23E-02	8.41E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Antimony-125	EPA 901.1 Modified	2.81E-03	4.12E-02	4.12E-02	7.26E-02	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Thorium-234	EPA 901.1 Modified	2.22E-01	3.91E-01	3.92E-01	5.59E-01	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Thallium-208	EPA 901.1 Modified	7.11E-02	5.65E-02	5.66E-02	1.10E-01	U	pCi/g
19-11030-02	MBL	BLANK	11/08/19 00:00	11/8/2019	11/12/2019	19-11030	Uranium-235	EPA 901.1 Modified	-2.86E-02	1.38E-01	1.38E-01	1.78E-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: 19-11030
Purchase Order: 677118
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Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Actinium-228	EPA 901.1 Modified	3.51E-01	1.78E-01	1.79E-01	4.65E-01	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Silver-108m	EPA 901.1 Modified	-3.53E-02	4.59E-02	4.59E-02	5.74E-02	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Americium-241	EPA 901.1 Modified	-7.70E-03	9.89E-02	9.89E-02	1.55E-01	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Barium-133	EPA 901.1 Modified	1.45E-01	1.11E-01	1.11E-01	1.67E-01	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Bismuth-214	EPA 901.1 Modified	3.06E-01	1.18E-01	1.19E-01	1.96E-01		pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Cobalt-60	EPA 901.1 Modified	1.23E-01	4.62E-02	4.66E-02	1.08E-01		pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Cesium-134	EPA 901.1 Modified	3.25E-02	4.51E-02	4.52E-02	7.18E-02	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Cesium-137	EPA 901.1 Modified	9.52E+00	8.50E-01	9.81E-01	1.58E-01		pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Europium-152	EPA 901.1 Modified	1.85E-02	2.05E-01	2.05E-01	2.86E-01	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Europium-154	EPA 901.1 Modified	-3.26E-02	1.57E-01	1.57E-01	1.43E-01	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Europium-155	EPA 901.1 Modified	-2.16E-04	1.28E-01	1.28E-01	1.87E-01	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Holmium-166m	EPA 901.1 Modified	-1.72E-03	7.19E-02	7.19E-02	1.06E-01	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Iodine-129	EPA 901.1 Modified	-6.87E-01	4.00E-01	4.01E-01	4.86E-01	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Potassium-40	EPA 901.1 Modified	8.08E+00	1.27E+00	1.33E+00	2.80E-01		pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Manganese-54	EPA 901.1 Modified	-2.50E-02	4.42E-02	4.42E-02	6.24E-02	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	1.97E-02	3.97E-02	3.97E-02	5.65E-02	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Niobium-94	EPA 901.1 Modified	5.14E-03	1.19E-02	1.19E-02	5.82E-02	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Lead-210	EPA 901.1 Modified	2.69E+00	1.74E+00	1.75E+00	2.85E+00	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Lead-212	EPA 901.1 Modified	3.97E-01	1.79E-01	1.80E-01	2.76E-01		pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Lead-214	EPA 901.1 Modified	4.94E-01	2.21E-01	2.22E-01	4.20E-01		pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Promethium-145	EPA 901.1 Modified	9.19E-02	2.11E-01	2.11E-01	3.40E-01	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Radium-226	EPA 901.1 Modified	3.06E-01	1.18E-01	1.19E-01	1.96E-01		pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Antimony-125	EPA 901.1 Modified	-2.57E-01	2.84E-01	2.84E-01	3.87E-01	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Thorium-234	EPA 901.1 Modified	8.34E-01	8.86E-01	8.87E-01	1.47E+00	U	pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Thallium-208	EPA 901.1 Modified	3.81E-01	1.78E-01	1.79E-01	2.26E-01		pCi/g
19-11030-03	DUP	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Uranium-235	EPA 901.1 Modified	2.55E-01	3.95E-01	3.95E-01	5.88E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-11030
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
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Actinium-228	EPA 901.1 Modified	1.49E-01	1.84E-01	1.85E-01	3.17E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Silver-108m	EPA 901.1 Modified	-4.42E-03	1.85E-02	1.85E-02	6.85E-02	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Americium-241	EPA 901.1 Modified	-1.14E-01	9.91E-02	9.93E-02	1.50E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Barium-133	EPA 901.1 Modified	1.97E-02	4.20E-02	4.21E-02	1.71E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Bismuth-214	EPA 901.1 Modified	3.36E-01	1.30E-01	1.32E-01	2.00E-01		pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Cobalt-60	EPA 901.1 Modified	1.35E-01	4.64E-02	4.69E-02	8.21E-02		pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Cesium-134	EPA 901.1 Modified	-2.94E-02	4.56E-02	4.56E-02	6.83E-02	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Cesium-137	EPA 901.1 Modified	9.55E+00	8.52E-01	9.83E-01	1.39E-01		pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Europium-152	EPA 901.1 Modified	-2.22E-01	3.40E-01	3.40E-01	2.79E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Europium-154	EPA 901.1 Modified	3.21E-02	1.09E-01	1.09E-01	1.44E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Europium-155	EPA 901.1 Modified	1.39E-02	1.27E-01	1.27E-01	1.85E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Holmium-166m	EPA 901.1 Modified	-1.37E-02	7.10E-02	7.10E-02	1.06E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Iodine-129	EPA 901.1 Modified	-6.93E-01	4.11E-01	4.12E-01	4.95E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Potassium-40	EPA 901.1 Modified	8.53E+00	1.34E+00	1.41E+00	6.03E-01		pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Manganese-54	EPA 901.1 Modified	-3.97E-02	4.51E-02	4.52E-02	5.80E-02	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	2.36E-02	4.14E-02	4.14E-02	6.56E-02	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Niobium-94	EPA 901.1 Modified	1.14E-02	3.71E-02	3.71E-02	5.98E-02	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Lead-210	EPA 901.1 Modified	4.47E+00	1.83E+00	1.84E+00	2.89E+00		pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Lead-212	EPA 901.1 Modified	4.93E-01	1.94E-01	1.95E-01	2.91E-01		pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Lead-214	EPA 901.1 Modified	2.38E-01	2.26E-01	2.26E-01	3.70E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Promethium-145	EPA 901.1 Modified	-4.23E-02	2.11E-01	2.11E-01	3.34E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Radium-226	EPA 901.1 Modified	3.36E-01	1.30E-01	1.32E-01	2.00E-01		pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Antimony-125	EPA 901.1 Modified	2.03E-01	2.79E-01	2.80E-01	4.19E-01	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Thorium-234	EPA 901.1 Modified	8.88E-01	8.77E-01	8.78E-01	1.46E+00	U	pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Thallium-208	EPA 901.1 Modified	3.48E-01	1.67E-01	1.68E-01	2.11E-01		pCi/g
19-11030-04	DO	L1-10207-A-FIGS-005-SS-A	10/22/19 08:01	11/8/2019	11/12/2019	19-11030	Uranium-235	EPA 901.1 Modified	-6.62E-03	4.02E-01	4.02E-01	5.86E-01	U	pCi/g

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Final Report of Analysis

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2701 Deborah Ave
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Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Actinium-228	EPA 901.1 Modified	6.19E-01	1.74E-01	1.77E-01	4.16E-01		pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Silver-108m	EPA 901.1 Modified	8.20E-03	1.56E-02	1.56E-02	5.32E-02	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Americium-241	EPA 901.1 Modified	4.60E-03	4.83E-02	4.83E-02	1.40E-01	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Barium-133	EPA 901.1 Modified	6.65E-03	2.61E-02	2.61E-02	9.23E-02	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Bismuth-214	EPA 901.1 Modified	4.77E-01	9.89E-02	1.02E-01	4.80E-02		pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Cobalt-60	EPA 901.1 Modified	4.73E-05	2.84E-02	2.84E-02	7.13E-02	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Cesium-134	EPA 901.1 Modified	1.17E-02	1.58E-02	1.59E-02	7.16E-02	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Cesium-137	EPA 901.1 Modified	4.45E-01	8.83E-02	9.12E-02	1.05E-01		pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Europium-152	EPA 901.1 Modified	-1.13E-03	5.54E-02	5.54E-02	1.85E-01	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Europium-154	EPA 901.1 Modified	3.98E-02	1.21E-01	1.21E-01	9.54E-02	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Europium-155	EPA 901.1 Modified	1.51E-01	1.11E-01	1.11E-01	1.87E-01	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Holmium-166m	EPA 901.1 Modified	-6.34E-02	8.25E-02	8.25E-02	7.10E-02	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Iodine-129	EPA 901.1 Modified	4.90E-02	1.52E-01	1.52E-01	2.28E-01	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Potassium-40	EPA 901.1 Modified	1.33E+01	1.72E+00	1.85E+00	8.95E-01		pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Manganese-54	EPA 901.1 Modified	-2.92E-03	4.56E-02	4.56E-02	6.32E-02	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	4.36E-02	3.66E-02	3.66E-02	4.21E-02	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Niobium-94	EPA 901.1 Modified	2.81E-02	3.34E-02	3.35E-02	5.64E-02	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Lead-210	EPA 901.1 Modified	1.14E+00	8.70E-01	8.72E-01	1.43E+00	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Lead-212	EPA 901.1 Modified	6.88E-01	1.49E-01	1.53E-01	1.73E-01		pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Lead-214	EPA 901.1 Modified	6.05E-01	1.35E-01	1.38E-01	1.90E-01		pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Promethium-145	EPA 901.1 Modified	-1.36E-02	1.24E-01	1.24E-01	1.81E-01	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Radium-226	EPA 901.1 Modified	4.77E-01	9.89E-02	1.02E-01	4.80E-02		pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Antimony-125	EPA 901.1 Modified	-5.81E-03	7.91E-02	7.91E-02	1.48E-01	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Thorium-234	EPA 901.1 Modified	2.13E+00	9.32E-01	9.39E-01	1.46E+00	U	pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Thallium-208	EPA 901.1 Modified	4.10E-01	1.00E-01	1.02E-01	1.28E-01		pCi/g
19-11030-05	TRG	L1-10207-A-FIGS-003-SS-A	10/22/19 07:47	11/8/2019	11/12/2019	19-11030	Uranium-235	EPA 901.1 Modified	1.95E-01	2.60E-01	2.60E-01	3.96E-01	U	pCi/g

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Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Actinium-228	EPA 901.1 Modified	1.56E-01	1.70E-01	1.71E-01	2.89E-01	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Silver-108m	EPA 901.1 Modified	2.83E-02	3.34E-02	3.34E-02	7.00E-02	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Americium-241	EPA 901.1 Modified	2.50E-03	1.08E-01	1.08E-01	1.38E-01	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Barium-133	EPA 901.1 Modified	4.63E-03	3.55E-02	3.55E-02	9.27E-02	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Bismuth-214	EPA 901.1 Modified	2.87E-01	1.08E-01	1.09E-01	1.95E-01		pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Cobalt-60	EPA 901.1 Modified	2.03E-01	5.18E-02	5.29E-02	8.92E-02		pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Cesium-134	EPA 901.1 Modified	1.01E-03	2.44E-02	2.44E-02	6.29E-02	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Cesium-137	EPA 901.1 Modified	5.13E+00	4.78E-01	5.46E-01	1.05E-01		pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Europium-152	EPA 901.1 Modified	5.83E-04	2.22E-01	2.22E-01	2.14E-01	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Europium-154	EPA 901.1 Modified	2.77E-02	9.71E-02	9.71E-02	1.09E-01	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Europium-155	EPA 901.1 Modified	3.75E-02	1.18E-01	1.18E-01	1.54E-01	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Holmium-166m	EPA 901.1 Modified	-1.03E-02	5.74E-02	5.74E-02	7.80E-02	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Iodine-129	EPA 901.1 Modified	-4.18E-02	2.31E-01	2.31E-01	2.89E-01	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Potassium-40	EPA 901.1 Modified	7.93E+00	1.26E+00	1.33E+00	8.93E-01		pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Manganese-54	EPA 901.1 Modified	1.37E-01	8.06E-02	8.09E-02	1.23E-01		pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	1.15E-04	2.55E-02	2.55E-02	3.85E-02	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Niobium-94	EPA 901.1 Modified	-9.61E-04	3.24E-02	3.24E-02	5.08E-02	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Lead-210	EPA 901.1 Modified	3.23E+00	1.23E+00	1.24E+00	1.90E+00		pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Lead-212	EPA 901.1 Modified	2.98E-01	8.95E-02	9.08E-02	3.18E-01	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Lead-214	EPA 901.1 Modified	2.52E-01	1.34E-01	1.35E-01	2.52E-01	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Promethium-145	EPA 901.1 Modified	2.48E-01	1.89E-01	1.89E-01	2.57E-01	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Radium-226	EPA 901.1 Modified	2.87E-01	1.08E-01	1.09E-01	1.95E-01		pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Antimony-125	EPA 901.1 Modified	8.52E-02	1.38E-01	1.38E-01	2.36E-01	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Thorium-234	EPA 901.1 Modified	4.63E-01	9.95E-01	9.95E-01	1.33E+00	U	pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Thallium-208	EPA 901.1 Modified	3.89E-01	1.15E-01	1.17E-01	1.98E-01		pCi/g
19-11030-06	TRG	L1-10207-A-FIGS-002-SS-A	10/22/19 07:45	11/8/2019	11/12/2019	19-11030	Uranium-235	EPA 901.1 Modified	-1.59E-01	3.55E-01	3.55E-01	4.40E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-11030
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
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Actinium-228	EPA 901.1 Modified	2.59E-01	1.10E-01	1.11E-01	1.94E-01		pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Silver-108m	EPA 901.1 Modified	-2.00E-02	4.03E-02	4.03E-02	4.05E-02	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Americium-241	EPA 901.1 Modified	-9.39E-02	8.28E-02	8.30E-02	1.11E-01	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Barium-133	EPA 901.1 Modified	-5.88E-03	1.39E-02	1.39E-02	7.06E-02	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Bismuth-214	EPA 901.1 Modified	3.09E-01	8.60E-02	8.75E-02	1.50E-01		pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Cobalt-60	EPA 901.1 Modified	2.99E-03	4.09E-02	4.09E-02	5.44E-02	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Cesium-134	EPA 901.1 Modified	4.81E-03	1.82E-02	1.82E-02	5.97E-02	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Cesium-137	EPA 901.1 Modified	4.22E-02	3.96E-02	3.97E-02	6.50E-02	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Europium-152	EPA 901.1 Modified	0.00E+00	5.08E-02	5.08E-02	1.47E-01	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Europium-154	EPA 901.1 Modified	3.32E-02	9.20E-02	9.20E-02	7.36E-02	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Europium-155	EPA 901.1 Modified	5.83E-02	8.33E-02	8.33E-02	1.25E-01	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Holmium-166m	EPA 901.1 Modified	1.74E-02	6.26E-02	6.26E-02	5.60E-02	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Iodine-129	EPA 901.1 Modified	-6.28E-02	1.19E-01	1.19E-01	1.67E-01	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Potassium-40	EPA 901.1 Modified	1.00E+01	1.40E+00	1.49E+00	9.76E-01		pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Manganese-54	EPA 901.1 Modified	-2.09E-03	3.77E-02	3.77E-02	5.32E-02	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	-1.22E-02	3.53E-02	3.53E-02	3.55E-02	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Niobium-94	EPA 901.1 Modified	9.86E-03	1.45E-02	1.45E-02	4.05E-02	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Lead-210	EPA 901.1 Modified	7.74E-01	7.18E-01	7.19E-01	1.11E+00	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Lead-212	EPA 901.1 Modified	3.46E-01	1.06E-01	1.08E-01	1.50E-01		pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Lead-214	EPA 901.1 Modified	2.96E-01	9.76E-02	9.88E-02	1.66E-01		pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Promethium-145	EPA 901.1 Modified	3.31E-02	1.03E-01	1.03E-01	1.52E-01	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Radium-226	EPA 901.1 Modified	3.09E-01	8.60E-02	8.75E-02	1.50E-01		pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Antimony-125	EPA 901.1 Modified	-9.86E-02	8.98E-02	8.99E-02	1.14E-01	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Thorium-234	EPA 901.1 Modified	1.04E+00	7.26E-01	7.28E-01	1.12E+00	U	pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Thallium-208	EPA 901.1 Modified	3.39E-01	8.91E-02	9.08E-02	1.12E-01		pCi/g
19-11030-07	TRG	L1-10208-C-QIGS-004-SS-A	09/04/19 13:30	11/8/2019	11/12/2019	19-11030	Uranium-235	EPA 901.1 Modified	-1.14E-01	2.16E-01	2.16E-01	3.05E-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

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Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Actinium-228	EPA 901.1 Modified	4.43E-01	1.53E-01	1.55E-01	2.98E-01		pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Silver-108m	EPA 901.1 Modified	2.15E-04	2.23E-02	2.23E-02	4.88E-02	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Americium-241	EPA 901.1 Modified	-5.08E-02	1.02E-01	1.02E-01	1.25E-01	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Barium-133	EPA 901.1 Modified	3.14E-02	2.80E-02	2.81E-02	7.69E-02	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Bismuth-214	EPA 901.1 Modified	3.41E-01	9.67E-02	9.83E-02	1.79E-01		pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Cobalt-60	EPA 901.1 Modified	1.95E-02	4.31E-02	4.31E-02	6.43E-02	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Cesium-134	EPA 901.1 Modified	-4.16E-04	2.32E-02	2.32E-02	5.56E-02	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Cesium-137	EPA 901.1 Modified	1.03E+00	1.25E-01	1.36E-01	1.55E-01		pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Europium-152	EPA 901.1 Modified	1.21E-01	1.61E-01	1.61E-01	1.82E-01	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Europium-154	EPA 901.1 Modified	1.25E-01	1.14E-01	1.14E-01	9.28E-02	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Europium-155	EPA 901.1 Modified	-1.01E-02	1.11E-01	1.11E-01	1.43E-01	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Holmium-166m	EPA 901.1 Modified	-1.12E-02	6.40E-02	6.40E-02	6.74E-02	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Iodine-129	EPA 901.1 Modified	2.65E-01	1.84E-01	1.84E-01	2.63E-01	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Potassium-40	EPA 901.1 Modified	1.02E+01	1.48E+00	1.57E+00	9.32E-01		pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Manganese-54	EPA 901.1 Modified	-2.30E-02	4.17E-02	4.17E-02	5.71E-02	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	3.27E-03	3.30E-02	3.30E-02	2.79E-02	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Niobium-94	EPA 901.1 Modified	7.52E-03	3.26E-02	3.26E-02	4.95E-02	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Lead-210	EPA 901.1 Modified	1.82E+00	9.06E-01	9.11E-01	1.42E+00		pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Lead-212	EPA 901.1 Modified	3.22E-01	8.48E-02	8.63E-02	1.77E-01		pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Lead-214	EPA 901.1 Modified	3.18E-01	1.03E-01	1.05E-01	2.06E-01		pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Promethium-145	EPA 901.1 Modified	1.09E-01	1.47E-01	1.47E-01	2.00E-01	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Radium-226	EPA 901.1 Modified	3.41E-01	9.67E-02	9.83E-02	1.79E-01		pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Antimony-125	EPA 901.1 Modified	9.29E-03	9.52E-02	9.52E-02	1.59E-01	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Thorium-234	EPA 901.1 Modified	8.15E-01	9.07E-01	9.08E-01	1.25E+00	U	pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Thallium-208	EPA 901.1 Modified	2.55E-01	1.05E-01	1.06E-01	1.41E-01		pCi/g
19-11030-08	TRG	L1-10207-A-FIGS-006-SS-A	10/22/19 08:03	11/8/2019	11/12/2019	19-11030	Uranium-235	EPA 901.1 Modified	-4.76E-02	2.82E-01	2.82E-01	3.62E-01	U	pCi/g

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

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Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Actinium-228	EPA 901.1 Modified	4.39E-01	1.51E-01	1.52E-01	4.41E-01	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Silver-108m	EPA 901.1 Modified	1.73E-02	3.05E-02	3.06E-02	5.23E-02	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Americium-241	EPA 901.1 Modified	1.46E-02	8.16E-02	8.16E-02	1.29E-01	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Barium-133	EPA 901.1 Modified	1.56E-01	8.12E-02	8.16E-02	1.19E-01	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Bismuth-214	EPA 901.1 Modified	4.45E-01	1.04E-01	1.07E-01	3.72E-01		pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Cobalt-60	EPA 901.1 Modified	7.17E-03	6.38E-02	6.38E-02	7.72E-02	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Cesium-134	EPA 901.1 Modified	-1.88E-01	8.81E-02	8.87E-02	6.16E-02	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Cesium-137	EPA 901.1 Modified	1.15E-01	4.87E-02	4.91E-02	1.42E-01	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Europium-152	EPA 901.1 Modified	1.85E-02	1.06E-01	1.06E-01	1.83E-01	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Europium-154	EPA 901.1 Modified	4.26E-02	1.43E-01	1.43E-01	9.11E-02	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Europium-155	EPA 901.1 Modified	9.09E-02	1.10E-01	1.10E-01	1.76E-01	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Holmium-166m	EPA 901.1 Modified	1.11E-02	6.20E-02	6.20E-02	6.88E-02	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Iodine-129	EPA 901.1 Modified	-1.70E-01	2.21E-01	2.21E-01	3.31E-01	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Potassium-40	EPA 901.1 Modified	1.17E+01	1.72E+00	1.82E+00	1.13E+00		pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Manganese-54	EPA 901.1 Modified	-7.34E-03	4.82E-02	4.83E-02	6.84E-02	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	1.57E-02	3.52E-02	3.52E-02	5.82E-02	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Niobium-94	EPA 901.1 Modified	1.15E-02	3.57E-02	3.57E-02	5.90E-02	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Lead-210	EPA 901.1 Modified	1.55E+00	8.76E-01	8.80E-01	1.51E+00	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Lead-212	EPA 901.1 Modified	5.85E-01	1.41E-01	1.44E-01	1.69E-01		pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Lead-214	EPA 901.1 Modified	5.10E-01	1.27E-01	1.30E-01	1.89E-01		pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Promethium-145	EPA 901.1 Modified	1.00E-02	1.44E-01	1.44E-01	2.34E-01	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Radium-226	EPA 901.1 Modified	4.45E-01	1.04E-01	1.07E-01	3.72E-01		pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Antimony-125	EPA 901.1 Modified	-6.95E-02	1.14E-01	1.14E-01	1.59E-01	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Thorium-234	EPA 901.1 Modified	-2.95E-01	7.43E-01	7.43E-01	1.17E+00	U	pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Thallium-208	EPA 901.1 Modified	5.01E-01	2.31E-01	2.33E-01	3.48E-01		pCi/g
19-11030-09	TRG	L1-10208-A-FSGS-021-SS-A	10/08/19 13:40	11/8/2019	11/12/2019	19-11030	Uranium-235	EPA 901.1 Modified	4.03E-01	2.52E-01	2.52E-01	4.02E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-11030
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
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Actinium-228	EPA 901.1 Modified	2.89E-01	1.01E-01	1.02E-01	2.96E-01	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Silver-108m	EPA 901.1 Modified	8.84E-03	2.50E-02	2.50E-02	3.85E-02	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Americium-241	EPA 901.1 Modified	-7.70E-02	7.74E-02	7.75E-02	1.04E-01	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Barium-133	EPA 901.1 Modified	-2.45E-04	1.54E-02	1.54E-02	6.53E-02	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Bismuth-214	EPA 901.1 Modified	1.33E-01	8.75E-02	8.78E-02	1.49E-01	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Cobalt-60	EPA 901.1 Modified	4.56E-02	2.05E-02	2.06E-02	3.44E-02		pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Cesium-134	EPA 901.1 Modified	9.38E-03	1.84E-02	1.84E-02	5.86E-02	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Cesium-137	EPA 901.1 Modified	9.74E-02	3.59E-02	3.63E-02	5.65E-02		pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Europium-152	EPA 901.1 Modified	3.14E-02	1.24E-01	1.24E-01	1.48E-01	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Europium-154	EPA 901.1 Modified	2.43E-02	8.93E-02	8.93E-02	7.63E-02	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Europium-155	EPA 901.1 Modified	7.01E-03	8.28E-02	8.28E-02	1.20E-01	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Holmium-166m	EPA 901.1 Modified	-7.38E-02	6.40E-02	6.41E-02	5.35E-02	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Iodine-129	EPA 901.1 Modified	-1.42E-01	1.24E-01	1.24E-01	1.62E-01	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Potassium-40	EPA 901.1 Modified	7.97E+00	1.14E+00	1.21E+00	6.06E-01		pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Manganese-54	EPA 901.1 Modified	-1.23E-02	3.82E-02	3.82E-02	5.09E-02	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	-1.43E-02	3.05E-02	3.05E-02	3.97E-02	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Niobium-94	EPA 901.1 Modified	2.02E-02	3.14E-02	3.14E-02	4.71E-02	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Lead-210	EPA 901.1 Modified	1.10E+00	7.53E-01	7.55E-01	1.22E+00	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Lead-212	EPA 901.1 Modified	2.98E-01	7.26E-02	7.42E-02	1.81E-01		pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Lead-214	EPA 901.1 Modified	2.20E-01	8.21E-02	8.29E-02	1.32E-01		pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Promethium-145	EPA 901.1 Modified	7.13E-02	9.18E-02	9.18E-02	1.41E-01	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Radium-226	EPA 901.1 Modified	1.33E-01	8.75E-02	8.78E-02	1.49E-01	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Antimony-125	EPA 901.1 Modified	6.92E-03	8.11E-02	8.11E-02	1.24E-01	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Thorium-234	EPA 901.1 Modified	1.07E+00	6.80E-01	6.82E-01	1.07E+00	U	pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Thallium-208	EPA 901.1 Modified	3.05E-01	9.63E-02	9.76E-02	1.67E-01		pCi/g
19-11030-10	TRG	L1-10208-A-FSGS-009-SS-A	10/08/19 13:16	11/8/2019	11/13/2019	19-11030	Uranium-235	EPA 901.1 Modified	-7.87E-02	2.13E-01	2.13E-01	3.06E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-11030
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
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Actinium-228	EPA 901.1 Modified	4.43E-01	1.92E-01	1.93E-01	3.40E-01		pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Silver-108m	EPA 901.1 Modified	-4.18E-02	5.76E-02	5.77E-02	7.81E-02	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Americium-241	EPA 901.1 Modified	-2.99E-01	1.74E-01	1.75E-01	1.88E-01	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Barium-133	EPA 901.1 Modified	-1.67E-02	6.98E-02	6.98E-02	1.31E-01	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Bismuth-214	EPA 901.1 Modified	5.04E-01	1.50E-01	1.52E-01	2.46E-01		pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Cobalt-60	EPA 901.1 Modified	3.29E-01	6.91E-02	7.11E-02	9.77E-02		pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Cesium-134	EPA 901.1 Modified	-1.08E-02	3.64E-02	3.64E-02	9.53E-02	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Cesium-137	EPA 901.1 Modified	9.69E+00	8.77E-01	1.01E+00	1.49E-01		pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Europium-152	EPA 901.1 Modified	-1.62E-01	3.54E-01	3.54E-01	3.05E-01	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Europium-154	EPA 901.1 Modified	-4.95E-02	1.51E-01	1.51E-01	1.55E-01	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Europium-155	EPA 901.1 Modified	1.28E-01	1.29E-01	1.29E-01	2.15E-01	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Holmium-166m	EPA 901.1 Modified	-1.85E-02	8.37E-02	8.37E-02	1.16E-01	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Iodine-129	EPA 901.1 Modified	4.44E-01	3.41E-01	3.42E-01	4.60E-01	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Potassium-40	EPA 901.1 Modified	1.09E+01	1.62E+00	1.71E+00	7.33E-01		pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Manganese-54	EPA 901.1 Modified	-3.22E-02	5.13E-02	5.13E-02	7.09E-02	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	-1.23E-02	4.00E-02	4.00E-02	5.92E-02	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Niobium-94	EPA 901.1 Modified	2.51E-02	4.18E-02	4.18E-02	7.31E-02	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Lead-210	EPA 901.1 Modified	7.82E+00	2.14E+00	2.17E+00	3.14E+00		pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Lead-212	EPA 901.1 Modified	4.45E-01	1.86E-01	1.88E-01	2.83E-01		pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Lead-214	EPA 901.1 Modified	3.20E-01	1.78E-01	1.79E-01	3.17E-01		pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Promethium-145	EPA 901.1 Modified	3.71E-01	2.81E-01	2.82E-01	3.79E-01	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Radium-226	EPA 901.1 Modified	5.04E-01	1.50E-01	1.52E-01	2.46E-01		pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Antimony-125	EPA 901.1 Modified	-5.21E-02	2.18E-01	2.18E-01	3.51E-01	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Thorium-234	EPA 901.1 Modified	1.95E+00	1.44E+00	1.44E+00	1.97E+00	U	pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Thallium-208	EPA 901.1 Modified	4.70E-01	1.72E-01	1.73E-01	3.14E-01		pCi/g
19-11030-11	TRG	L1-10207-A-FIGS-014-SS-A	10/29/19 13:34	11/8/2019	11/13/2019	19-11030	Uranium-235	EPA 901.1 Modified	-5.66E-02	4.93E-01	4.93E-01	6.32E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-11030
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
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Actinium-228	EPA 901.1 Modified	2.63E-01	1.07E-01	1.08E-01	1.83E-01		pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Silver-108m	EPA 901.1 Modified	8.40E-03	1.78E-02	1.78E-02	3.74E-02	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Americium-241	EPA 901.1 Modified	2.44E-03	3.49E-02	3.49E-02	1.05E-01	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Barium-133	EPA 901.1 Modified	6.98E-03	7.00E-02	7.00E-02	7.30E-02	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Bismuth-214	EPA 901.1 Modified	3.40E-01	9.13E-02	9.29E-02	1.50E-01		pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Cobalt-60	EPA 901.1 Modified	2.34E-02	4.06E-02	4.06E-02	5.76E-02	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Cesium-134	EPA 901.1 Modified	7.78E-03	2.01E-02	2.01E-02	5.95E-02	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Cesium-137	EPA 901.1 Modified	9.27E-02	3.72E-02	3.75E-02	8.02E-02		pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Europium-152	EPA 901.1 Modified	-1.59E-01	1.27E-01	1.27E-01	1.46E-01	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Europium-154	EPA 901.1 Modified	1.77E-02	8.42E-02	8.42E-02	7.58E-02	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Europium-155	EPA 901.1 Modified	1.27E-01	1.05E-01	1.05E-01	1.52E-01	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Holmium-166m	EPA 901.1 Modified	-1.67E-02	5.72E-02	5.72E-02	5.21E-02	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Iodine-129	EPA 901.1 Modified	7.42E-02	7.35E-02	7.36E-02	1.20E-01	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Potassium-40	EPA 901.1 Modified	9.66E+00	1.30E+00	1.39E+00	7.11E-01		pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Manganese-54	EPA 901.1 Modified	4.15E-02	3.10E-02	3.11E-02	4.78E-02	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	-4.50E-03	2.77E-02	2.77E-02	3.55E-02	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Niobium-94	EPA 901.1 Modified	-2.13E-03	2.37E-02	2.37E-02	3.85E-02	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Lead-210	EPA 901.1 Modified	6.00E-01	7.00E-01	7.01E-01	1.17E+00	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Lead-212	EPA 901.1 Modified	2.70E-01	7.36E-02	7.49E-02	1.55E-01		pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Lead-214	EPA 901.1 Modified	3.62E-01	7.91E-02	8.13E-02	2.58E-01		pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Promethium-145	EPA 901.1 Modified	6.74E-02	9.28E-02	9.28E-02	1.42E-01	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Radium-226	EPA 901.1 Modified	3.40E-01	9.13E-02	9.29E-02	1.50E-01		pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Antimony-125	EPA 901.1 Modified	-5.99E-04	3.27E-02	3.27E-02	1.27E-01	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Thorium-234	EPA 901.1 Modified	7.55E-01	8.58E-01	8.58E-01	1.38E+00	U	pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Thallium-208	EPA 901.1 Modified	2.44E-01	7.63E-02	7.73E-02	1.86E-01		pCi/g
19-11030-12	TRG	L1-10208-C-FSGS-017-SS-A	08/13/19 09:04	11/8/2019	11/13/2019	19-11030	Uranium-235	EPA 901.1 Modified	1.99E-01	2.04E-01	2.04E-01	3.17E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Patricia Giza	SDG:	19-11030
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
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Actinium-228	EPA 901.1 Modified	3.83E-01	1.69E-01	1.70E-01	4.51E-01	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Silver-108m	EPA 901.1 Modified	-2.94E-02	5.68E-02	5.68E-02	6.25E-02	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Americium-241	EPA 901.1 Modified	-1.68E-02	6.49E-02	6.49E-02	1.49E-01	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Barium-133	EPA 901.1 Modified	1.35E-02	3.18E-02	3.18E-02	1.18E-01	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Bismuth-214	EPA 901.1 Modified	5.54E-01	1.35E-01	1.38E-01	1.93E-01		pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Cobalt-60	EPA 901.1 Modified	5.04E-02	6.41E-02	6.42E-02	8.30E-02	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Cesium-134	EPA 901.1 Modified	8.70E-04	1.78E-02	1.78E-02	7.76E-02	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Cesium-137	EPA 901.1 Modified	9.65E-02	5.02E-02	5.04E-02	7.42E-02		pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Europium-152	EPA 901.1 Modified	-2.73E-02	1.15E-01	1.15E-01	1.99E-01	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Europium-154	EPA 901.1 Modified	1.55E-02	1.33E-01	1.33E-01	1.02E-01	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Europium-155	EPA 901.1 Modified	1.11E-01	1.13E-01	1.14E-01	1.91E-01	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Holmium-166m	EPA 901.1 Modified	5.61E-02	7.24E-02	7.25E-02	7.29E-02	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Iodine-129	EPA 901.1 Modified	-6.95E-02	3.42E-01	3.42E-01	5.40E-01	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Potassium-40	EPA 901.1 Modified	1.35E+01	1.82E+00	1.94E+00	6.83E-01		pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Manganese-54	EPA 901.1 Modified	1.73E-02	3.49E-02	3.49E-02	7.57E-02	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	-2.83E-03	3.70E-02	3.70E-02	5.21E-02	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Niobium-94	EPA 901.1 Modified	-2.15E-02	3.67E-02	3.67E-02	5.32E-02	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Lead-210	EPA 901.1 Modified	4.60E-01	1.16E+00	1.16E+00	1.90E+00	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Lead-212	EPA 901.1 Modified	4.10E-01	1.09E-01	1.11E-01	2.19E-01		pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Lead-214	EPA 901.1 Modified	5.78E-01	1.39E-01	1.43E-01	2.02E-01		pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Promethium-145	EPA 901.1 Modified	2.49E-01	2.17E-01	2.18E-01	3.56E-01	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Radium-226	EPA 901.1 Modified	5.54E-01	1.35E-01	1.38E-01	1.93E-01		pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Antimony-125	EPA 901.1 Modified	-1.81E-02	1.44E-01	1.44E-01	2.08E-01	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Thorium-234	EPA 901.1 Modified	1.30E+00	1.39E+00	1.39E+00	2.32E+00	U	pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Thallium-208	EPA 901.1 Modified	4.73E-01	1.46E-01	1.48E-01	5.11E-02		pCi/g
19-11030-13	TRG	L1-10208-B-FSGS-016-SS-A	08/12/19 09:00	11/8/2019	11/13/2019	19-11030	Uranium-235	EPA 901.1 Modified	9.29E-03	2.85E-01	2.85E-01	4.20E-01	U	pCi/g

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

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Final Report of Analysis

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Patricia Giza	SDG:	19-11030
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
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Actinium-228	EPA 901.1 Modified	3.40E-01	1.32E-01	1.33E-01	3.38E-01		pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Silver-108m	EPA 901.1 Modified	1.27E-03	1.32E-02	1.32E-02	3.50E-02	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Americium-241	EPA 901.1 Modified	-7.64E-02	8.30E-02	8.31E-02	9.67E-02	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Barium-133	EPA 901.1 Modified	2.41E-02	2.84E-02	2.84E-02	5.16E-02	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Bismuth-214	EPA 901.1 Modified	3.07E-01	8.63E-02	8.77E-02	1.36E-01		pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Cobalt-60	EPA 901.1 Modified	2.12E-03	3.50E-02	3.50E-02	4.52E-02	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Cesium-134	EPA 901.1 Modified	-1.74E-03	1.54E-02	1.54E-02	4.42E-02	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Cesium-137	EPA 901.1 Modified	4.23E-02	3.73E-02	3.73E-02	6.06E-02	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Europium-152	EPA 901.1 Modified	-5.11E-02	1.21E-01	1.21E-01	1.50E-01	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Europium-154	EPA 901.1 Modified	0.00E+00	8.97E-02	8.97E-02	7.26E-02	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Europium-155	EPA 901.1 Modified	-9.71E-02	9.74E-02	9.75E-02	1.14E-01	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Holmium-166m	EPA 901.1 Modified	-1.33E-02	5.08E-02	5.08E-02	4.96E-02	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Iodine-129	EPA 901.1 Modified	2.78E-01	1.57E-01	1.57E-01	2.21E-01	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Potassium-40	EPA 901.1 Modified	1.02E+01	1.36E+00	1.46E+00	7.08E-01		pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Manganese-54	EPA 901.1 Modified	1.64E-02	3.43E-02	3.43E-02	5.56E-02	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Molybdenum-93	EPA 901.1 Modified	-1.29E-04	2.67E-02	2.67E-02	3.87E-02	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Niobium-94	EPA 901.1 Modified	6.54E-03	3.05E-02	3.05E-02	4.61E-02	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Lead-210	EPA 901.1 Modified	7.23E-01	7.15E-01	7.16E-01	1.02E+00	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Lead-212	EPA 901.1 Modified	2.68E-01	6.50E-02	6.64E-02	1.30E-01		pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Lead-214	EPA 901.1 Modified	2.91E-01	8.65E-02	8.78E-02	1.24E-01		pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Promethium-145	EPA 901.1 Modified	9.76E-02	1.20E-01	1.20E-01	1.64E-01	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Radium-226	EPA 901.1 Modified	3.07E-01	8.63E-02	8.77E-02	1.36E-01		pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Antimony-125	EPA 901.1 Modified	6.83E-03	6.82E-02	6.82E-02	1.14E-01	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Thorium-234	EPA 901.1 Modified	4.02E-01	7.53E-01	7.53E-01	1.01E+00	U	pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Thallium-208	EPA 901.1 Modified	2.27E-01	8.74E-02	8.82E-02	1.58E-01		pCi/g
19-11030-14	TRG	L1-10208-C-FIGS-002-SS-A	08/13/19 13:12	11/8/2019	11/13/2019	19-11030	Uranium-235	EPA 901.1 Modified	3.10E-02	2.17E-01	2.17E-01	2.85E-01	U	pCi/g

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

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ZS-WM-131
Revision 0
Information Use

REC'D NOV 0 8 2019

19-11030

Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L1-10207-A-FIGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/28/19	1451	5 ROC HTD	NA	801.99
L1-10207-A-FSGS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/16/19	1334	5 ROC HTD	NA	811.21
L1-10207-A-FIGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/29/19	1330	5 ROC HTD	NA	922.44
L1-10207-A-FIGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/29/19	1332	5 ROC HTD	NA	841.51
L1-10207-A-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/16/19	1324	5 ROC HTD	NA	876.15
L1-10207-A-FIGS-015-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/29/19	1336	5 ROC HTD	NA	893.62
L1-10207-A-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/16/19	1328	5 ROC HTD	NA	746.34
L1-10207-A-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/16/19	1322	5 ROC HTD	NA	867.31
L1-10208-B-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	8/12/19	0834	5 ROC HTD	NA	1071.96
L1-10208-B-FSGS-017-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/5/19	0820	5 ROC HTD	NA	970.53
L1-10207-A-FIGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	0749	5 ROC HTD	NA	853.76
4 L1-10207-A-FIGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	0801	5 ROC HTD	NA	837.38
5 L1-10207-A-FIGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	0747	5 ROC HTD	NA	896.71
6 L1-10207-A-FIGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	0745	5 ROC HTD	NA	939.31
7 L1-10208-C-QIGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/4/19	1330	5 ROC HTD	NA	959.99
8 L1-10207-A-FIGS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/22/19	0803	5 ROC HTD	NA	814.48
9 L1-10208-A-FSGS-021-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/8/19	1340	5 ROC HTD	NA	855.69

Rec RB 11-08-19 ⓒ 1015

[268]

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19-11030

REC'D NOV 08 2019

ZS-WM-131
Revision 0
Information Use

10	L1-10208-A-FSGS-009-SS-A	N/A	N/A	SOIL	500	ml	MARINELLI	1	10/8/19	1316	5 ROC HTD	NA	902.39
11	L1-10207-A-FIGS-014-SS-A	N/A	N/A	SOIL	500	ml	MARINELLI	1	10/29/19	1334	5 ROC HTD	NA	666.62
12	L1-10208-C-FSGS-017-SS-A	N/A	N/A	SOIL	500	ml	MARINELLI	1	8/13/19	0904	5 ROC HTD	NA	1041.13
13	L1-10208-B-FSGS-016-SS-A	N/A	N/A	SOIL	500	ml	MARINELLI	1	8/12/19	0900	5 ROC HTD	NA	906.06
14	L1-10208-C-FIGS-002-SS-A	N/A	N/A	SOIL	500	ml	MARINELLI	1	8/13/19	1312	5 ROC HTD	NA	1215.38
		N/A	N/A	SOIL	500	ml	MARINELLI	1			5 ROC HTD	NA	

Laboratory: **EBERLINE LABS**	Date Submitted To Lab:	Ship Container No.: **NA**	Cooler Temperature: **N/A**
Airbill Number: Fed Ex Ground 7769 1135 8823 / 7769 1135 8640			

Master #001 — #007

Relinquished by: Jacen Mucia	Date (mm/dd/yyyy): 11/5/19	Time: 1525	Received by: Richard F. Rickert	Date: (mm/dd/yyyy): 11/05/2019	1525
Relinquished by: Richard F. Rickert	Date (mm/dd/yyyy): 11/07/2019	Time: 1600	Received by: Fed Ex Ground	Date: (mm/dd/yyyy): 11/07/2019	1600
Relinquished by: Fedex Ground	Date (mm/dd/yyyy):	Time:	Received by: Donald R Spencer	Date: (mm/dd/yyyy): 11/08/2019	1015
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	

Comments
PO # HTO's 67718 14 Day Turn Around

[269]

EBERLINE ANALYTICAL

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

EBS-OR-46721

February 7, 2020

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

CASE NARRATIVE
Work Order # 20-01085-OR

SAMPLE RECEIPT

This work order contains two soil samples received 01/17/2020. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID
L110204AFSGS017SS-A	20-01085-04
L110208AFSGS020SS-A	20-01085-05

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.

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.

ANALYTICAL RESULTS CONTINUED

TOTAL STRONTIUM CONTINUED

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

TRITIUM

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

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

NICKEL-63

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

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

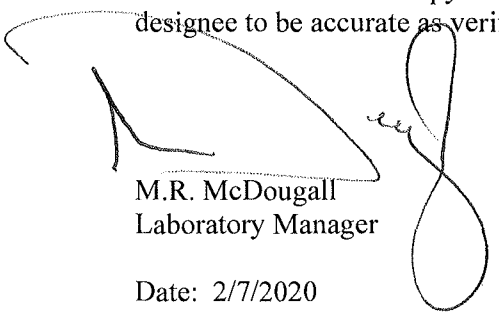
GAMMA SPECTROSCOPY

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

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

CERTIFICATION OF ACCURACY

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



M.R. McDougall
Laboratory Manager

Date: 2/7/2020

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

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Jeffrey Graham		SDG:	20-01085
Zion Solutions		Purchase Order:	677118
2701 Deborah Ave		Analysis Category:	ENVIRONMENTAL
Zion, IL 60099		Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01085-01	LCS	KNOWN	01/17/20 00:00	1/17/2020	1/23/2020	20-01085	Tritium	LANL ER-210 Modified	2.00E+02	7.22E+00				pCi/g
20-01085-01	LCS	SPIKE	01/17/20 00:00	1/17/2020	1/23/2020	20-01085	Tritium	LANL ER-210 Modified	2.13E+02	7.77E+00	1.42E+01	5.33E+00		pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/23/2020	20-01085	Tritium	LANL ER-210 Modified	-1.30E+00	3.00E+00	3.00E+00	5.30E+00	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/23/2020	20-01085	Tritium	LANL ER-210 Modified	7.45E-01	3.08E+00	3.08E+00	5.31E+00	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/23/2020	20-01085	Tritium	LANL ER-210 Modified	1.11E+00	3.09E+00	3.09E+00	5.29E+00	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/23/2020	20-01085	Tritium	LANL ER-210 Modified	1.13E+00	3.13E+00	3.13E+00	5.36E+00	U	pCi/g
20-01085-01	LCS	KNOWN	01/17/20 00:00	1/17/2020	1/23/2020	20-01085	Nickel-63	ASTM 3500-Ni Modified	1.48E+03	4.45E+01				pCi/g
20-01085-01	LCS	SPIKE	01/17/20 00:00	1/17/2020	1/23/2020	20-01085	Nickel-63	ASTM 3500-Ni Modified	1.49E+03	1.29E+01	8.83E+01	3.11E+00		pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/23/2020	20-01085	Nickel-63	ASTM 3500-Ni Modified	1.41E+01	2.17E+00	2.32E+00	3.07E+00		pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/23/2020	20-01085	Nickel-63	ASTM 3500-Ni Modified	1.89E+00	1.87E+00	1.88E+00	3.13E+00	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/23/2020	20-01085	Nickel-63	ASTM 3500-Ni Modified	1.01E+00	1.81E+00	1.81E+00	3.07E+00	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/23/2020	20-01085	Nickel-63	ASTM 3500-Ni Modified	1.62E-01	1.72E+00	1.72E+00	2.95E+00	U	pCi/g
20-01085-01	LCS	KNOWN	01/17/20 00:00	1/17/2020	1/22/2020	20-01085	Strontium-90	EIChroM SRW01 Modified	5.01E+01	2.81E-01				pCi/g
20-01085-01	LCS	SPIKE	01/17/20 00:00	1/17/2020	1/22/2020	20-01085	Strontium-90	EIChroM SRW01 Modified	4.82E+01	2.67E+00	1.70E+01	1.01E+00		pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/22/2020	20-01085	Strontium-90	EIChroM SRW01 Modified	1.90E-01	3.31E-01	3.38E-01	6.88E-01	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/22/2020	20-01085	Strontium-90	EIChroM SRW01 Modified	3.43E-01	4.16E-01	4.33E-01	8.52E-01	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/22/2020	20-01085	Strontium-90	EIChroM SRW01 Modified	1.33E-01	3.50E-01	3.53E-01	7.34E-01	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/22/2020	20-01085	Strontium-90	EIChroM SRW01 Modified	1.01E-01	3.12E-01	3.14E-01	6.58E-01	U	pCi/g
20-01085-01	LCS	KNOWN	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
20-01085-01	LCS	KNOWN	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
20-01085-01	LCS	SPIKE	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Cobalt-60	EPA 901.1 Modified	1.31E+02	7.99E+00	1.04E+01	1.54E+00		pCi/g
20-01085-01	LCS	SPIKE	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Cesium-137	EPA 901.1 Modified	8.56E+01	7.68E+00	8.85E+00	1.99E+00		pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:

Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	**20-01085**
Purchase Order:	677118
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Actinium-228	EPA 901.1 Modified	2.51E-03	6.61E-02	6.61E-02	1.01E-01	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Silver-108m	EPA 901.1 Modified	-9.82E-03	2.43E-02	2.43E-02	2.36E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Americium-241	EPA 901.1 Modified	-7.98E-02	5.46E-02	5.47E-02	6.27E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Barium-133	EPA 901.1 Modified	-1.06E-02	2.49E-02	2.49E-02	3.55E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Bismuth-214	EPA 901.1 Modified	7.32E-02	4.35E-02	4.36E-02	7.97E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Cobalt-60	EPA 901.1 Modified	-7.50E-03	1.88E-02	1.88E-02	2.88E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Cesium-134	EPA 901.1 Modified	-1.87E-02	2.83E-02	2.83E-02	3.11E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Cesium-137	EPA 901.1 Modified	2.19E-02	1.65E-02	1.65E-02	3.27E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Europium-152	EPA 901.1 Modified	-3.53E-02	7.12E-02	7.12E-02	8.21E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Europium-154	EPA 901.1 Modified	-2.39E-02	4.72E-02	4.72E-02	4.15E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Europium-155	EPA 901.1 Modified	-4.68E-02	4.44E-02	4.45E-02	5.81E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Holmium-166m	EPA 901.1 Modified	2.97E-02	2.54E-02	2.55E-02	3.42E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Iodine-129	EPA 901.1 Modified	1.68E-02	7.52E-02	7.52E-02	1.15E-01	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Potassium-40	EPA 901.1 Modified	1.37E-01	1.38E-01	1.38E-01	2.11E-01	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Manganese-54	EPA 901.1 Modified	8.46E-04	2.05E-02	2.05E-02	2.94E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Molybdenum-93	EPA 901.1 Modified	6.92E-04	1.68E-02	1.68E-02	2.50E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Niobium-94	EPA 901.1 Modified	4.58E-03	1.72E-02	1.72E-02	2.69E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Lead-210	EPA 901.1 Modified	7.12E-01	4.01E-01	4.02E-01	6.85E-01	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Lead-212	EPA 901.1 Modified	8.08E-02	4.68E-02	4.70E-02	7.28E-02		pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Lead-214	EPA 901.1 Modified	-4.42E-03	4.17E-02	4.17E-02	6.29E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Promethium-145	EPA 901.1 Modified	-1.77E-02	5.94E-02	5.94E-02	8.57E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Radium-226	EPA 901.1 Modified	7.32E-02	4.35E-02	4.36E-02	7.97E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Antimony-125	EPA 901.1 Modified	-2.79E-02	4.79E-02	4.80E-02	6.45E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Thorium-234	EPA 901.1 Modified	1.20E+00	3.87E-01	3.92E-01	6.93E-01	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Thallium-208	EPA 901.1 Modified	3.21E-02	5.96E-02	5.96E-02	9.33E-02	U	pCi/g
20-01085-02	MBL	BLANK	01/17/20 00:00	1/17/2020	1/21/2020	20-01085	Uranium-235	EPA 901.1 Modified	6.67E-02	1.13E-01	1.13E-01	1.80E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01085
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Actinium-228	EPA 901.1 Modified	2.73E-01	1.84E-01	1.85E-01	3.44E-01	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Silver-108m	EPA 901.1 Modified	-3.48E-02	4.81E-02	4.82E-02	3.82E-02	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Americium-241	EPA 901.1 Modified	-2.44E-02	1.01E-01	1.01E-01	1.26E-01	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Barium-133	EPA 901.1 Modified	1.70E-03	2.13E-02	2.13E-02	6.12E-02	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Bismuth-214	EPA 901.1 Modified	3.67E-01	1.20E-01	1.21E-01	1.86E-01		pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Cobalt-60	EPA 901.1 Modified	-4.94E-03	4.30E-02	4.30E-02	6.29E-02	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Cesium-134	EPA 901.1 Modified	2.36E-03	2.26E-02	2.26E-02	5.54E-02	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Cesium-137	EPA 901.1 Modified	5.83E-02	4.94E-02	4.94E-02	7.99E-02	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Europium-152	EPA 901.1 Modified	2.12E-02	9.18E-02	9.18E-02	1.80E-01	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Europium-154	EPA 901.1 Modified	3.93E-02	1.14E-01	1.14E-01	9.27E-02	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Europium-155	EPA 901.1 Modified	4.69E-02	1.11E-01	1.11E-01	1.47E-01	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Holmium-166m	EPA 901.1 Modified	-6.44E-02	7.77E-02	7.78E-02	6.98E-02	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Iodine-129	EPA 901.1 Modified	1.52E-01	1.38E-01	1.38E-01	2.08E-01	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Potassium-40	EPA 901.1 Modified	8.11E+00	1.27E+00	1.33E+00	7.44E-01		pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Manganese-54	EPA 901.1 Modified	4.56E-02	4.34E-02	4.35E-02	7.56E-02	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Molybdenum-93	EPA 901.1 Modified	-1.45E-02	3.35E-02	3.35E-02	4.22E-02	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Niobium-94	EPA 901.1 Modified	-2.17E-03	3.19E-02	3.19E-02	4.98E-02	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Lead-210	EPA 901.1 Modified	1.80E+00	1.31E+00	1.32E+00	2.16E+00	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Lead-212	EPA 901.1 Modified	3.47E-01	8.46E-02	8.65E-02	1.78E-01		pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Lead-214	EPA 901.1 Modified	4.29E-01	1.18E-01	1.20E-01	1.74E-01		pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Promethium-145	EPA 901.1 Modified	-1.62E-01	1.55E-01	1.55E-01	1.77E-01	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Radium-226	EPA 901.1 Modified	3.67E-01	1.20E-01	1.21E-01	1.86E-01		pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Antimony-125	EPA 901.1 Modified	1.80E-02	8.89E-02	8.89E-02	1.48E-01	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Thorium-234	EPA 901.1 Modified	9.42E-01	1.13E+00	1.13E+00	1.89E+00	U	pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Thallium-208	EPA 901.1 Modified	4.29E-01	1.14E-01	1.16E-01	1.71E-01		pCi/g
20-01085-03	DUP	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Uranium-235	EPA 901.1 Modified	3.99E-01	2.70E-01	2.70E-01	4.00E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Jeffrey Graham	SDG:	20-01085
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Actinium-228	EPA 901.1 Modified	3.83E-01	1.38E-01	1.40E-01	3.42E-01		pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Silver-108m	EPA 901.1 Modified	-3.52E-02	4.77E-02	4.77E-02	4.72E-02	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Americium-241	EPA 901.1 Modified	-8.58E-02	9.96E-02	9.97E-02	1.19E-01	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Barium-133	EPA 901.1 Modified	4.23E-03	3.09E-02	3.09E-02	6.39E-02	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Bismuth-214	EPA 901.1 Modified	3.55E-01	1.03E-01	1.05E-01	1.86E-01		pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Cobalt-60	EPA 901.1 Modified	3.89E-02	3.92E-02	3.92E-02	7.24E-02	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Cesium-134	EPA 901.1 Modified	1.44E-02	2.28E-02	2.28E-02	5.89E-02	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Cesium-137	EPA 901.1 Modified	4.00E-02	4.60E-02	4.61E-02	7.67E-02	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Europium-152	EPA 901.1 Modified	4.44E-02	9.51E-02	9.52E-02	1.79E-01	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Europium-154	EPA 901.1 Modified	-6.57E-02	1.16E-01	1.16E-01	9.07E-02	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Europium-155	EPA 901.1 Modified	-3.98E-02	1.12E-01	1.12E-01	1.41E-01	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Holmium-166m	EPA 901.1 Modified	1.71E-02	6.02E-02	6.02E-02	6.54E-02	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Iodine-129	EPA 901.1 Modified	-3.73E-03	1.53E-01	1.53E-01	2.04E-01	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Potassium-40	EPA 901.1 Modified	8.06E+00	1.23E+00	1.30E+00	5.48E-01		pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Manganese-54	EPA 901.1 Modified	-1.42E-03	3.68E-02	3.68E-02	5.81E-02	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Molybdenum-93	EPA 901.1 Modified	-1.62E-02	3.35E-02	3.35E-02	4.74E-02	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Niobium-94	EPA 901.1 Modified	1.39E-03	2.44E-02	2.44E-02	4.77E-02	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Lead-210	EPA 901.1 Modified	1.10E+00	9.48E-01	9.50E-01	1.36E+00	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Lead-212	EPA 901.1 Modified	3.77E-01	1.12E-01	1.13E-01	1.48E-01		pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Lead-214	EPA 901.1 Modified	4.48E-01	1.21E-01	1.23E-01	1.69E-01		pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Promethium-145	EPA 901.1 Modified	8.27E-02	1.38E-01	1.38E-01	1.90E-01	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Radium-226	EPA 901.1 Modified	3.55E-01	1.03E-01	1.05E-01	1.86E-01		pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Antimony-125	EPA 901.1 Modified	-4.95E-02	9.30E-02	9.31E-02	1.44E-01	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Thorium-234	EPA 901.1 Modified	7.03E-01	9.18E-01	9.18E-01	1.27E+00	U	pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Thallium-208	EPA 901.1 Modified	3.67E-01	1.19E-01	1.21E-01	2.27E-01		pCi/g
20-01085-04	DO	L110204AFSGS017SS-A	11/15/19 14:02	1/17/2020	1/21/2020	20-01085	Uranium-235	EPA 901.1 Modified	2.23E-01	2.65E-01	2.66E-01	3.78E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01085
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Actinium-228	EPA 901.1 Modified	4.72E-01	1.69E-01	1.71E-01	3.38E-01		pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Silver-108m	EPA 901.1 Modified	-6.39E-02	5.81E-02	5.82E-02	6.63E-02	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Americium-241	EPA 901.1 Modified	-1.76E-01	1.00E-01	1.00E-01	1.41E-01	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Barium-133	EPA 901.1 Modified	6.74E-02	8.33E-02	8.33E-02	1.17E-01	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Bismuth-214	EPA 901.1 Modified	3.54E-01	1.15E-01	1.16E-01	2.79E-01		pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Cobalt-60	EPA 901.1 Modified	6.93E-02	3.89E-02	3.91E-02	7.86E-02	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Cesium-134	EPA 901.1 Modified	4.30E-02	3.88E-02	3.89E-02	1.16E-01	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Cesium-137	EPA 901.1 Modified	2.62E-01	7.70E-02	7.82E-02	9.57E-02		pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Europium-152	EPA 901.1 Modified	4.93E-03	7.11E-02	7.11E-02	2.12E-01	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Europium-154	EPA 901.1 Modified	-1.70E-02	1.53E-01	1.53E-01	1.09E-01	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Europium-155	EPA 901.1 Modified	6.97E-02	1.22E-01	1.22E-01	1.82E-01	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Holmium-166m	EPA 901.1 Modified	-1.90E-02	8.58E-02	8.58E-02	7.59E-02	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Iodine-129	EPA 901.1 Modified	5.24E-02	2.32E-01	2.32E-01	3.82E-01	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Potassium-40	EPA 901.1 Modified	9.21E+00	1.55E+00	1.62E+00	9.40E-01		pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Manganese-54	EPA 901.1 Modified	-5.71E-02	7.00E-02	7.01E-02	8.94E-02	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Molybdenum-93	EPA 901.1 Modified	-2.02E-03	2.83E-02	2.83E-02	6.13E-02	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Niobium-94	EPA 901.1 Modified	2.75E-02	3.86E-02	3.86E-02	6.86E-02	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Lead-210	EPA 901.1 Modified	1.69E+00	1.06E+00	1.07E+00	2.40E+00	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Lead-212	EPA 901.1 Modified	4.44E-01	1.45E-01	1.47E-01	2.00E-01		pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Lead-214	EPA 901.1 Modified	3.23E-01	1.34E-01	1.35E-01	2.64E-01		pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Promethium-145	EPA 901.1 Modified	-2.81E-02	1.64E-01	1.64E-01	2.66E-01	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Radium-226	EPA 901.1 Modified	3.54E-01	1.15E-01	1.16E-01	2.79E-01		pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Antimony-125	EPA 901.1 Modified	-1.05E-01	1.33E-01	1.33E-01	1.79E-01	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Thorium-234	EPA 901.1 Modified	1.43E+00	1.36E+00	1.36E+00	2.26E+00	U	pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Thallium-208	EPA 901.1 Modified	4.15E-01	1.49E-01	1.50E-01	6.38E-02		pCi/g
20-01085-05	TRG	L110208AFSGS020SS-A	10/08/19 13:38	1/17/2020	1/21/2020	20-01085	Uranium-235	EPA 901.1 Modified	-1.69E-01	3.02E-01	3.02E-01	4.28E-01	U	pCi/g

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

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ZS-WM-131
Revision 0
Information Use

Attachment 1 – Chain-of-Custody Form

20-01085

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks (weight)
L110204AFSGS017SS-A	N/A	N/A	Soil	500	mL	Marinelli	1	11-15-19	14:02	HTD	N/A	779.13g
L110208AFSGS020SS-A	N/A	N/A	Soil	500	mL	Marinelli	1	10-8-19	13:38	HTD	N/A	684.63g

Laboratory:	Date Submitted To Lab:	Ship Container No.:	Cooler Temperature:	Airbill Number:
EBERLINE LABS		1 of 1	N/A	Fed Ex Standard Overnight 8132 0229 4926

Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	Time:
Vicky Baldwin	01/16/2020	07:56	Richard F. Rickert	01/16/2020	0756
Richard F. Rickert	01/16/2020	1600	FedEx Standard Overnight	01/16/2020	1600
Fedex			Kenneth Spencer	01/17/2020	1323

Comments
PO # 67718 HTDs 7day turn around

~~8 of 9~~ RJR 1-16-2020
1 of 1