ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

SOUTH WAREHOUSE AREA

SURVEY UNIT 10208C

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

This open land survey unit has a MARSSIM classification of one. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I (α) and Type II (β) decision error rates were set at 0.05. Seventeen (17) systematic surface soil samples were acquired from the survey unit. In addition, surface scanning was performed on 100% of the total surface area in the survey unit. One (1) small area of elevated activity was detected during the scans (see Section 9 for further discussion). The analytical results for all soil samples (systematic and investigation) taken in survey unit 10208C 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. For the systematic samples, the maximum Operational SOF (OpSOF) was 0.083 with a mean OpSOF of 0.045. 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 0.291 mrem/yr Total Effective Dose Equivalent (TEDE). Therefore, the null hypothesis is rejected and survey unit 10208C is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 10208C, "South Warehouse Area," is a Class 1 open land survey unit and is 1,868 m^2 in size. It is bounded on the west by survey unit 10208B, the east by survey unit 10208D, the north by survey units 10207C and 10207D, and the south by survey units 10218A and 10221A.

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

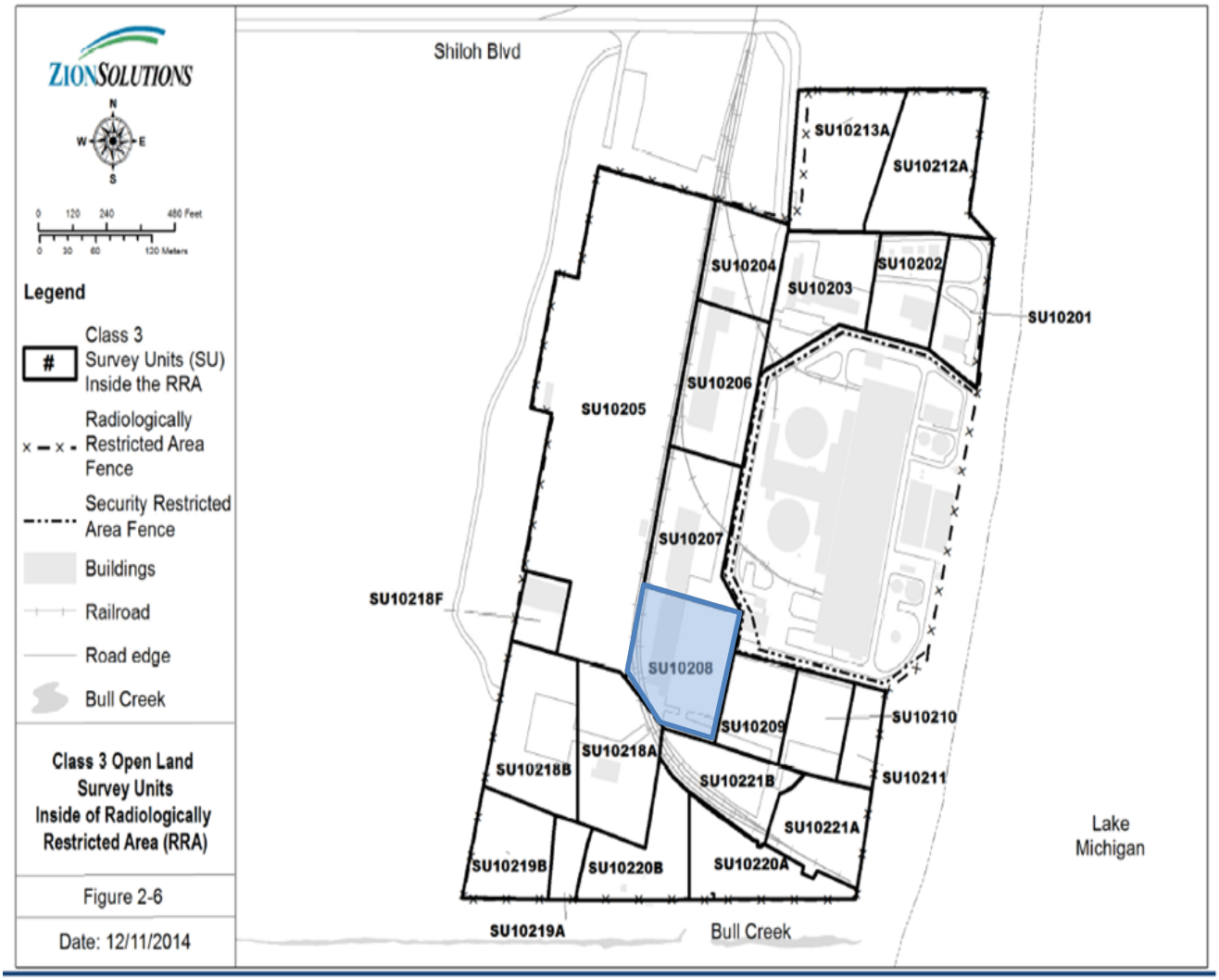
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 10208C 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 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 of the storm drains which tied into the south oil separator into which was also connected to the fire sump system.

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

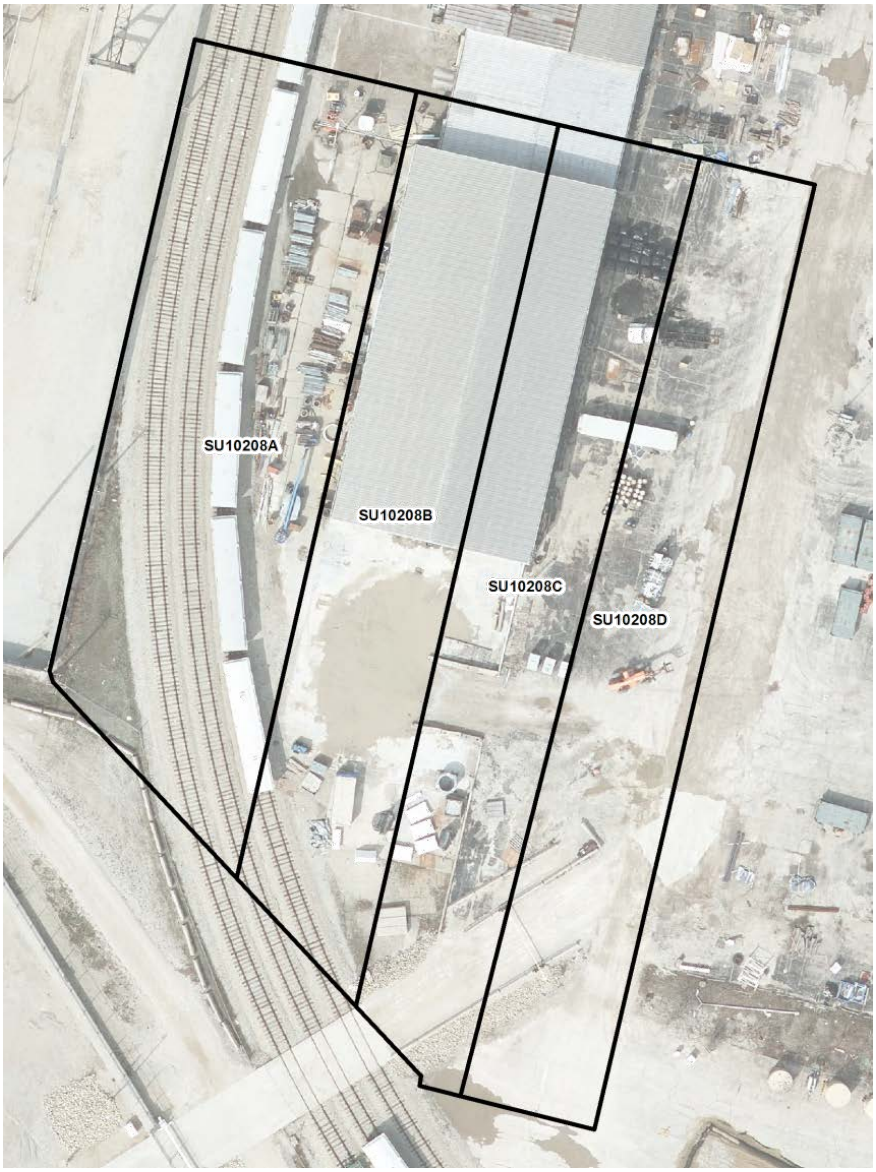
- Eight (8) judgmental surface samples and one (1) judgmental subsurface sample taken at the direction of the cognizant Radiological Engineer (RE) in areas that could have served as collection points for runoff from the parking lot.
- Twenty-two (22) random surface samples and one (1) random subsurface sample.
- Three (3) investigation surface samples and one (1) investigation subsurface sample taken in areas identified by scan alarms.
- NaI walkover scans of approximately 34% of the surface area in 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 August 13, 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 10208C 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 10208C 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 presented in Table 4 and Table 5, respectively.

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

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

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

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

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

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

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

unique sample identification, analytical method, radionuclide, result, uncertainty, laboratory data qualifiers, units, and the observed MDC.

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

5. SURVEY DESIGN

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

The DQO process determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 would be the ROC in survey unit 10208C. 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 10208C, 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 Operational DCGL 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 Zion*Solutions* TSD-11-004, *"Ludlum Model 44-10 Detector Sensitivity"* (Reference 11) with the following parameters:

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

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

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

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

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

The computer program Visual Sample Plan (VSP) was used to generate the sample map, in accordance with ZS-LT-300-001-001. The map used was provided by the Survey Mapping/Computer Assisted Design Specialist, with coordinates based on the Illinois State Plane NAD 1983 standard topographical grid coordinate system. The number of samples generated by VSP for a systematic triangular grid was seventeen. 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: $A = \frac{A_{SU}}{N} = \frac{1868}{17} = 109.9\ m^2$
- From the LTP, Table 5-16, the Area Factors for the next larger area (300 m^2) were used:
  - Cs-137 - 1.46
  - Cs-134 - 1.30
  - Co-60 - 1.16
- The $DCGL_{EMC}$ is the Surrogate Base Case DCGL times the Area Factor:
  - The $DCGL_{EMC}$ for Cs-137 = $1.46 * 14.15 = 20.66\ pCi/g$
  - The $DCGL_{EMC}$ for Cs-134 = $1.30 * 6.77 = 8.80\ pCi/g$
  - The $DCGL_{EMC}$ for Co-60 = $1.16 * 3.51 = 4.07\ pCi/g$

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

The implementation of quality control (QC) measures as referenced by LTP, Section 5.9 and Zion*Solutions* procedure ZS-LT-01, "*Quality Assurance Project Plan (for Characterization and FSS)*" (QAPP) (Reference 12) includes the collection of a soil sample for "split sample" analysis on 5% of the soil samples taken in a survey unit with the locations selected at random. One (1) surface soil sample (L1-10208C-FQGS-005-SS) was selected randomly for split sample analysis for the FSS of this survey unit.

In accordance with Section 5.7.1.6.2 of the LTP, a subsurface soil sample was taken at 10% of the systematic surface soil sample locations in the survey unit with the location(s) selected at random. Locations L1-10208C-FSGS-009-SB and L1-10208C-FSGS-016-SB were selected for this survey unit.

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

Table 8 - Systematic Sample Measurement Locations

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L1-10208C-FSGS-001-SS	641571.45	343492.44
L1-10208C-FSGS-002-SS	641581.21	343486.81
L1-10208C-FSGS-003-SS	641590.96	343492.44
L1-10208C-FSGS-004-SS	641600.72	343486.81
L1-10208C-FSGS-005-SS	641600.72	343498.07
L1-10208C-FSGS-006-SS	641610.47	343492.44
L1-10208C-FSGS-007-SS	641620.22	343498.07
L1-10208C-FSGS-008-SS	641629.98	343492.44
L1-10208C-FSGS-009-SS	641629.98	343503.70
L1-10208C-FSGS-010-SS	641639.73	343498.07
L1-10208C-FSGS-011-SS	641639.73	343509.33
L1-10208C-FSGS-012-SS	641649.48	343503.70
L1-10208C-FSGS-013-SS	641659.24	343509.33
L1-10208C-FSGS-014-SS	641668.99	343503.70
L1-10208C-FSGS-015-SS	641668.99	343514.97
L1-10208C-FSGS-016-SS	641678.75	343509.33
L1-10208C-FSGS-017-SS	641678.75	343520.60
L1-10208C-FSGS-009-SB	641629.98	343503.70
L1-10208C-FSGS-016-SB	641678.75	343509.33

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

The selection of three (3) soil samples met the requirement that 10% of the samples collected for the FSS of survey unit 10208C be analyzed for HTD ROC. Sample numbers L1-10208C-FSGS-017-SS, L1-10208C-FIGS-002-SS and L1-10208C-QIGS-004-SS were selected based on exhibiting Cs-137 concentrations greater than MDC. Each selected sample was sent off-site (Eberline Analytical) for analysis of the HTD ROC as specified in LTP, Section 5.1. Eberline analytical reports are provided in Attachment 8. Table 9 provides a synopsis of the

survey design for survey unit 10208C.

In addition, LTP, Section 5.1 states that if levels of residual gamma radioactivity in an individual soil sample exceed an OpSOF of 0.1, then the sample(s) will be analyzed for HTD ROC. This threshold was not encountered during the FSS of survey unit 10208C.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	1,868 m^2	GPS measurements of area
Number of Surface Soil Samples	17 (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	11.3 m	(LTP , Section 5.6.4.5.2)
DCGLs	• Co-60 – 1.091 pCi/g • Cs-134 – 1.733 pCi/g • Cs-137 – 3.630 pCi/g • Ni-63 – 914.458 pCi/g • Sr-90 – 3.095 pCi/g	Operational DCGLs for Surface Soils, (LTP , Table 5-7)
HTD ROC Analysis	A minimum of two (2) soil samples selected for HTD ROC analysis	(LTP , Section 5.1)
Measurement Investigation Level	Operational DCGL	(LTP, Table 5-25)
Scan Survey Area Coverage	100%	(LTP, Table 5-24)
QC	One (1) surface soil sample selected randomly for split sample analysis	(LTP, Section 5.9)
Number of Subsurface Soil Samples	Two (2) systematic surface soil sample locations selected, at locations 9 and 16	(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 L1-10208C-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 10208C, compliance with the unrestricted release criteria was demonstrated through a combination of surface scanning with a Ludlum Model 44-10 gamma detector and the sampling of surface soil for isotopic analysis. In accordance with the LTP Chapter 5, two (2) subsurface samples were obtained and analyzed. Also, if during the performance of FSS, the analysis of a surface soil sample, or the results of a surface gamma scan indicated the potential presence of residual radioactivity at a concentration of 75% of the subsurface OpDCGL, then a biased subsurface soil sample(s) would have been taken to the appropriate depth within the area of concern as part of the investigation. This threshold was encountered during the FSS of survey unit 10208C while performing a gamma scan in row #74 (see Section 9 for further discussion). Surface and subsurface investigation soil samples were taken at this location (L1-10208C-FIGS-001-SS thru L1-10208C-FIGS-004-SS and L1-10208C-FIGS-002-SB).

FSS field activities were conducted under FSS sample plan L1-10208C-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 August 13, 2019, and concluding on September 5, 2019.

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

Gamma scans were performed on 100% of the surface area of the survey unit using a Ludlum 2350-1 paired with a Model 44-10 (2" 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. One (1) area of elevated activity was detected on the scans (see Section 9 for further discussion).

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

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

Table 10 - Instruments and Detectors

Instrument/Detector Type	Serial #	Calibration Due Date
Ludlum 2350-1/Ludlum 44-10	95361/PR372150	12/05/2019
Ludlum 2350-1/Ludlum 44-10	216166/PR372106	11/29/2019
Ludlum 2350-1/Ludlum 44-10	304730/PR375273	01/16/2020
Ludlum 2350-1/Ludlum 44-10	304718/PR363311	12/13/2019
Ludlum 2350-1/Ludlum 44-10	304711/PR321902	01/18/2020

In accordance with the survey design, seventeen (17) surface soil samples were collected at the designated systematic sample points along with two (2) subsurface samples taken at randomly selected sample locations. In addition, four (4) surface samples and one (1) subsurface sample were collected as part of the investigation of an area of elevated activity identified during the surface scans.

Three (3) samples (L1-10208C-FSGS-017-SS, L1-10208C-FIGS-002-SS and L1-10208C-QIGS-004-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. One hundred eighteen (118) 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. One (1) elevated measurement location was identified by surface scan in row 74. 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	2089	2601	None	None
Row 2	2084	2601	None	None
Row 3	2086	2601	None	None
Row 4	2049	2601	None	None
Row 5	2164	2601	None	None
Row 6	2166	2601	None	None
Row 7	2130	2601	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 8	2275	2601	None	None
Row 9	2213	2601	None	None
Row 10	2273	2601	None	None
Row 11	2302	2601	None	None
Row 12	2177	2601	None	None
Row 13	2160	2601	None	None
Row 14	2293	2601	None	None
Row 15	2600	2601	None	None
Row 16	2251	2601	None	None
Row 17	2914	3380	None	None
Row 18	2976	3380	None	None
Row 19	3014	3380	None	None
Row 20	2888	3380	None	None
Row 21	3087	3380	None	None
Row 22	3180	3380	None	None
Row 23	2899	3380	None	None
Row 24	2906	3380	None	None
Row 25	3158	3380	None	None
Row 26	3174	3380	None	None
Row 27	3061	3380	None	None
Row 28	5503	5827	None	None
Row 29	5735	5827	None	None
Row 30	5575	5827	None	None
Row 31	5403	5827	None	None
Row 32	5673	5827	None	None
Row 33	5626	5827	None	None
Row 34	5757	5827	None	None
Row 35	5454	5827	None	None
Row 36	5700	5827	None	None
Row 37	5602	5827	None	None
Row 38	5628	5827	None	None
Row 39	5777	5827	None	None
Row 40	5709	5827	None	None
Row 41	5610	5827	None	None
Row 42	5557	5827	None	None
Row 43	5670	5827	None	None
Row 44	5534	5827	None	None
Row 45	5347	5827	None	None

Table 11 (continued) - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[1] (cpm)	# of Scan Alarms	Investigation Samples
Row 46	5396	5827	None	None
Row 47	5434	5827	None	None
Row 48	5695	5827	None	None
Row 49	5666	5827	None	None
Row 50	5544	5827	None	None
Row 51	5705	5759	None	None
Row 52	5423	5759	None	None
Row 53	5449	5759	None	None
Row 54	5470	5759	None	None
Row 55	5686	5759	None	None
Row 56	5321	5759	None	None
Row 57	5492	5759	None	None
Row 58	5693	5759	None	None
Row 59	5276	5759	None	None
Row 60	5240	5759	None	None
Row 61	5589	5759	None	None
Row 62	5374	5759	None	None
Row 63	5276	5759	None	None
Row 64	5219	5759	None	None
Row 65	5268	5759	None	None
Row 66	5078	5759	None	None
Row 67	5127	5759	None	None
Row 68	4858	5759	None	None
Row 69	4489	4713	None	None
Row 70	4594	4713	None	None
Row 71	4555	4713	None	None
Row 72	4647	4713	None	None
Row 73	4418	4713	None	None
Row 74	5081	4496	2	L1-10208C-FIGS-001-SS to L1-10208C-FIGS-004-SS, L1-10208C-FIGS-002-SB
Row 75	4839	4858	None	None
Row 76	4727	4858	None	None
Row 77	4715	4858	None	None
Row 78	4658	4858	None	None
Row 79	4709	4858	None	None
Row 80	4553	4858	None	None
Row 81	4227	4496	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 82	4670	4858	None	None
Row 83	4210	4496	None	None
Row 84	4450	4496	None	None
Row 85	4327	4496	None	None
Row 86	4311	4496	None	None
Row 87	4202	4496	None	None
Row 88	4231	4496	None	None
Row 89	4453	4496	None	None
Row 90	4206	4496	None	None
Row 91	4089	4496	None	None
Row 92	4043	4496	None	None
Row 93	4180	4496	None	None
Row 94	4209	4496	None	None
Row 95	4130	4496	None	None
Row 96	4231	4496	None	None
Row 97	4231	4602	None	None
Row 98	4401	4602	None	None
Row 99	4560	4602	None	None
Row 100	4301	4602	None	None
Row 101	4309	4602	None	None
Row 102	4220	4602	None	None
Row 103	3977	4602	None	None
Row 104	4464	4602	None	None
Row 105	4469	4602	None	None
Row 106	4246	4602	None	None
Row 107	4486	4602	None	None
Row 108	4395	4602	None	None
Row 109	4036	4602	None	None
Row 110	4051	4602	None	None
Row 111	4129	4602	None	None
Row 112	4413	4602	None	None
Row 113	3941	4602	None	None
Row 114	4021	4602	None	None
Row 115	3816	4602	None	None
Row 116	3961	4602	None	None
Row 117	3824	4602	None	None
Row 118	3792	4602	None	None

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

The seventeen (17) systematic surface soil samples taken for non-parametric statistical testing, the four (4) biased surface soil samples (investigation samples) and the three (3) subsurface soil samples (two randomly selected samples and one investigation) were analyzed using the on-site gamma spectroscopy system. Summaries of the sample analysis results are provided in Tables 12, 13 and 14, respectively. The basic statistics for the systematic sample population are summarized in Table 21. For the systematic samples, the gamma spectroscopy results revealed two (2) samples with activity levels above MDC for Cs-137 and no samples with activity levels above MDC for Co-60 or Cs-134. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6. The mean of the gamma spectroscopic analysis results for the sample population indicated that Cs-137 was present at levels lower than the concentrations of Cs-137 expected to be found in off-site soil in the vicinity of the ZNPS as presented in Zion*Solutions* TSD 13-004, "*Examination of Cs-137 Global Fallout In Soils At Zion Station*" (Reference 15). The complete gamma spectroscopy reports are presented in Attachment 7.

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

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L1-10208C-FSGS-001-SS	1.46E-02	4.91E-03	**5.83E-02**	2.63E+00	1.17E-04
L1-10208C-FSGS-002-SS	2.09E-03	7.41E-03	0.00E+00	3.77E-01	0.00E+00
L1-10208C-FSGS-003-SS	2.37E-02	3.50E-02	1.09E-02	4.28E+00	2.18E-05
L1-10208C-FSGS-004-SS	3.26E-02	1.13E-02	0.00E+00	5.88E+00	0.00E+00
L1-10208C-FSGS-005-SS	2.92E-02	2.19E-02	5.65E-03	5.27E+00	1.13E-05
L1-10208C-FSGS-006-SS	4.10E-02	0.00E+00	2.60E-02	7.40E+00	5.20E-05
L1-10208C-FSGS-007-SS	2.59E-02	4.02E-02	5.92E-02	4.67E+00	1.18E-04
L1-10208C-FSGS-008-SS	1.45E-03	1.29E-02	3.77E-02	2.62E-01	7.54E-05
L1-10208C-FSGS-009-SS	1.79E-02	2.65E-02	9.48E-03	3.23E+00	1.90E-05
L1-10208C-FSGS-010-SS	5.28E-02	3.79E-03	1.39E-02	9.53E+00	2.78E-05
L1-10208C-FSGS-011-SS	7.59E-03	1.40E-02	2.94E-02	1.37E+00	5.88E-05
L1-10208C-FSGS-012-SS	0.00E+00	2.46E-02	5.52E-02	0.00E+00	1.10E-04
L1-10208C-FSGS-013-SS	1.13E-02	6.45E-02	2.37E-02	2.04E+00	4.74E-05
L1-10208C-FSGS-014-SS	5.61E-02	3.35E-02	2.25E-03	1.01E+01	4.50E-06
L1-10208C-FSGS-015-SS	9.20E-03	0.00E+00	0.00E+00	1.66E+00	0.00E+00
L1-10208C-FSGS-016-SS	4.92E-02	8.61E-03	9.10E-03	8.88E+00	1.82E-05
L1-10208C-FSGS-017-SS	6.33E-02	0.00E+00	**4.52E-02**	1.14E+01	9.04E-05

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

Table 13 - Summary of Gamma Spectroscopy Results for 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)
L1-10208C-FIGS-001-SS	2.54E-02	4.57E-02	0.00E+00	4.58E+00	0.00E+00
L1-10208C-FIGS-002-SS	8.20E-03	1.30E-02	**5.03E-02**	1.48E+00	1.01E-04
L1-10208C-FIGS-003-SS	4.88E-02	5.16E-02	6.58E-03	8.81E+00	1.32E-05
L1-10208C-FIGS-004-SS	3.01E-02	3.53E-02	5.38E-02	5.43E+00	1.08E-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 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)
L1-10208C-FSGS-009-SB	0.00E+00	3.96E-02	2.20E-02	0.00E+00	4.40E-05
L1-10208C-FSGS-016-SB	0.00E+00	1.32E-02	1.61E-02	0.00E+00	3.22E-05
L1-10208C-FIGS-002-SB	3.84E-02	8.03E-03	0.00E+00	6.93E+00	0.00E+00

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

The off-site laboratory, Eberline Analytical, processed the three (3) samples selected for HTD ROC analysis (L1-10208C-FSGS-017-SS-A, L1-10208C-FIGS-002-SS-A and L1-10208C-QIGS-004-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 was positively detected in one of the samples at a concentration greater than MDC. Consequently, comparison of existing ratios versus the maximum ratios from Table 6 was not required. The results are provided in Table 15.

Table 15 - Off-Site Analysis Results
Sample # L1-10208C-FSGS-017-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	2.34E-02	4.06E-02	5.76E-02	No
Cs-134	7.78E-03	2.01E-02	5.95E-02	No
Cs-137	9.27E-02	3.72E-02	8.02E-02	Yes
Ni-63	9.00E-01	1.92E+00	3.26E+00	No
Sr-90	-1.19E-01	2.58E-01	5.69E-01	No

Table 15 (continued) - Off-Site Analysis Results

Sample # L1-10208C-FIGS-002-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	2.12E-03	3.50E-02	4.52E-02	No
Cs-134	-1.74E-03	1.54E-02	4.42E-02	No
Cs-137	4.23E-02	3.73E-02	6.06E-02	No
Ni-63	-3.57E-01	1.86E+00	3.23E+00	No
Sr-90	1.52E-01	2.22E-01	4.59E-01	No

Sample # L1-10208C-QIGS-004-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	2.99E-03	4.09E-02	5.44E-02	No
Cs-134	4.81E-03	1.82E-02	5.97E-02	No
Cs-137	4.22E-02	3.96E-02	6.50E-02	No
Ni-63	1.02E+00	1.97E+00	3.35E+00	No
Sr-90	2.70E-02	2.99E-01	6.39E-01	No

The implementation of survey specific QC measures included the collection of two (2) samples (L1-10208C-FQGS-005-SS and L1-10208C-QIGS-004-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 the concentration for Cs-137 was greater than MDC in one of the samples and the concentrations for Co-60 and Cs-134 were less than MDC 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)
L1-10208C-FQGS-005-SS	2.03E-02	1.07E-02	4.88E-02	3.66E+00	9.76E-05
L1-10208C-QIGS-004-SS	1.01E-02	9.56E-03	**3.80E-02**	1.82E+00	7.60E-05

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

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

Equation 6

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

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 10208C are provided in Table 17. The results of the unity rule calculation for the ROC for the biased surface samples are provided in Table 18, the results for the subsurface samples are provided in Table 19 and the results for the QC samples are provided in Table 20.

Table 17 - Sum of Fractions for 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	
L1-10208C-FSGS-001-SS	1.34E-02	2.83E-03	1.61E-02	2.88E-03	3.77E-05	0.035
L1-10208C-FSGS-002-SS	1.92E-03	4.28E-03	0.00E+00	4.12E-04	0.00E+00	0.007
L1-10208C-FSGS-003-SS	2.17E-02	2.02E-02	3.00E-03	4.68E-03	7.04E-06	0.050
L1-10208C-FSGS-004-SS	2.99E-02	6.52E-03	0.00E+00	6.43E-03	0.00E+00	0.043
L1-10208C-FSGS-005-SS	2.68E-02	1.26E-02	1.56E-03	5.76E-03	3.65E-06	0.047
L1-10208C-FSGS-006-SS	3.76E-02	0.00E+00	7.16E-03	8.09E-03	1.68E-05	0.053
L1-10208C-FSGS-007-SS	2.37E-02	2.32E-02	1.63E-02	5.11E-03	3.83E-05	0.068
L1-10208C-FSGS-008-SS	1.33E-03	7.44E-03	1.04E-02	2.86E-04	2.44E-05	0.019
L1-10208C-FSGS-009-SS	1.64E-02	1.53E-02	2.61E-03	3.53E-03	6.13E-06	0.038
L1-10208C-FSGS-010-SS	4.84E-02	2.19E-03	3.83E-03	1.04E-02	8.98E-06	0.065
L1-10208C-FSGS-011-SS	6.96E-03	8.08E-03	8.10E-03	1.50E-03	1.90E-05	0.025
L1-10208C-FSGS-012-SS	0.00E+00	1.42E-02	1.52E-02	0.00E+00	3.57E-05	0.029
L1-10208C-FSGS-013-SS	1.04E-02	3.72E-02	6.53E-03	2.23E-03	1.53E-05	0.056
L1-10208C-FSGS-014-SS	5.14E-02	1.93E-02	6.20E-04	1.11E-02	1.45E-06	0.082
L1-10208C-FSGS-015-SS	8.43E-03	0.00E+00	0.00E+00	1.82E-03	0.00E+00	0.010
L1-10208C-FSGS-016-SS	4.51E-02	4.97E-03	2.51E-03	9.71E-03	5.88E-06	0.062
L1-10208C-FSGS-017-SS	5.80E-02	0.00E+00	1.25E-02	1.25E-02	2.92E-05	0.083

Systematic Measurements

Number of Systematic Measurements =	17
# of Systematic Measurements with OpSOF ≥ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	0
Max Individual Systematic Measurement OpSOF =	0.083
Mean Systematic Measurement OpSOF =	0.045

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	
L1-10208C-FIGS-001-SS	2.33E-02	2.64E-02	0.00E+00	5.01E-03	0.00E+00	0.055
L1-10208C-FIGS-002-SS	7.52E-03	7.50E-03	1.39E-02	1.62E-03	3.25E-05	0.031
L1-10208C-FIGS-003-SS	4.47E-02	2.98E-02	1.81E-03	9.63E-03	4.25E-06	0.086
L1-10208C-FIGS-004-SS	2.76E-02	2.04E-02	1.48E-02	5.94E-03	3.48E-05	0.069

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	
L1-10208C-FSGS-009-SB	0.00E+00	3.48E-02	1.11E-02	0.00E+00	1.04E-04	0.046
L1-10208C-FSGS-016-SB	0.00E+00	1.16E-02	8.11E-03	0.00E+00	7.58E-05	0.020
L1-10208C-FIGS-002-SB	4.36E-02	7.06E-03	0.00E+00	3.55E-02	0.00E+00	0.086

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	
L1-10208C-FQGS-005-SS	1.86E-02	6.17E-03	1.34E-02	4.01E-03	3.15E-05	0.042
L1-10208C-QIGS-004-SS	9.26E-03	5.52E-03	1.05E-02	1.99E-03	2.46E-05	0.027

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	2.58E-02	2.37E-02	6.33E-02	0.00E+00	0.020	4.26	6.05E-03	1.51E-01
Cs-134	1.82E-02	1.29E-02	6.45E-02	0.00E+00	0.018	6.77	2.69E-03	6.71E-02
Cs-137	2.27E-02	1.39E-02	5.92E-02	0.00E+00	0.021	14.18	1.60E-03	4.00E-02
Ni-63	4.65E+00	4.28E+00	1.14E+01	0.00E+00	3.698	3572.1	1.30E-03	3.25E-02
Sr-90	4.54E-05	2.78E-05	1.18E-04	0.00E+00	0.000	12.09	3.76E-06	9.39E-05

The mean BcSOF for survey unit 10208C is 0.012 which equates to a dose of 0.291 mrem/year TEDE.

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

8. QUALITY CONTROL

The on-site laboratory processed two (2) split samples, L1-10208C-FQGS-005-SS and L1-10208C-QIGS-004-SS, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in ZS-LT-01. The standard samples and QC samples did not both have positive results for a gamma-emitting ROC, therefore, K-40 was used in the QC comparison. There was acceptable agreement between field split results. Refer to Attachment 5 for data and QC analysis results.

9. INVESTIGATIONS AND RESULTS

An investigation was performed following a scan alarm in scan row #74 on August 13, 2019. A 2 ft. x 6 ft. area was identified with a maximum count rate of 5,081 cpm (a map of this area is included in Attachment 1). Four (4) surface soil samples were taken in this area: L1-10208C-FIGS-001-SS through L1-10208C-FIGS-004-SS. Gamma spectroscopy results revealed only one (1) sample with an activity level above MDC for Cs-137 and no samples with activity levels above MDC for Co-60 or Cs-134. Since the OpSOF for the investigation samples were all less than 1.0, with a maximum OpSOF of 0.086 for sample L1-10208C-FIGS-003-SS, no further action was necessary. The investigation is documented in an Attachment 13 (from ZS- LT-300-001-004), "Final Status Survey Investigation." The gamma spectroscopy results are summarized in Table 13, and the Sum of Fractions summarized in Table 18.

10. REMEDIATION AND RESULTS

No remediation was performed in this survey unit.

11. CHANGES FROM THE SURVEY PLAN

There were no addendums to the FSS plan.

12. DATA QUALITY ASSESSMENT

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

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

Although MARSSIM states that the Sign Test need not be performed in the instance that no measurements surpass the DCGL, the test was conducted to demonstrate coherence to the statistical principles of the DQO process. The Sign Test was performed on the data and compared to the original assumptions of the DQOs. The evaluation of the Sign Test results clearly

demonstrates that the survey unit passes the unrestricted release criteria, thus, the null hypothesis is rejected. The Sign Test is included in Attachment 4.

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

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

13. ANOMALIES

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

14. CONCLUSION

Survey unit 10208C 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 exceed the OpDCGL or any investigational levels; therefore, in accordance with the LTP Section 5.10, the survey unit meets the release criterion.

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

The mean BcSOF, when the analytical results were compared to the BcDCGLs, was 0.012, which results in a dose contribution from soil in survey unit 10208C of 0.291 mrem/year TEDE, based on the average concentration of the ROC in samples used for non-parametric statistical sampling.

The conclusion of this Release Record is that survey unit 10208C is acceptable for unrestricted release.

15. REFERENCES

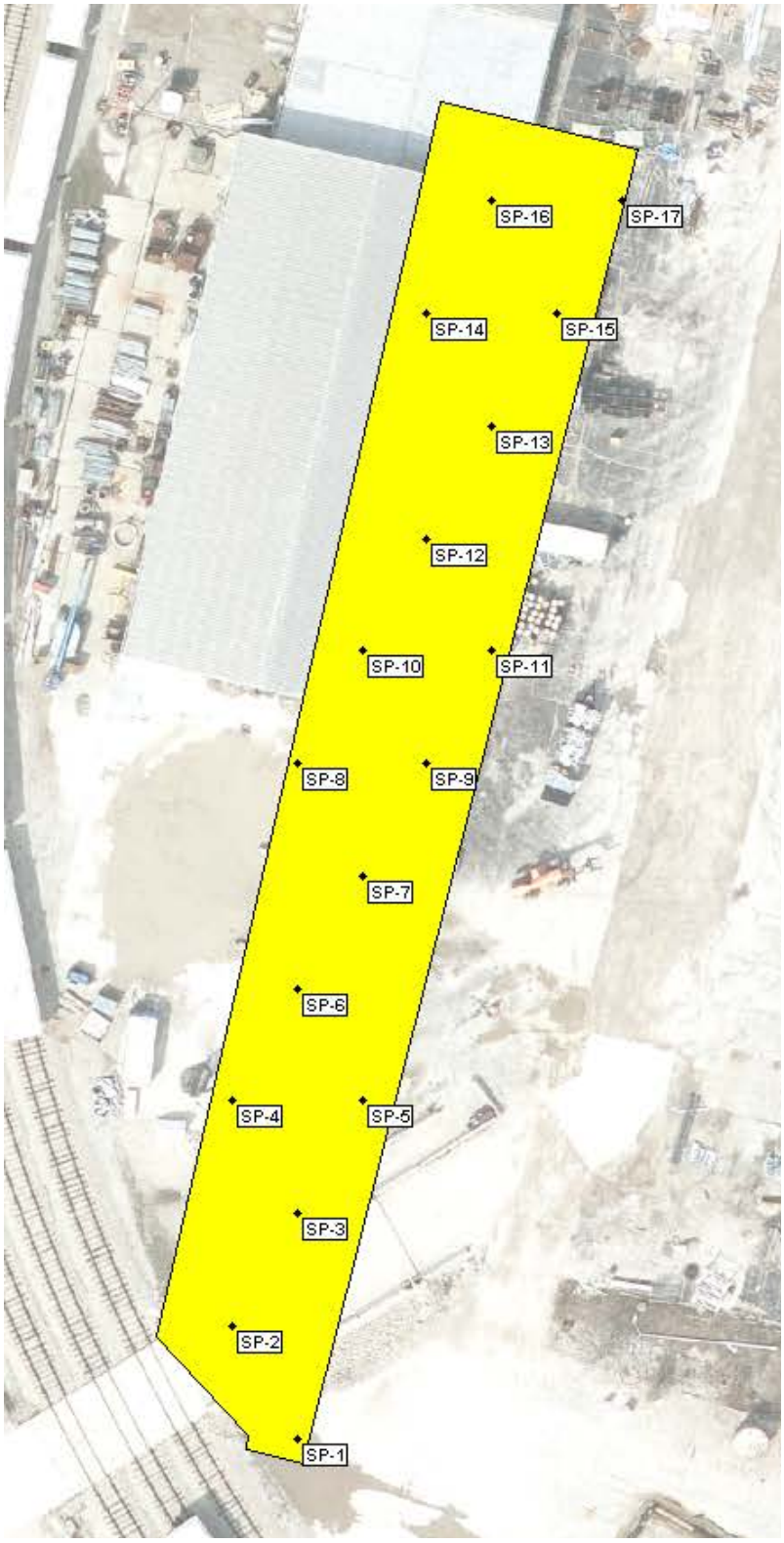
1. Zion*Solutions* procedure ZS-LT-300-001-005, "Final Status Survey Data Reporting"
2. Zion Station Restoration Project License Termination Plan
3. Zion*Solutions* procedure ZS-LT-300-001-001, "Final Status Survey Package Development"
4. NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation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

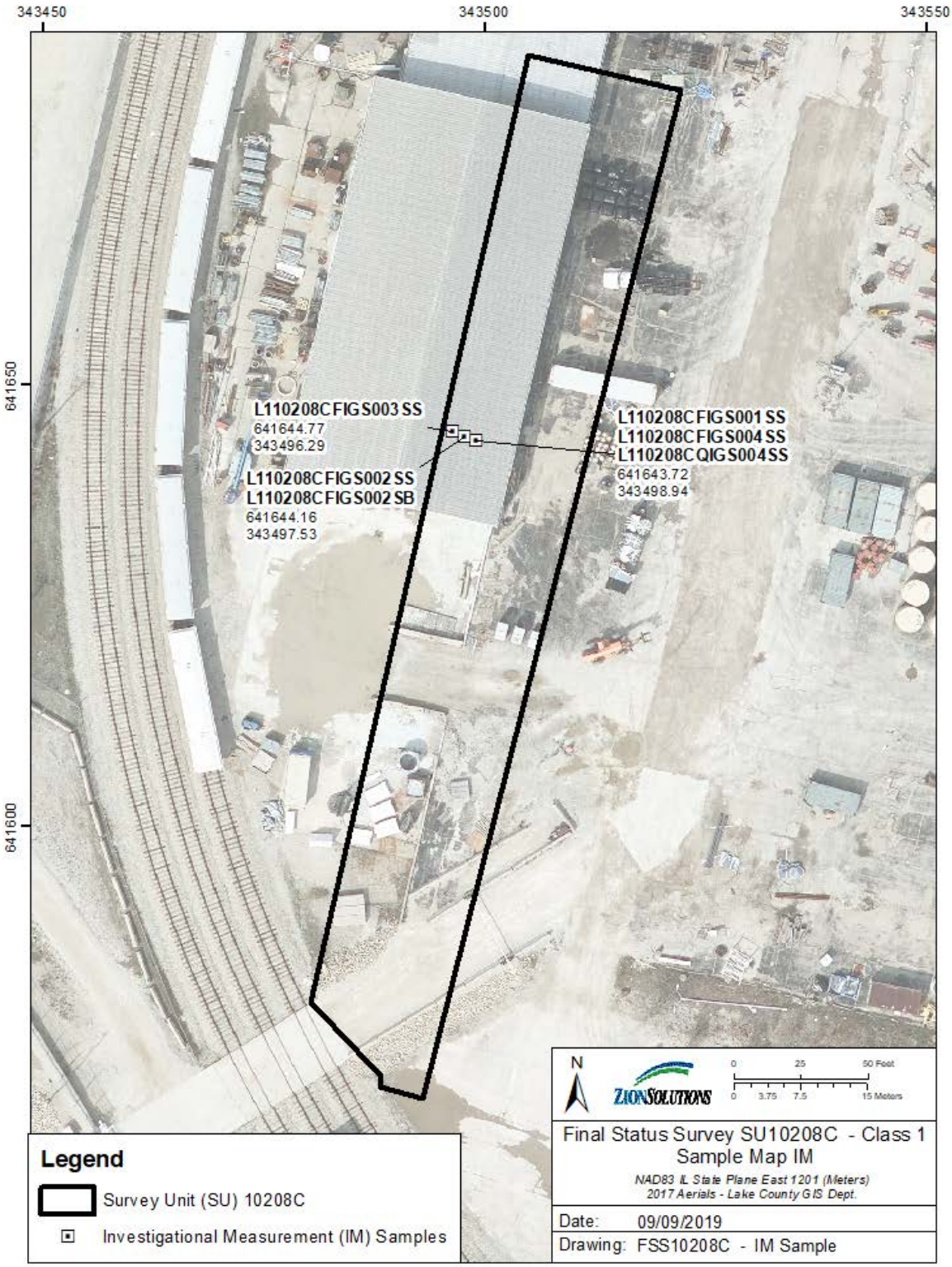
1. Attachment 1 - Figures and Map
2. Attachment 2 - Scan Data
3. Attachment 3 - Consultation Triggers for Residential and Commercial/Industrial Soil Contamination
4. Attachment 4 - Sign Test
5. Attachment 5 - QC Sample Assessment
6. Attachment 6 - Graphical Presentations
7. Attachment 7 - Sample Analytical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

ATTACHMENT 1
FIGURES AND MAP

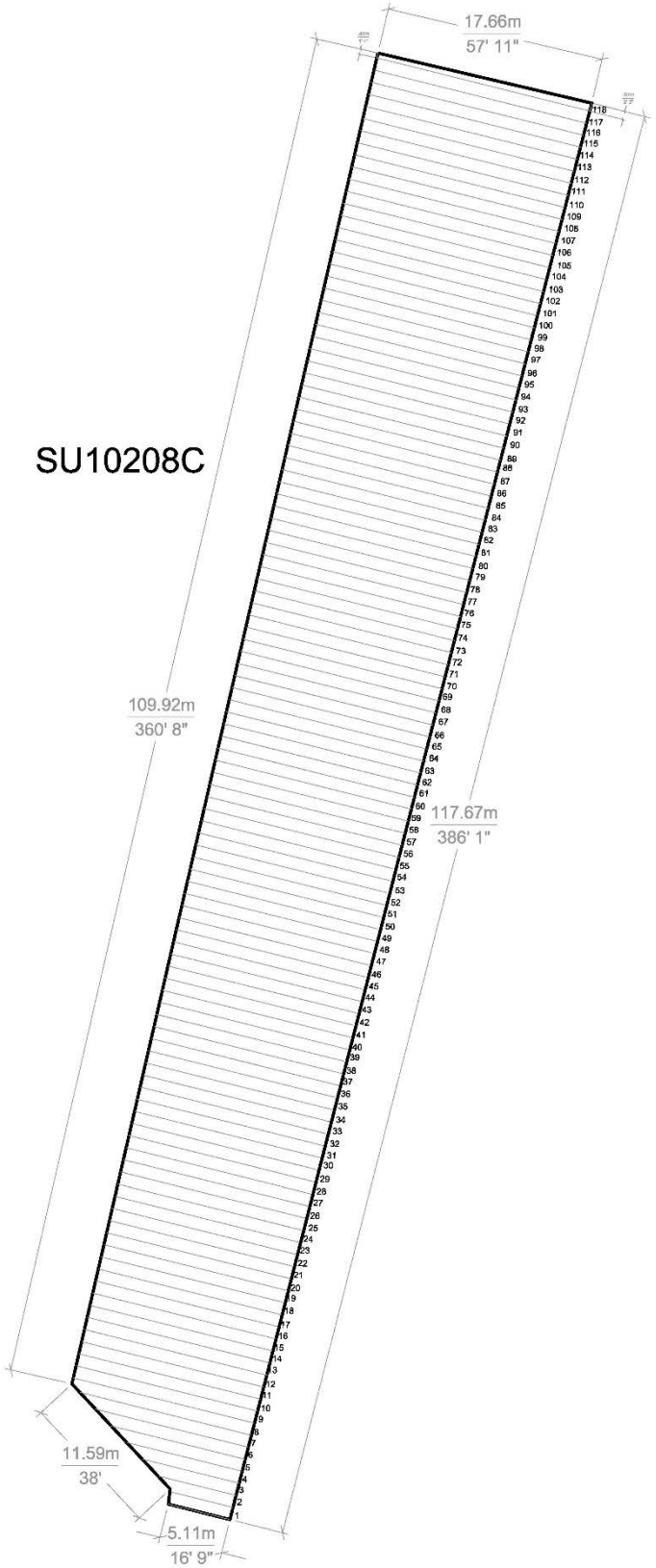
Survey Unit 10208C Final Status Survey Boundaries and Systematic Sample Points



Survey Unit 10208C Investigation Sample Points



Survey Unit 10208C Final Status Survey Scan Rows



ATTACHMENT 2
SCAN DATA

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR321902	304711	10208C	GS001	8/13/2019 8:47	2089	1936	2601	No
44-10	PR321902	304711	10208C	GS002	8/13/2019 8:50	2084	1936	2601	No
44-10	PR321902	304711	10208C	GS003	8/13/2019 8:53	2086	1936	2601	No
44-10	PR321902	304711	10208C	GS004	8/13/2019 8:57	2049	1936	2601	No
44-10	PR321902	304711	10208C	GS005	8/13/2019 9:00	2058	1936	2601	No
44-10	PR321902	304711	10208C	GS006	8/13/2019 9:04	1978	1936	2601	No
44-10	PR321902	304711	10208C	GS007	8/13/2019 9:06	2072	1936	2601	No
44-10	PR321902	304711	10208C	GS008	8/13/2019 9:09	2071	1936	2601	No
44-10	PR321902	304711	10208C	GS009	8/13/2019 9:12	2150	1936	2601	No
44-10	PR321902	304711	10208C	GS010	8/13/2019 9:15	2052	1936	2601	No
44-10	PR321902	304711	10208C	GS005	8/13/2019 9:23	2164	1936	2601	No
44-10	PR321902	304711	10208C	GS006	8/13/2019 9:26	2166	1936	2601	No
44-10	PR321902	304711	10208C	GS007	8/13/2019 9:28	2130	1936	2601	No
44-10	PR321902	304711	10208C	GS008	8/13/2019 9:32	2275	1936	2601	No
44-10	PR321902	304711	10208C	GS009	8/13/2019 9:35	2213	1936	2601	No
44-10	PR321902	304711	10208C	GS010	8/13/2019 9:39	2273	1936	2601	No
44-10	PR321902	304711	10208C	GS011	8/13/2019 9:41	2039	1936	2601	No
44-10	PR321902	304711	10208C	GS011	8/13/2019 9:44	2302	1936	2601	No
44-10	PR321902	304711	10208C	GS012	8/13/2019 9:47	2177	1936	2601	No
44-10	PR321902	304711	10208C	GS012	8/13/2019 9:48	1947	1936	2601	No
44-10	PR321902	304711	10208C	GS013	8/13/2019 9:52	2024	1936	2601	No
44-10	PR321902	304711	10208C	GS013	8/13/2019 9:54	2160	1936	2601	No
44-10	PR321902	304711	10208C	GS014	8/13/2019 9:58	2293	1936	2601	No
44-10	PR321902	304711	10208C	GS014	8/13/2019 10:01	2011	1936	2601	No
44-10	PR321902	304711	10208C	GS015	8/13/2019 10:15	1986	1936	2601	No
44-10	PR321902	304711	10208C	GS015	8/13/2019 10:19	2600	1936	2601	No
44-10	PR321902	304711	10208C	GS016	8/13/2019 10:21	2069	1936	2601	No
44-10	PR321902	304711	10208C	GS016	8/13/2019 10:24	2251	1936	2601	No
44-10	PR321902	304711	10208C	GS017	8/13/2019 12:26	2904	2608	3380	No
44-10	PR321902	304711	10208C	GS017	8/13/2019 12:29	2914	2608	3380	No
44-10	PR321902	304711	10208C	GS018	8/13/2019 12:37	2976	2608	3380	No
44-10	PR321902	304711	10208C	GS018	8/13/2019 12:39	2838	2608	3380	No
44-10	PR321902	304711	10208C	GS019	8/13/2019 12:42	2700	2608	3380	No
44-10	PR321902	304711	10208C	GS019	8/13/2019 12:44	3014	2608	3380	No
44-10	PR321902	304711	10208C	GS020	8/13/2019 12:47	2888	2608	3380	No
44-10	PR321902	304711	10208C	GS020	8/13/2019 12:49	2655	2608	3380	No
44-10	PR321902	304711	10208C	GS021	8/13/2019 12:52	2725	2608	3380	No
44-10	PR321902	304711	10208C	GS021	8/13/2019 12:54	3087	2608	3380	No
44-10	PR321902	304711	10208C	GS022	8/13/2019 12:57	3180	2608	3380	No
44-10	PR321902	304711	10208C	GS022	8/13/2019 12:59	2869	2608	3380	No
44-10	PR321902	304711	10208C	GS023	8/13/2019 13:02	2786	2608	3380	No
44-10	PR321902	304711	10208C	GS023	8/13/2019 13:04	2899	2608	3380	No
44-10	PR321902	304711	10208C	GS024	8/13/2019 13:07	2906	2608	3380	No
44-10	PR321902	304711	10208C	GS024	8/13/2019 13:09	2789	2608	3380	No
44-10	PR321902	304711	10208C	GS025	8/13/2019 13:13	3062	2608	3380	No
44-10	PR321902	304711	10208C	GS025	8/13/2019 13:15	3158	2608	3380	No
44-10	PR321902	304711	10208C	GS026	8/13/2019 13:22	3174	2608	3380	No
44-10	PR321902	304711	10208C	GS026	8/13/2019 13:24	2914	2608	3380	No
44-10	PR321902	304711	10208C	GS027	8/13/2019 13:27	2813	2608	3380	No
44-10	PR321902	304711	10208C	GS027	8/13/2019 13:29	3061	2608	3380	No
44-10	PR375273	304730	10208C	GS028	8/13/2019 8:32	5503	4808	5827	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR375273	304730	10208C	GS028	8/13/2019 8:34	5282	4808	5827	No
44-10	PR375273	304730	10208C	GS029	8/13/2019 8:36	5627	4808	5827	No
44-10	PR375273	304730	10208C	GS029	8/13/2019 8:38	5735	4808	5827	No
44-10	PR375273	304730	10208C	GS030	8/13/2019 8:42	5575	4808	5827	No
44-10	PR375273	304730	10208C	GS030	8/13/2019 8:44	5453	4808	5827	No
44-10	PR375273	304730	10208C	GS031	8/13/2019 8:46	5403	4808	5827	No
44-10	PR375273	304730	10208C	GS031	8/13/2019 8:48	5364	4808	5827	No
44-10	PR375273	304730	10208C	GS032	8/13/2019 8:50	5247	4808	5827	No
44-10	PR375273	304730	10208C	GS032	8/13/2019 8:52	5673	4808	5827	No
44-10	PR375273	304730	10208C	GS033	8/13/2019 8:54	5626	4808	5827	No
44-10	PR375273	304730	10208C	GS033	8/13/2019 8:56	5259	4808	5827	No
44-10	PR375273	304730	10208C	GS034	8/13/2019 8:58	5757	4808	5827	No
44-10	PR375273	304730	10208C	GS034	8/13/2019 9:01	5401	4808	5827	No
44-10	PR375273	304730	10208C	GS035	8/13/2019 9:03	5454	4808	5827	No
44-10	PR375273	304730	10208C	GS035	8/13/2019 9:05	5340	4808	5827	No
44-10	PR375273	304730	10208C	GS036	8/13/2019 9:07	5215	4808	5827	No
44-10	PR375273	304730	10208C	GS036	8/13/2019 9:09	5700	4808	5827	No
44-10	PR375273	304730	10208C	GS037	8/13/2019 9:11	5602	4808	5827	No
44-10	PR375273	304730	10208C	GS037	8/13/2019 9:13	5315	4808	5827	No
44-10	PR375273	304730	10208C	GS038	8/13/2019 9:33	5628	4808	5827	No
44-10	PR375273	304730	10208C	GS038	8/13/2019 9:35	5425	4808	5827	No
44-10	PR375273	304730	10208C	GS039	8/13/2019 9:37	5463	4808	5827	No
44-10	PR375273	304730	10208C	GS039	8/13/2019 9:39	5777	4808	5827	No
44-10	PR375273	304730	10208C	GS040	8/13/2019 9:41	5709	4808	5827	No
44-10	PR375273	304730	10208C	GS040	8/13/2019 9:43	5708	4808	5827	No
44-10	PR375273	304730	10208C	GS041	8/13/2019 9:45	5610	4808	5827	No
44-10	PR375273	304730	10208C	GS041	8/13/2019 9:47	5330	4808	5827	No
44-10	PR375273	304730	10208C	GS042	8/13/2019 9:49	5491	4808	5827	No
44-10	PR375273	304730	10208C	GS042	8/13/2019 9:51	5557	4808	5827	No
44-10	PR375273	304730	10208C	GS043	8/13/2019 9:53	5670	4808	5827	No
44-10	PR375273	304730	10208C	GS043	8/13/2019 9:55	5636	4808	5827	No
44-10	PR375273	304730	10208C	GS044	8/13/2019 9:57	5130	4808	5827	No
44-10	PR375273	304730	10208C	GS044	8/13/2019 9:59	5534	4808	5827	No
44-10	PR375273	304730	10208C	GS045	8/13/2019 10:01	5347	4808	5827	No
44-10	PR375273	304730	10208C	GS045	8/13/2019 10:03	4939	4808	5827	No
44-10	PR375273	304730	10208C	GS046	8/13/2019 12:16	5192	4808	5827	No
44-10	PR375273	304730	10208C	GS046	8/13/2019 12:20	5396	4808	5827	No
44-10	PR375273	304730	10208C	GS047	8/13/2019 12:22	5434	4808	5827	No
44-10	PR375273	304730	10208C	GS047	8/13/2019 12:24	5401	4808	5827	No
44-10	PR375273	304730	10208C	GS048	8/13/2019 12:26	5695	4808	5827	No
44-10	PR375273	304730	10208C	GS048	8/13/2019 12:28	5515	4808	5827	No
44-10	PR375273	304730	10208C	GS049	8/13/2019 12:30	5666	4808	5827	No
44-10	PR375273	304730	10208C	GS049	8/13/2019 12:32	5559	4808	5827	No
44-10	PR375273	304730	10208C	GS050	8/13/2019 12:34	5511	4808	5827	No
44-10	PR375273	304730	10208C	GS050	8/13/2019 12:36	5544	4808	5827	No
44-10	PR363311	304718	10208C	GS051	8/13/2019 8:35	5396	4720	5759	No
44-10	PR363311	304718	10208C	GS051	8/13/2019 8:37	5705	4720	5759	No
44-10	PR363311	304718	10208C	GS052	8/13/2019 8:39	5423	4720	5759	No
44-10	PR363311	304718	10208C	GS052	8/13/2019 8:41	5103	4720	5759	No
44-10	PR363311	304718	10208C	GS053	8/13/2019 8:43	5449	4720	5759	No
44-10	PR363311	304718	10208C	GS053	8/13/2019 8:45	5361	4720	5759	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR363311	304718	10208C	GS054	8/13/2019 8:47	5415	4720	5759	No
44-10	PR363311	304718	10208C	GS054	8/13/2019 8:49	5470	4720	5759	No
44-10	PR363311	304718	10208C	GS055	8/13/2019 8:51	5223	4720	5759	No
44-10	PR363311	304718	10208C	GS055	8/13/2019 8:53	5686	4720	5759	No
44-10	PR363311	304718	10208C	GS056	8/13/2019 9:01	5321	4720	5759	No
44-10	PR363311	304718	10208C	GS056	8/13/2019 9:03	5277	4720	5759	No
44-10	PR363311	304718	10208C	GS057	8/13/2019 9:05	5343	4720	5759	No
44-10	PR363311	304718	10208C	GS057	8/13/2019 9:07	5492	4720	5759	No
44-10	PR363311	304718	10208C	GS058	8/13/2019 9:09	5693	4720	5759	No
44-10	PR363311	304718	10208C	GS058	8/13/2019 9:11	4924	4720	5759	No
44-10	PR363311	304718	10208C	GS059	8/13/2019 9:13	4858	4720	5759	No
44-10	PR363311	304718	10208C	GS059	8/13/2019 9:15	5276	4720	5759	No
44-10	PR363311	304718	10208C	GS060	8/13/2019 9:17	5240	4720	5759	No
44-10	PR363311	304718	10208C	GS060	8/13/2019 9:19	4758	4720	5759	No
44-10	PR363311	304718	10208C	GS061	8/13/2019 9:36	4807	4720	5759	No
44-10	PR363311	304718	10208C	GS061	8/13/2019 9:38	5589	4720	5759	No
44-10	PR363311	304718	10208C	GS062	8/13/2019 9:40	5374	4720	5759	No
44-10	PR363311	304718	10208C	GS062	8/13/2019 9:42	4957	4720	5759	No
44-10	PR363311	304718	10208C	GS063	8/13/2019 9:44	4942	4720	5759	No
44-10	PR363311	304718	10208C	GS063	8/13/2019 9:46	5276	4720	5759	No
44-10	PR363311	304718	10208C	GS064	8/13/2019 9:48	5219	4720	5759	No
44-10	PR363311	304718	10208C	GS064	8/13/2019 9:52	4783	4720	5759	No
44-10	PR363311	304718	10208C	GS065	8/13/2019 9:54	4946	4720	5759	No
44-10	PR363311	304718	10208C	GS065	8/13/2019 9:56	5268	4720	5759	No
44-10	PR363311	304718	10208C	GS066	8/13/2019 9:58	4944	4720	5759	No
44-10	PR363311	304718	10208C	GS066	8/13/2019 10:00	5078	4720	5759	No
44-10	PR363311	304718	10208C	GS067	8/13/2019 10:02	4933	4720	5759	No
44-10	PR363311	304718	10208C	GS067	8/13/2019 10:04	5127	4720	5759	No
44-10	PR363311	304718	10208C	GS068	8/13/2019 10:06	4809	4720	5759	No
44-10	PR363311	304718	10208C	GS068	8/13/2019 10:08	4858	4720	5759	No
44-10	PR363311	304718	10208C	GS069	8/13/2019 10:29	4489	3783	4713	No
44-10	PR363311	304718	10208C	GS069	8/13/2019 10:32	3862	3783	4713	No
44-10	PR363311	304718	10208C	GS070	8/13/2019 12:21	4578	3783	4713	No
44-10	PR363311	304718	10208C	GS070	8/13/2019 12:23	4594	3783	4713	No
44-10	PR363311	304718	10208C	GS071	8/13/2019 12:25	4438	3783	4713	No
44-10	PR363311	304718	10208C	GS071	8/13/2019 12:27	4555	3783	4713	No
44-10	PR363311	304718	10208C	GS072	8/13/2019 12:29	4647	3783	4713	No
44-10	PR363311	304718	10208C	GS072	8/13/2019 12:31	4506	3783	4713	No
44-10	PR363311	304718	10208C	GS073	8/13/2019 12:33	4418	3783	4713	No
44-10	PR363311	304718	10208C	GS073	8/13/2019 12:35	4360	3783	4713	No
44-10	PR372150	95361	10208C	GS074	8/13/2019 8:17	4638	3590	4496	Yes
44-10	PR372150	95361	10208C	GS074	8/13/2019 8:35	5081	3590	4496	Yes
44-10	PR372150	95361	10208C	GS081	8/13/2019 9:20	4227	3590	4496	No
44-10	PR372150	95361	10208C	GS081	8/13/2019 9:22	3969	3590	4496	No
44-10	PR372150	95361	10208C	GS083	8/13/2019 9:29	4210	3590	4496	No
44-10	PR372150	95361	10208C	GS083	8/13/2019 9:31	3671	3590	4496	No
44-10	PR372150	95361	10208C	GS084	8/13/2019 9:34	4098	3590	4496	No
44-10	PR372150	95361	10208C	GS084	8/13/2019 9:36	4450	3590	4496	No
44-10	PR372150	95361	10208C	GS085	8/13/2019 9:38	4327	3590	4496	No
44-10	PR372150	95361	10208C	GS085	8/13/2019 9:41	3979	3590	4496	No
44-10	PR372150	95361	10208C	GS086	8/13/2019 9:55	3931	3590	4496	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR372150	95361	10208C	GS086	8/13/2019 9:57	4311	3590	4496	No
44-10	PR372150	95361	10208C	GS087	8/13/2019 9:59	3950	3590	4496	No
44-10	PR372150	95361	10208C	GS087	8/13/2019 10:01	4202	3590	4496	No
44-10	PR372150	95361	10208C	GS088	8/13/2019 10:04	3842	3590	4496	No
44-10	PR372150	95361	10208C	GS088	8/13/2019 10:06	4231	3590	4496	No
44-10	PR372150	95361	10208C	GS089	8/13/2019 10:08	4453	3590	4496	No
44-10	PR372150	95361	10208C	GS089	8/13/2019 10:11	3847	3590	4496	No
44-10	PR372150	95361	10208C	GS090	8/13/2019 10:13	3890	3590	4496	No
44-10	PR372150	95361	10208C	GS090	8/13/2019 10:15	4206	3590	4496	No
44-10	PR372150	95361	10208C	GS091	8/13/2019 10:17	4089	3590	4496	No
44-10	PR372150	95361	10208C	GS091	8/13/2019 10:19	3747	3590	4496	No
44-10	PR372150	95361	10208C	GS092	8/13/2019 10:22	4022	3590	4496	No
44-10	PR372150	95361	10208C	GS092	8/13/2019 10:25	4043	3590	4496	No
44-10	PR372150	95361	10208C	GS093	8/13/2019 10:27	4180	3590	4496	No
44-10	PR372150	95361	10208C	GS093	8/13/2019 10:29	3694	3590	4496	No
44-10	PR372150	95361	10208C	GS094	8/13/2019 12:19	3880	3590	4496	No
44-10	PR372150	95361	10208C	GS094	8/13/2019 12:21	4209	3590	4496	No
44-10	PR372150	95361	10208C	GS095	8/13/2019 12:23	4130	3590	4496	No
44-10	PR372150	95361	10208C	GS095	8/13/2019 12:26	3780	3590	4496	No
44-10	PR372150	95361	10208C	GS096	8/13/2019 12:30	4034	3590	4496	No
44-10	PR372150	95361	10208C	GS096	8/13/2019 12:32	4231	3590	4496	No
44-10	PR372150	95361	10208C	GS075	8/20/2019 8:07	4839	3912	4858	No
44-10	PR372150	95361	10208C	GS075	8/20/2019 8:11	4564	3912	4858	No
44-10	PR372150	95361	10208C	GS076	8/20/2019 8:13	4669	3912	4858	No
44-10	PR372150	95361	10208C	GS076	8/20/2019 8:17	4727	3912	4858	No
44-10	PR372150	95361	10208C	GS077	8/20/2019 8:20	4618	3912	4858	No
44-10	PR372150	95361	10208C	GS077	8/20/2019 8:22	4715	3912	4858	No
44-10	PR372150	95361	10208C	GS078	8/20/2019 8:25	4658	3912	4858	No
44-10	PR372150	95361	10208C	GS078	8/20/2019 8:28	4274	3912	4858	No
44-10	PR372150	95361	10208C	GS079	8/20/2019 8:31	4562	3912	4858	No
44-10	PR372150	95361	10208C	GS079	8/20/2019 8:33	4709	3912	4858	No
44-10	PR372150	95361	10208C	GS080	8/20/2019 8:37	4442	3912	4858	No
44-10	PR372150	95361	10208C	GS080	8/20/2019 8:40	4553	3912	4858	No
44-10	PR372150	95361	10208C	GS082	8/20/2019 8:43	4670	3912	4858	No
44-10	PR372150	95361	10208C	GS082	8/20/2019 8:46	4662	3912	4858	No
44-10	PR372106	216166	10208C	GS097	8/13/2019 8:25	4231	3685	4602	No
44-10	PR372106	216166	10208C	GS097	8/13/2019 8:27	4137	3685	4602	No
44-10	PR372106	216166	10208C	GS098	8/13/2019 8:29	4401	3685	4602	No
44-10	PR372106	216166	10208C	GS098	8/13/2019 8:31	4111	3685	4602	No
44-10	PR372106	216166	10208C	GS099	8/13/2019 8:36	4560	3685	4602	No
44-10	PR372106	216166	10208C	GS100	8/13/2019 8:38	4301	3685	4602	No
44-10	PR372106	216166	10208C	GS100	8/13/2019 8:40	4047	3685	4602	No
44-10	PR372106	216166	10208C	GS101	8/13/2019 8:43	4052	3685	4602	No
44-10	PR372106	216166	10208C	GS101	8/13/2019 8:45	4309	3685	4602	No
44-10	PR372106	216166	10208C	GS102	8/13/2019 8:47	4220	3685	4602	No
44-10	PR372106	216166	10208C	GS102	8/13/2019 8:49	3945	3685	4602	No
44-10	PR372106	216166	10208C	GS103	8/13/2019 8:51	3872	3685	4602	No
44-10	PR372106	216166	10208C	GS103	8/13/2019 8:54	3977	3685	4602	No
44-10	PR372106	216166	10208C	GS104	8/13/2019 8:56	4464	3685	4602	No
44-10	PR372106	216166	10208C	GS104	8/13/2019 8:58	4086	3685	4602	No
44-10	PR372106	216166	10208C	GS105	8/13/2019 9:00	3806	3685	4602	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	10208C	GS105	8/13/2019 9:02	4469	3685	4602	No
44-10	PR372106	216166	10208C	GS106	8/13/2019 9:04	4246	3685	4602	No
44-10	PR372106	216166	10208C	GS106	8/13/2019 9:07	3836	3685	4602	No
44-10	PR372106	216166	10208C	GS107	8/13/2019 9:09	3751	3685	4602	No
44-10	PR372106	216166	10208C	GS107	8/13/2019 9:11	4486	3685	4602	No
44-10	PR372106	216166	10208C	GS108	8/13/2019 9:13	4395	3685	4602	No
44-10	PR372106	216166	10208C	GS108	8/13/2019 9:15	3946	3685	4602	No
44-10	PR372106	216166	10208C	GS109	8/13/2019 9:17	3735	3685	4602	No
44-10	PR372106	216166	10208C	GS109	8/13/2019 9:20	4036	3685	4602	No
44-10	PR372106	216166	10208C	GS110	8/13/2019 9:22	4051	3685	4602	No
44-10	PR372106	216166	10208C	GS110	8/13/2019 9:24	3793	3685	4602	No
44-10	PR372106	216166	10208C	GS111	8/13/2019 9:26	3746	3685	4602	No
44-10	PR372106	216166	10208C	GS111	8/13/2019 9:28	4129	3685	4602	No
44-10	PR372106	216166	10208C	GS112	8/13/2019 9:30	4413	3685	4602	No
44-10	PR372106	216166	10208C	GS112	8/13/2019 9:32	3780	3685	4602	No
44-10	PR372106	216166	10208C	GS113	8/13/2019 9:39	3837	3685	4602	No
44-10	PR372106	216166	10208C	GS113	8/13/2019 9:41	3941	3685	4602	No
44-10	PR372106	216166	10208C	GS114	8/13/2019 9:43	4021	3685	4602	No
44-10	PR372106	216166	10208C	GS114	8/13/2019 9:45	3827	3685	4602	No
44-10	PR372106	216166	10208C	GS115	8/13/2019 9:49	3630	3685	4602	No
44-10	PR372106	216166	10208C	GS115	8/13/2019 9:51	3816	3685	4602	No
44-10	PR372106	216166	10208C	GS116	8/13/2019 9:53	3838	3685	4602	No
44-10	PR372106	216166	10208C	GS116	8/13/2019 9:56	3961	3685	4602	No
44-10	PR372106	216166	10208C	GS117	8/13/2019 9:58	3781	3685	4602	No
44-10	PR372106	216166	10208C	GS117	8/13/2019 10:00	3824	3685	4602	No
44-10	PR372106	216166	10208C	GS118	8/13/2019 10:02	3792	3685	4602	No
44-10	PR372106	216166	10208C	GS118	8/13/2019 10:06	3694	3685	4602	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. 10208C **Description:** South Warehouse Area
Classification: 1 **Type I (α) Error:** 0.05 **Number of Samples:** 17

#	Fraction of the Release Criterion						Weighted Sum (W_s)	1-W_s	Sign
	Radionuclides of Concern					Activity or SOF			
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	(as applicable)			
1	1.34E-02	2.83E-03	1.61E-02	2.88E-03	3.77E-05	SOF	0.035	0.965	+
2	1.92E-03	4.28E-03	0.00E+00	4.12E-04	0.00E+00	SOF	0.007	0.993	+
3	2.17E-02	2.02E-02	3.00E-03	4.68E-03	7.04E-06	SOF	0.050	0.950	+
4	2.99E-02	6.52E-03	0.00E+00	6.43E-03	0.00E+00	SOF	0.043	0.957	+
5	2.68E-02	1.26E-02	1.56E-03	5.76E-03	3.65E-06	SOF	0.047	0.953	+
6	3.76E-02	0.00E+00	7.16E-03	8.09E-03	1.68E-05	SOF	0.053	0.947	+
7	2.37E-02	2.32E-02	1.63E-02	5.11E-03	3.83E-05	SOF	0.068	0.932	+
8	1.33E-03	7.44E-03	1.04E-02	2.86E-04	2.44E-05	SOF	0.019	0.981	+
9	1.64E-02	1.53E-02	2.61E-03	3.53E-03	6.13E-06	SOF	0.038	0.962	+
10	4.84E-02	2.19E-03	3.83E-03	1.04E-02	8.98E-06	SOF	0.065	0.935	+
11	6.96E-03	8.08E-03	8.10E-03	1.50E-03	1.90E-05	SOF	0.025	0.975	+
12	0.00E+00	1.42E-02	1.52E-02	0.00E+00	3.57E-05	SOF	0.029	0.971	+
13	1.04E-02	3.72E-02	6.53E-03	2.23E-03	1.53E-05	SOF	0.056	0.944	+
14	5.14E-02	1.93E-02	6.20E-04	1.11E-02	1.45E-06	SOF	0.082	0.918	+
15	8.43E-03	0.00E+00	0.00E+00	1.82E-03	0.00E+00	SOF	0.010	0.990	+
16	4.51E-02	4.97E-03	2.51E-03	9.71E-03	5.88E-06	SOF	0.062	0.938	+
17	5.80E-02	0.00E+00	1.25E-02	1.25E-02	2.92E-05	SOF	0.083	0.917	+

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

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

Prepared By (RE): R.J. Mandia (Print Name) / (Signature) 1-12-20 (Date)

Peer Reviewed By (RE): T Graham (Print Name) / (Signature) 1/15/2020 (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

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

Sample Description: Comparison of split samples collected from systematic surface soil sample #5 and investigation surface soil sample #4. The samples were analyzed using gamma spectroscopy by on-site HPGe system. The standard/comparison samples were L1-10208C-FSGS-005SS/L1-10208C-FQGS-005SS and L1-10208C-FIGS-004SS/L1-10208C-QIGS-004SS.

	STANDARD				COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
Systematic Sample #5								
K-40	7.44E+00	4.99E-01	14.91	0.6 - 1.66	6.85E+00	4.76E-01	1.09	Y
Investigation Sample #4								
K-40	8.00E+00	5.65E-01	14.16	0.6-1.66	7.42E+00	5.25E-01	1.08	Y

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

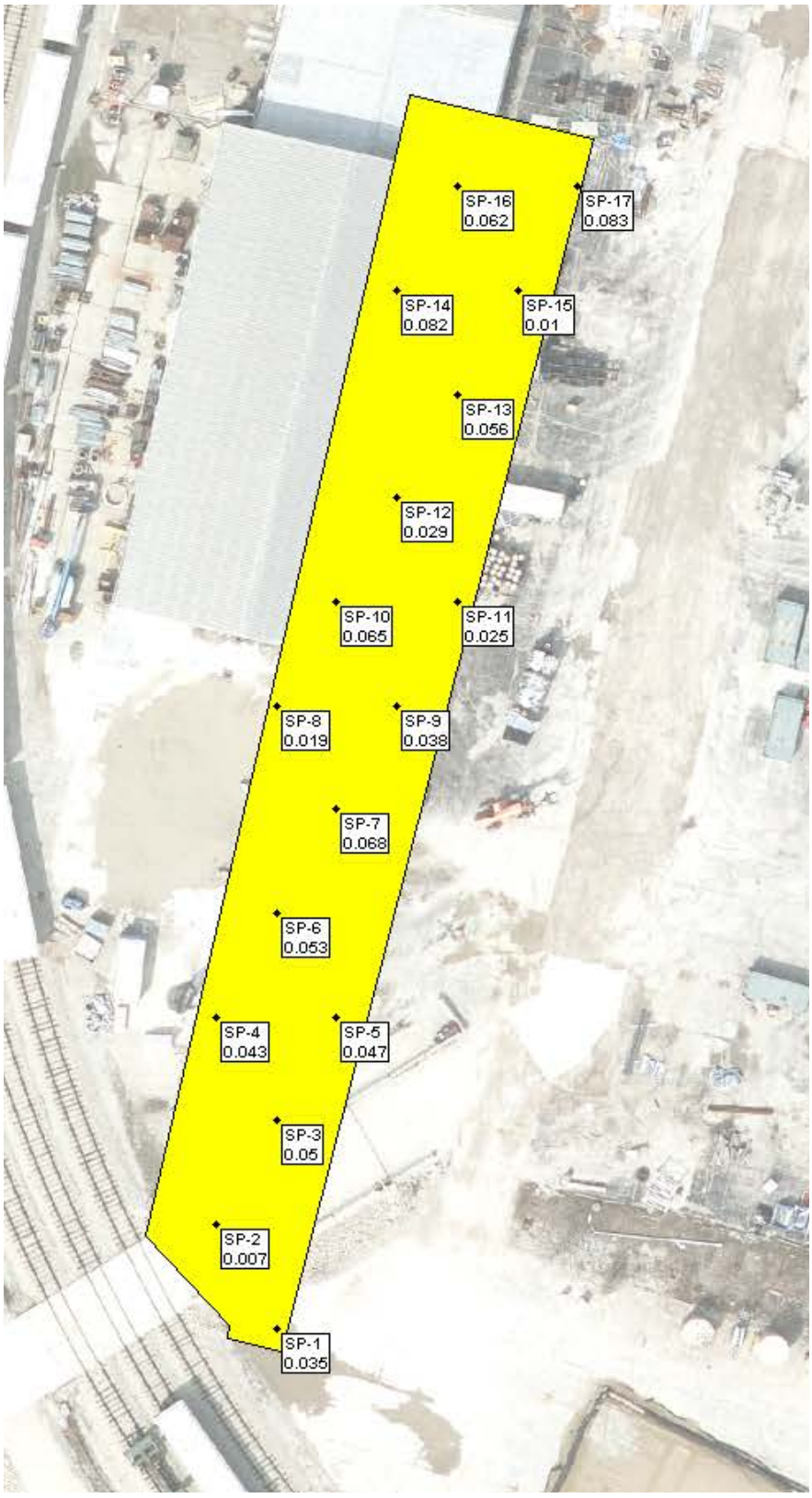
Table 4-1 from the QAPP is reproduced below to show acceptance criteria used to assess split samples.

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

Performed by:	Date:	Reveiwed by:	Date:
R.J. Mandia	1-9-20	J Graham	1/9/2020

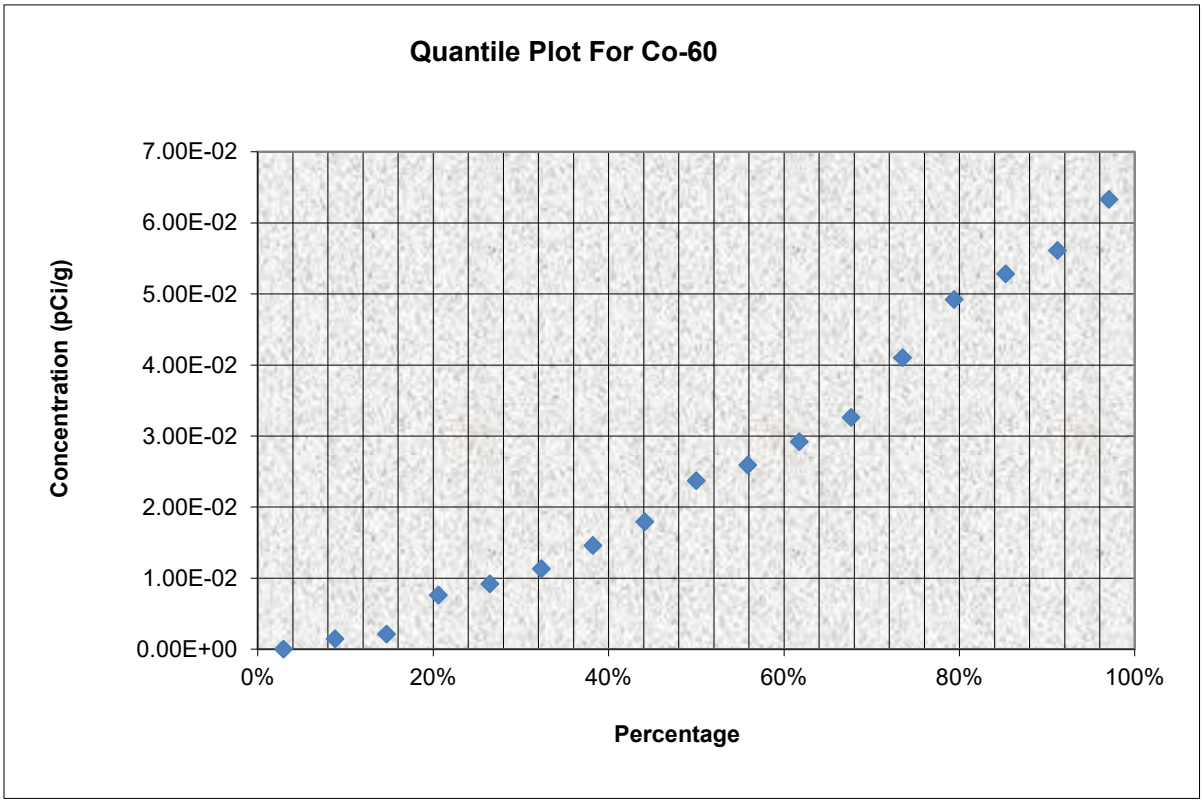
ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot



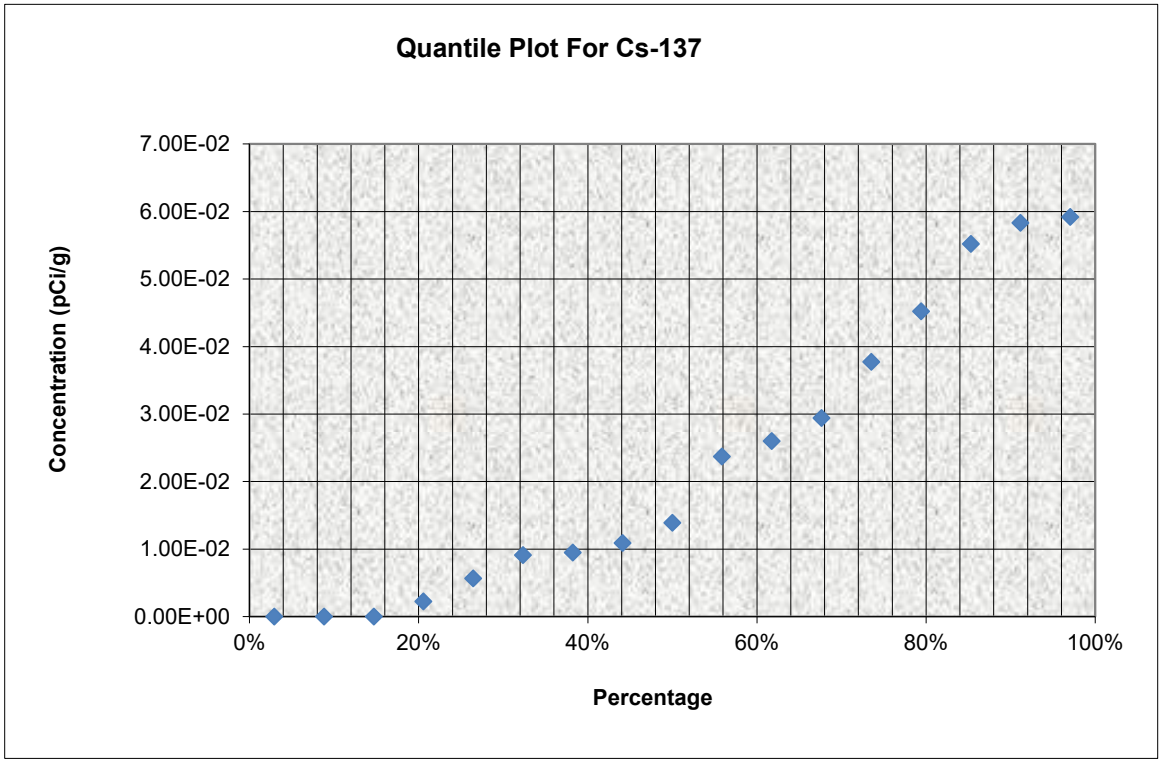
QUANTILE PLOT FOR Co-60

Survey Unit: 10208C
Survey Unit Name: South Warehouse Area
Mean: 2.58E-02 pCi/g



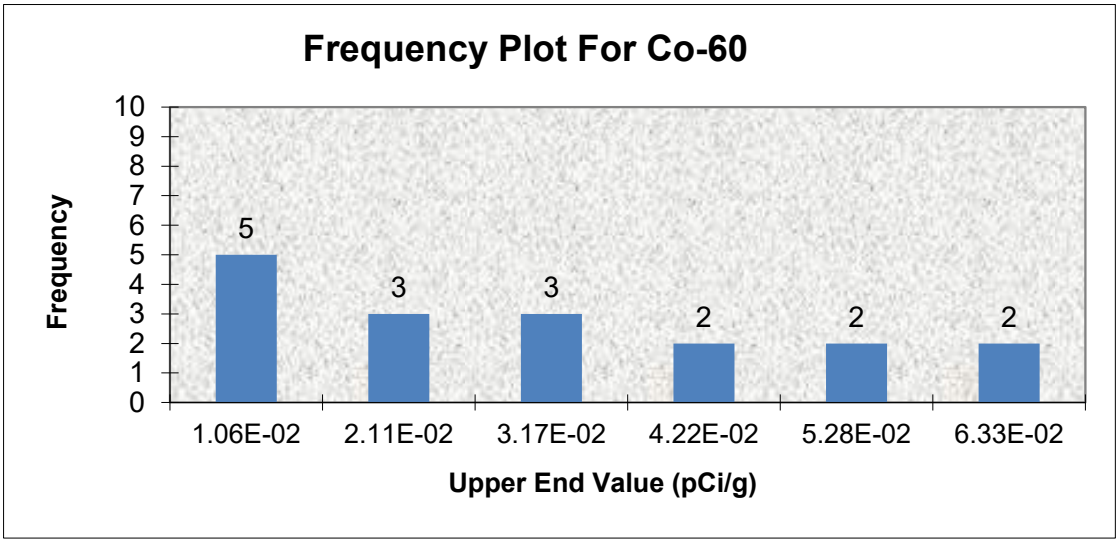
QUANTILE PLOT FOR Cs-137

Survey Unit: 10208C
Survey Unit Name: South Warehouse Area
Mean: 2.27E-02 pCi/g



HISTOGRAM FOR Co-60

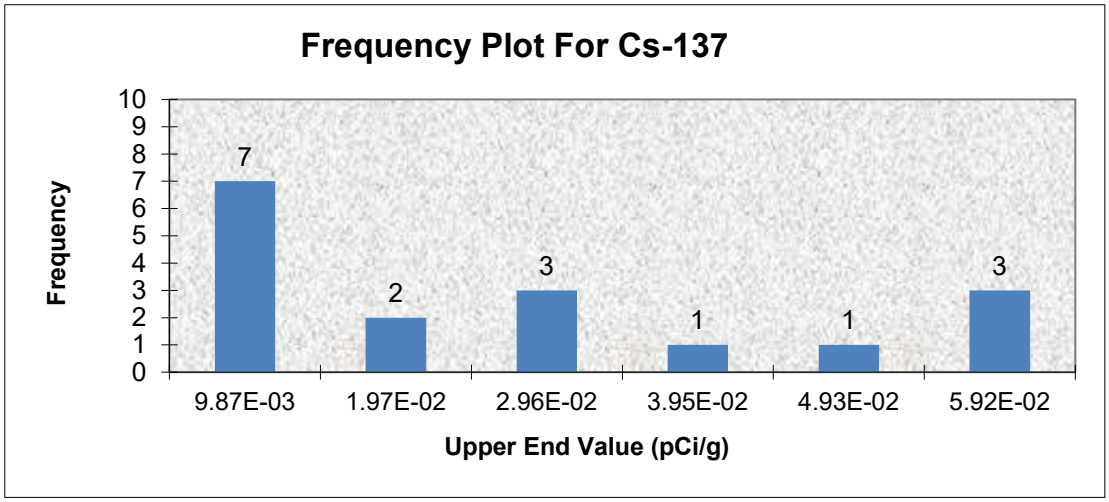
Survey Unit: 10208C
Survey Unit Name: South Warehouse Area
Mean: 2.58E-02 pCi/g
Median: 2.37E-02 pCi/g
ST DEV: 0.020
Skew: 0.471



Upper Value	Observation Frequency	Observation %
1.06E-02	5	29%
2.11E-02	3	18%
3.17E-02	3	18%
4.22E-02	2	12%
5.28E-02	2	12%
6.33E-02	2	12%
TOTAL	17	100%

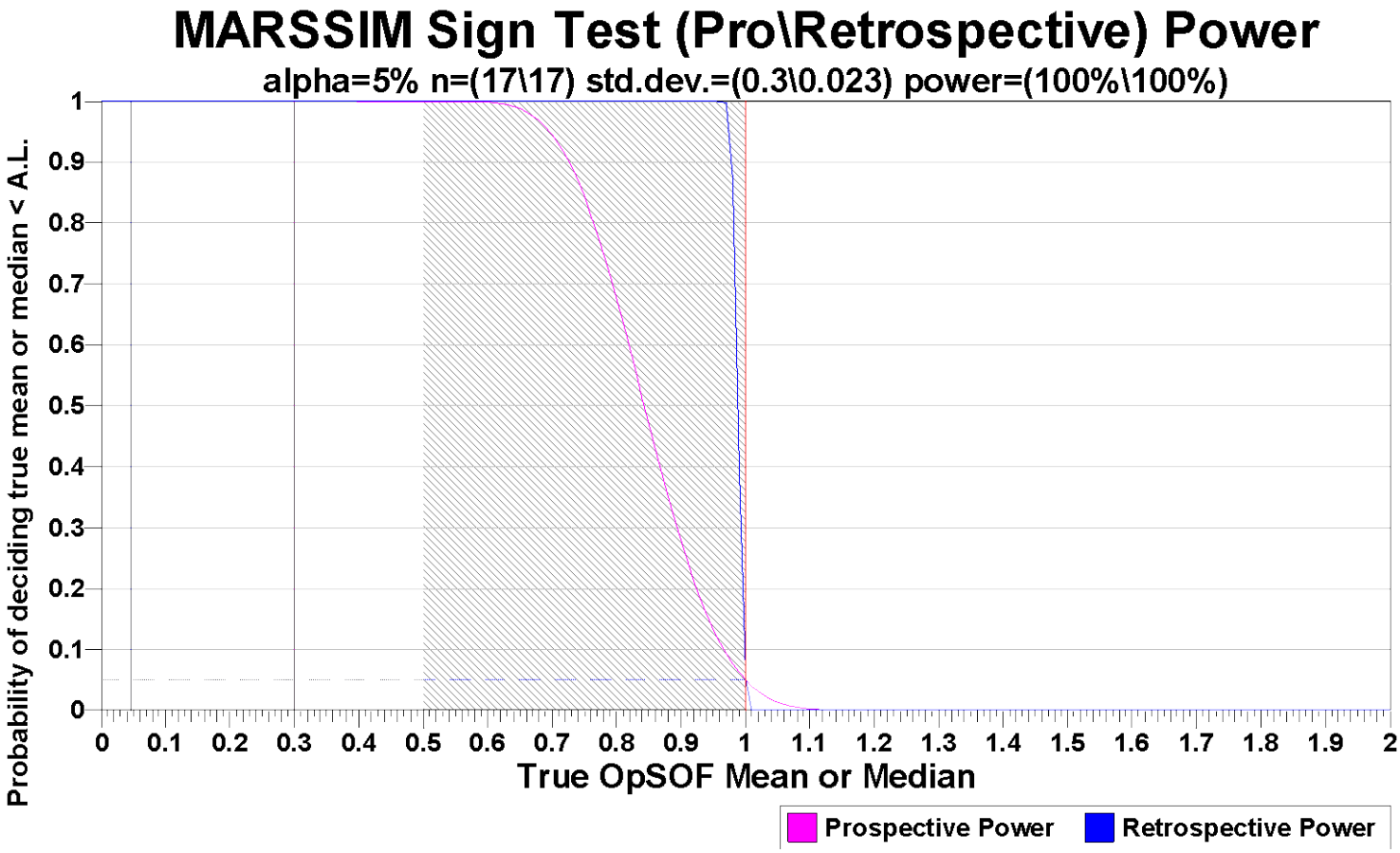
HISTOGRAM FOR Cs-137

Survey Unit: 10208C
Survey Unit Name: South Warehouse Area
Mean: 2.27E-02 pCi/g
Median: 1.39E-02 pCi/g
ST DEV: 0.021
Skew: 0.638



Upper Value	Observation Frequency	Observation %
9.87E-03	7	41%
1.97E-02	2	12%
2.96E-02	3	18%
3.95E-02	1	6%
4.93E-02	1	6%
5.92E-02	3	18%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Unit 10208C



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 14-Aug-19-10001

L1-10208C-FSGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10001
Sample Description	: L1-10208C-FSGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.546E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:30:00AM
Acquisition Started	: 8/14/2019 9:52:45AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78749
Fill Height	: 1545.68 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:07:48AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10001

L1-10208C-FSGS-001SS

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	477.49	1.55E+02	18.81	8.50E+01	1.35
2	294.95	585 -	594	589.95	6.38E+01	12.40	3.92E+01	0.83
3	351.95	700 -	708	703.84	8.21E+01	12.84	3.79E+01	1.72
4	583.17	1161 -	1170	1165.94	4.70E+01	10.10	2.40E+01	1.41
5	609.08	1212 -	1223	1217.74	6.63E+01	10.79	1.97E+01	1.40
6	1460.57	2914 -	2928	2921.19	2.85E+02	17.23	3.94E+00	1.53

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	5.34E+00	3.98E-01
Tl-208	1.00	583.19	*	85.00	6.05E-02	1.35E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.17E-01	3.16E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.64E-01	2.84E-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-Aug-19-10001

L1-10208C-FSGS-001SS

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	2.38E-01	5.01E-02
		351.93	*	35.60	1.79E-01	3.15E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.990	5.34E+00	3.98E-01	
	Tl-208	1.000	6.05E-02	1.35E-02	
X	Bi-211	0.884			
	Pb-212	1.000	2.17E-01	3.16E-02	
	Bi-214	0.996	1.64E-01	2.84E-02	
	Pb-214	0.996	1.96E-01	2.67E-02	

Analysis Report for 14-Aug-19-10001

L1-10208C-FSGS-001SS

? = 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-Aug-19-10001

L1-10208C-FSGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:07:48AM
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	6.42E-02	4.86E-02	4.86E-02
	BE-7	477.60		10.44	1.87E-01	3.36E-01	3.36E-01
+	K-40	1460.82	*	10.66	5.34E+00	2.72E-01	2.72E-01
	Mn-54	834.85		99.98	1.17E-02	4.10E-02	4.10E-02
	Co-60	1173.23		99.85	8.17E-03	4.23E-02	5.66E-02
		1332.49		99.98	1.46E-02		4.23E-02
	Nb-94	702.65		99.81	-7.56E-03	3.32E-02	3.32E-02
		871.09		99.89	-1.07E-02		3.53E-02
	Ag-108m	79.13		6.60	5.54E-01	3.26E-02	1.08E+00
		433.94		90.50	3.46E-03		3.26E-02
		614.28		89.80	-8.58E-03		4.68E-02
		722.94		90.80	-2.01E-02		3.79E-02
	Sb-125	176.31		6.84	2.17E-01	9.64E-02	5.14E-01
		380.45		1.52	-1.02E+00		1.74E+00
		427.87		29.60	2.11E-02		9.64E-02
		463.36		10.49	-6.71E-03		3.23E-01
		600.60		17.65	7.52E-02		2.03E-01
		606.71		4.98	-1.76E-01		1.12E+00
		635.95		11.22	6.02E-02		3.23E-01

Analysis Report for 14-Aug-19-10001

L1-10208C-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-9.22E-01	9.64E-02	1.92E+00
Ba-133	79.61	2.65	-5.64E-01	6.82E-02	2.36E+00
	81.00	32.90	-2.37E-01		1.61E-01
	276.40	7.16	3.43E-02		4.46E-01
	302.85	18.34	1.84E-02		1.70E-01
	356.01	62.05	-2.98E-02		6.82E-02
	383.85	8.94	1.12E-01		3.59E-01
Cs-134	475.36	1.48	1.47E+00	4.84E-02	2.36E+00
	563.25	8.34	7.72E-02		4.16E-01
	569.33	15.37	5.55E-02		2.33E-01
	604.72	97.62	-1.57E-02		5.16E-02
	795.86	85.46	4.91E-03		4.84E-02
	801.95	8.69	-2.11E-02		4.01E-01
	1038.61	0.99	6.44E-02		3.92E+00
	1167.97	1.79	4.43E-01		2.88E+00
	1365.19	3.02	-5.04E-02		1.35E+00
Cs-137	661.66	85.10	5.83E-02	5.41E-02	5.41E-02
Eu-152	121.78	28.67	1.14E-02	1.08E-01	1.08E-01
	244.70	7.61	1.95E-01		4.87E-01
	295.94	0.45	-9.26E-01		8.50E+00
	344.28	26.60	-1.17E-01		1.11E-01
	367.79	0.86	1.44E+00		3.30E+00
	411.12	2.24	4.61E-02		1.43E+00
	443.96	2.83	2.56E-01		1.07E+00
	488.68	0.42	2.20E-01		7.24E+00
	563.99	0.49	2.76E+00		7.24E+00
	586.26	0.46	-2.84E+00		1.16E+01
	678.62	0.47	2.25E+00		8.10E+00
	688.67	0.86	1.58E+00		4.26E+00
	719.35	0.28	5.09E+00		1.21E+01
	778.90	12.96	-3.29E-02		2.64E-01
	810.45	0.32	1.94E+00		9.81E+00
	867.37	4.26	8.48E-02		8.77E-01
	919.33	0.43	-1.89E+00		8.56E+00
	964.08	14.65	-8.50E-02		3.28E-01
	1085.87	10.24	-5.09E-02		4.30E-01
	1089.74	1.73	7.63E-01		2.55E+00
	1112.07	13.69	-8.20E-02		3.08E-01
	1212.95	1.43	8.66E-01		3.90E+00
	1249.94	0.19	6.84E+00		2.88E+01
	1299.14	1.63	-8.91E-01		2.93E+00
	1408.01	21.07	4.79E-02		1.86E-01
	1457.64	0.50	-4.66E+00		3.37E+01
	1528.10	0.28	-2.64E+00		1.14E+01
Eu-154	123.07	40.40	-5.12E-03	7.47E-02	7.47E-02
	247.93	6.89	1.03E-01		4.94E-01
	591.76	4.95	-3.99E-01		6.69E-01
	692.42	1.78	-1.34E+00		1.78E+00
	723.30	20.06	-1.26E-03		1.83E-01
	756.80	4.52	-1.56E-01		8.36E-01
	873.18	12.08	5.89E-02		2.93E-01

Analysis Report for 14-Aug-19-10001

L1-10208C-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.37E-01	7.47E-02	3.60E-01
	1004.76	18.01	6.12E-02		2.11E-01
	1274.43	34.80	-5.01E-02		1.21E-01
	1596.48	1.80	-1.16E+00		2.05E+00
Eu-155	45.30	1.31	-3.97E+00	1.69E-01	9.95E+00
	60.01	1.22	-5.92E+00		1.11E+01
	86.55	30.70	4.47E-02		1.69E-01
	105.31	21.10	-3.60E-03		1.75E-01
Ra-226	186.21	3.64	6.36E-02	9.14E-01	9.14E-01
Pa-231	27.36	10.30	6.26E-01	1.11E+00	1.11E+00
	283.69	1.70	-6.62E-01		1.57E+00
	300.07	2.47	-8.80E-01		1.15E+00
	302.65	2.20	1.53E-01		1.41E+00
	330.06	1.40	-2.24E-02		2.38E+00
U-235	143.76	10.96	1.73E-03	5.85E-02	2.86E-01
	163.33	5.08	-3.89E-01		5.99E-01
	185.71	57.20	1.06E-02		5.85E-02
	202.11	1.08	-1.16E+00		3.00E+00
	205.31	5.01	-3.54E-01		6.59E-01
Am-241	59.54	35.90	-1.04E-01	4.02E-01	4.02E-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-Aug-19-10002

L1-10208C-FSGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10002
Sample Description	: L1-10208C-FSGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.628E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:32:00AM
Acquisition Started	: 8/14/2019 9:52:51AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.9 seconds
Dead Time	: 0.09 %
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78750
Fill Height	: 1628.10 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:07:55AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10002

L1-10208C-FSGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.80	949 -	959	955.28	5.62E+01	10.33	2.08E+01	0.66
2	351.97	1402 -	1412	1407.60	2.99E+01	7.53	1.11E+01	0.60
3	609.08	2429 -	2440	2435.47	2.11E+01	6.02	5.94E+00	0.36
4	1460.20	5833 -	5850	5840.63	8.65E+01	10.06	4.50E+00	0.74

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	0.94	1460.82	*	10.66	2.12E+00	2.63E-01
Bi-211	0.88	351.07	*	13.02	2.26E-01	5.98E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	9.93E-02	2.00E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	6.67E-02	1.95E-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		

Analysis Report for 14-Aug-19-10002

L1-10208C-FSGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	8.26E-02	2.18E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.940	2.12E+00	2.63E-01	
?	Bi-211	0.880	2.26E-01	5.98E-02	
	Pb-212	0.996	9.93E-02	2.00E-02	
	Bi-214	0.996	6.67E-02	1.95E-02	
?	Pb-214	1.000	8.26E-02	2.18E-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-Aug-19-10002

L1-10208C-FSGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:07:55AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.64E-02	4.72E-02	4.72E-02
	BE-7	477.60		10.44	3.97E-02	3.35E-01	3.35E-01
+	K-40	1460.82	*	10.66	2.12E+00	3.89E-01	3.89E-01
	Mn-54	834.85		99.98	-4.58E-02	2.61E-02	2.61E-02
	Co-60	1173.23		99.85	-2.80E-03	3.79E-02	4.21E-02
		1332.49		99.98	2.09E-03		3.79E-02
	Nb-94	702.65		99.81	4.75E-03	3.78E-02	3.78E-02
		871.09		99.89	-1.51E-02		4.26E-02
	Ag-108m	79.13		6.60	2.50E-01	3.20E-02	1.44E+00
		433.94		90.50	-2.58E-04		3.20E-02
		614.28		89.80	-1.97E-02		3.66E-02
		722.94		90.80	7.57E-03		3.71E-02
	Sb-125	176.31		6.84	-2.16E-01	9.89E-02	4.48E-01
		380.45		1.52	-3.78E-01		1.94E+00
		427.87		29.60	2.88E-02		9.89E-02
		463.36		10.49	1.52E-01		3.27E-01
		600.60		17.65	-2.00E-01		1.97E-01
		606.71		4.98	4.73E-01		9.80E-01
		635.95		11.22	8.82E-02		2.84E-01

Analysis Report for 14-Aug-19-10002

L1-10208C-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-9.14E-01	9.89E-02	1.79E+00
Ba-133	79.61	2.65	-1.10E+00	5.72E-02	3.39E+00
	81.00	32.90	-1.50E-01		2.39E-01
	276.40	7.16	-8.27E-02		4.39E-01
	302.85	18.34	6.73E-02		1.78E-01
	356.01	62.05	-1.90E-02		5.72E-02
	383.85	8.94	1.67E-01		3.85E-01
Cs-134	475.36	1.48	-7.30E-01	4.69E-02	2.21E+00
	563.25	8.34	-3.54E-01		3.62E-01
	569.33	15.37	-6.50E-02		1.87E-01
	604.72	97.62	-4.34E-03		4.94E-02
	795.86	85.46	7.41E-03		4.69E-02
	801.95	8.69	-8.49E-02		3.75E-01
	1038.61	0.99	-1.00E+00		4.21E+00
	1167.97	1.79	-2.97E+00		2.05E+00
	1365.19	3.02	-4.77E-01		1.12E+00
Cs-137	661.66	85.10	-2.05E-02	3.61E-02	3.61E-02
Eu-152	121.78	28.67	4.91E-05	1.14E-01	1.27E-01
	244.70	7.61	-2.88E-01		4.18E-01
	295.94	0.45	-5.58E-01		8.36E+00
	344.28	26.60	-1.52E-02		1.14E-01
	367.79	0.86	-4.59E-01		4.00E+00
	411.12	2.24	2.92E-01		1.34E+00
	443.96	2.83	3.58E-02		1.04E+00
	488.68	0.42	3.68E+00		6.68E+00
	563.99	0.49	3.75E+00		6.47E+00
	586.26	0.46	4.17E-01		8.34E+00
	678.62	0.47	-5.50E-01		6.63E+00
	688.67	0.86	-2.28E+00		2.84E+00
	719.35	0.28	3.90E+00		1.31E+01
	778.90	12.96	-5.44E-02		2.81E-01
	810.45	0.32	1.50E+00		1.10E+01
	867.37	4.26	5.97E-01		1.02E+00
	919.33	0.43	2.38E+00		8.36E+00
	964.08	14.65	2.38E-01		3.41E-01
	1085.87	10.24	-1.35E-01		4.71E-01
	1089.74	1.73	-3.46E-01		2.57E+00
	1112.07	13.69	-6.02E-02		2.60E-01
	1212.95	1.43	-4.01E-02		3.13E+00
	1249.94	0.19	-3.40E+00		2.23E+01
	1299.14	1.63	-7.00E-01		2.42E+00
	1408.01	21.07	-2.26E-02		1.50E-01
	1457.64	0.50	5.13E+01		2.62E+01
	1528.10	0.28	0.00E+00		1.30E+01
Eu-154	123.07	40.40	4.78E-02	8.85E-02	8.85E-02
	247.93	6.89	1.84E-01		4.59E-01
	591.76	4.95	-2.93E-01		6.79E-01
	692.42	1.78	-2.72E+00		1.29E+00
	723.30	20.06	-1.61E-02		1.63E-01
	756.80	4.52	7.59E-02		8.57E-01
	873.18	12.08	2.73E-02		3.26E-01

Analysis Report for 14-Aug-19-10002

L1-10208C-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-7.89E-02	8.85E-02	3.31E-01
	1004.76	18.01	-1.40E-02		2.03E-01
	1274.43	34.80	1.02E-01		1.46E-01
	1596.48	1.80	-1.21E+00		1.74E+00
Eu-155	45.30	1.31	2.10E+01	1.98E-01	2.50E+01
	60.01	1.22	-5.22E+00		2.11E+01
	86.55	30.70	-4.36E-02		2.00E-01
	105.31	21.10	-1.23E-01		1.98E-01
Ra-226	186.21	3.64	9.21E-01	9.11E-01	9.11E-01
Pa-231	27.36	10.30	7.79E-01	1.33E+00	2.39E+00
	283.69	1.70	1.15E+00		2.01E+00
	300.07	2.47	-5.80E-01		1.33E+00
	302.65	2.20	5.09E-01		1.50E+00
	330.06	1.40	1.72E+00		2.55E+00
U-235	143.76	10.96	-1.74E-01	5.70E-02	3.23E-01
	163.33	5.08	1.00E-01		6.27E-01
	185.71	57.20	3.11E-02		5.70E-02
	202.11	1.08	-6.23E-01		2.81E+00
	205.31	5.01	-3.06E-01		5.76E-01
Am-241	59.54	35.90	-5.54E-01	7.24E-01	7.24E-01

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

Apex-Gamma

Analysis Report for 14-Aug-19-10003

L1-10208C-FSGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10003
Sample Description	: L1-10208C-FSGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.819E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:34:00AM
Acquisition Started	: 8/14/2019 9:52:58AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78751
Fill Height	: 1819.11 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:08:09AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10003

L1-10208C-FSGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.17	739 -	750	744.56	3.34E+01	13.14	5.56E+01	0.60
2	238.82	947 -	960	954.86	1.31E+02	17.14	5.92E+01	0.89
3	295.20	1173 -	1187	1180.09	4.94E+01	12.33	3.56E+01	1.02
4	338.47	1347 -	1357	1352.95	3.32E+01	9.16	2.08E+01	0.46
5	351.98	1400 -	1416	1406.93	8.53E+01	12.71	2.37E+01	1.01
6	583.23	2324 -	2336	2331.04	6.44E+01	10.18	1.46E+01	0.64
7	609.32	2427 -	2443	2435.33	6.39E+01	10.57	1.51E+01	1.29
8	1460.01	5826 -	5848	5837.96	2.32E+02	16.29	8.52E+00	1.98

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.89	1460.82	*	10.66	4.99E+00	4.11E-01
Tl-208	1.00	583.19	*	85.00	9.36E-02	1.58E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.02E-01	3.11E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.79E-01	3.14E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 14-Aug-19-10003

L1-10208C-FSGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.05E-01	5.38E-02
		351.93	*	35.60	2.08E-01	3.52E-02
		785.96		1.06		
Ra-226	1.00	186.21	*	3.64	5.45E-01	2.19E-01
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.49E-01	7.16E-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		
U-235	0.97	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.47E-02	1.39E-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-Aug-19-10003

L1-10208C-FSGS-003SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.899	4.99E+00	4.11E-01	
	Tl-208	1.000	9.36E-02	1.58E-02	
X	Bi-211	0.876			
	Pb-212	0.995	2.02E-01	3.11E-02	
	Bi-214	1.000	1.79E-01	3.14E-02	
	Pb-214	1.000	2.07E-01	2.95E-02	
?	Ra-226	1.000	5.45E-01	2.19E-01	
	Ac-228	1.000	2.49E-01	7.16E-02	
?	U-235	0.976	3.47E-02	1.39E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 14-Aug-19-10003

L1-10208C-FSGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:08:09AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.46E-02	5.05E-02	5.05E-02
	BE-7	477.60		10.44	3.88E-01	4.15E-01	4.15E-01
+	K-40	1460.82	*	10.66	4.99E+00	4.78E-01	4.78E-01
	Mn-54	834.85		99.98	-7.40E-03	4.37E-02	4.37E-02
	Co-60	1173.23		99.85	2.37E-02	4.96E-02	5.65E-02
		1332.49		99.98	1.30E-02		4.96E-02
	Nb-94	702.65		99.81	-2.52E-02	3.56E-02	3.56E-02
		871.09		99.89	-6.68E-03		4.02E-02
	Ag-108m	79.13		6.60	1.06E+00	3.57E-02	1.26E+00
		433.94		90.50	-8.32E-03		3.57E-02
		614.28		89.80	2.07E-03		5.48E-02
		722.94		90.80	-4.32E-03		4.44E-02
	Sb-125	176.31		6.84	1.28E-01	1.08E-01	4.48E-01
		380.45		1.52	-2.43E-01		2.13E+00
		427.87		29.60	-4.70E-03		1.08E-01
		463.36		10.49	1.24E-01		3.70E-01
		600.60		17.65	-7.23E-04		2.43E-01
		606.71		4.98	-1.14E-02		1.34E+00
		635.95		11.22	1.47E-01		3.19E-01

Analysis Report for 14-Aug-19-10003

L1-10208C-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.12E-01	1.08E-01	2.07E+00
Ba-133	79.61	2.65	2.38E+00	6.20E-02	3.04E+00
	81.00	32.90	-3.82E-01		1.98E-01
	276.40	7.16	2.53E-01		4.68E-01
	302.85	18.34	1.03E-01		1.75E-01
	356.01	62.05	-3.31E-02		6.20E-02
	383.85	8.94	-1.90E-03		3.63E-01
Cs-134	475.36	1.48	1.90E+00	5.57E-02	2.87E+00
	563.25	8.34	-3.94E-01		4.75E-01
	569.33	15.37	1.30E-02		2.44E-01
	604.72	97.62	-2.54E-03		5.98E-02
	795.86	85.46	3.50E-02		5.57E-02
	801.95	8.69	-4.95E-02		4.73E-01
	1038.61	0.99	-1.07E+00		4.27E+00
	1167.97	1.79	6.74E-01		3.24E+00
	1365.19	3.02	2.78E-01		1.30E+00
Cs-137	661.66	85.10	1.09E-02	4.68E-02	4.68E-02
Eu-152	121.78	28.67	5.78E-03	1.26E-01	1.28E-01
	244.70	7.61	1.51E-01		5.06E-01
	295.94	0.45	7.25E+00		9.22E+00
	344.28	26.60	-2.16E-03		1.26E-01
	367.79	0.86	-1.46E+00		3.76E+00
	411.12	2.24	2.55E-01		1.57E+00
	443.96	2.83	-6.35E-01		1.12E+00
	488.68	0.42	-4.19E-01		8.85E+00
	563.99	0.49	-1.16E+01		7.06E+00
	586.26	0.46	-9.20E+00		1.33E+01
	678.62	0.47	2.95E+00		9.06E+00
	688.67	0.86	-5.15E+00		4.55E+00
	719.35	0.28	1.53E+00		1.29E+01
	778.90	12.96	-1.24E-01		2.75E-01
	810.45	0.32	6.22E+00		1.24E+01
	867.37	4.26	2.27E-01		8.99E-01
	919.33	0.43	5.00E+00		1.03E+01
	964.08	14.65	1.33E-01		4.18E-01
	1085.87	10.24	1.51E-01		4.44E-01
	1089.74	1.73	2.17E+00		2.64E+00
	1112.07	13.69	-2.16E-01		3.59E-01
	1212.95	1.43	1.73E+00		4.17E+00
	1249.94	0.19	7.24E+00		2.96E+01
	1299.14	1.63	1.33E+00		3.35E+00
	1408.01	21.07	8.45E-02		1.74E-01
	1457.64	0.50	1.01E+02		3.57E+01
	1528.10	0.28	-9.87E+00		1.23E+01
Eu-154	123.07	40.40	-3.39E-02	8.94E-02	8.94E-02
	247.93	6.89	1.70E-01		4.71E-01
	591.76	4.95	-4.96E-01		6.77E-01
	692.42	1.78	-6.59E-01		2.44E+00
	723.30	20.06	1.76E-01		2.11E-01
	756.80	4.52	2.78E-01		8.58E-01
	873.18	12.08	-1.71E-01		3.66E-01

Analysis Report for 14-Aug-19-10003

L1-10208C-FSGS-003SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	5.57E-02	8.94E-02	4.11E-01
		1004.76		18.01	9.44E-03		2.24E-01
		1274.43		34.80	7.03E-02		1.79E-01
		1596.48		1.80	-6.90E-01		2.24E+00
	Eu-155	45.30		1.31	-1.92E+00	1.77E-01	1.16E+01
		60.01		1.22	9.96E-01		1.21E+01
		86.55		30.70	-5.39E-02		1.77E-01
		105.31		21.10	-1.60E-02		1.85E-01
+	Ra-226	186.21	*	3.64	5.45E-01	6.99E-01	6.99E-01
	Pa-231	27.36		10.30	1.06E+00	1.27E+00	1.28E+00
		283.69		1.70	-2.65E-02		1.77E+00
		300.07		2.47	-3.26E-02		1.27E+00
		302.65		2.20	8.41E-01		1.46E+00
		330.06		1.40	-1.98E-01		2.39E+00
+	U-235	143.76		10.96	-7.74E-02	4.45E-02	2.99E-01
		163.33		5.08	-4.28E-01		6.34E-01
		185.71	*	57.20	3.47E-02		4.45E-02
		202.11		1.08	1.63E+00		3.00E+00
		205.31		5.01	-4.55E-01		5.57E-01
	Am-241	59.54		35.90	1.78E-01	4.37E-01	4.37E-01

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

Apex-Gamma

Analysis Report for 14-Aug-19-10004

L1-10208C-FSGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10004
Sample Description	: L1-10208C-FSGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.569E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:36:00AM
Acquisition Started	: 8/14/2019 9:53:06AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78752
Fill Height	: 1568.65 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:08:09AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10004

L1-10208C-FSGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.34	306 -	314	310.66	3.29E+01	12.61	5.91E+01	0.50
2	185.93	735 -	753	744.46	6.68E+01	17.31	6.82E+01	0.94
3	238.62	949 -	962	954.94	1.32E+02	18.06	6.93E+01	1.41
4	295.20	1172 -	1189	1181.02	4.99E+01	13.19	3.81E+01	1.18
5	351.84	1401 -	1414	1407.35	1.16E+02	13.82	2.74E+01	1.15
6	583.14	2326 -	2339	2331.87	5.03E+01	9.22	1.27E+01	1.07
7	609.47	2429 -	2446	2437.16	9.50E+01	11.69	1.30E+01	0.74
8	911.31	3639 -	3651	3644.27	3.51E+01	8.64	1.49E+01	0.35
9	1460.74	5830 -	5856	5843.35	3.02E+02	17.38	0.00E+00	2.25

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.28E+00	4.52E-01
Tl-208	1.00	583.19	*	85.00	7.15E-02	1.38E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.05E-01	3.27E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.03E-01	1.20E-01
		87.35		3.97		

Analysis Report for 14-Aug-19-10004

L1-10208C-FSGS-004SS

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	2.60E-01	3.56E-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	2.07E-01	5.70E-02
		351.93	*	35.60	2.80E-01	4.03E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	5.34E-01	2.13E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.98	186.21	*	3.64	1.12E+00	3.03E-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	2.20E-01	5.51E-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	7.10E-02	1.93E-02
		202.11		1.08		
		205.31		5.01		

Analysis Report for 14-Aug-19-10004

L1-10208C-FSGS-004SS

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	6.28E+00	4.52E-01	
	Tl-208	1.000	7.15E-02	1.38E-02	
X	Bi-211	0.910			
	Pb-212	1.000	2.05E-01	3.27E-02	
?	Pb212-XR	0.996	3.03E-01	1.20E-01	
	Bi-214	0.998	2.60E-01	3.56E-02	
	Pb-214	0.999	2.56E-01	3.29E-02	
?	Pb214-XR	0.996	5.34E-01	2.13E-01	
?	Ra-226	0.988	1.12E+00	3.03E-01	
	Ac-228	0.999	2.20E-01	5.51E-02	
?	U-235	0.994	7.10E-02	1.93E-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 14-Aug-19-10004

L1-10208C-FSGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:08:09AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.66E-02	5.55E-02	5.55E-02
	BE-7	477.60		10.44	3.56E-02	3.78E-01	3.78E-01
+	K-40	1460.82	*	10.66	6.28E+00	5.98E-02	5.98E-02
	Mn-54	834.85		99.98	1.54E-02	4.26E-02	4.26E-02
	Co-60	1173.23		99.85	-3.18E-02	6.04E-02	6.83E-02
		1332.49		99.98	3.26E-02		6.04E-02
	Nb-94	702.65		99.81	-1.90E-03	4.30E-02	4.44E-02
		871.09		99.89	-5.15E-03		4.30E-02
	Ag-108m	79.13		6.60	1.18E+00	3.81E-02	1.51E+00
		433.94		90.50	-5.22E-03		3.81E-02
		614.28		89.80	-1.60E-02		7.44E-02
		722.94		90.80	1.61E-02		5.26E-02
	Sb-125	176.31		6.84	-4.13E-02	1.24E-01	4.86E-01
		380.45		1.52	-2.42E-02		2.49E+00
		427.87		29.60	8.81E-02		1.24E-01
		463.36		10.49	2.93E-01		3.93E-01
		600.60		17.65	3.83E-03		2.35E-01
		606.71		4.98	2.60E+00		1.46E+00
		635.95		11.22	-1.60E-01		3.66E-01

Analysis Report for 14-Aug-19-10004

L1-10208C-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-8.32E-01	1.24E-01	2.43E+00
Ba-133	79.61	2.65	-1.73E+00	8.18E-02	3.65E+00
	81.00	32.90	-2.24E-01		2.34E-01
	276.40	7.16	-5.82E-01		5.03E-01
	302.85	18.34	1.29E-02		2.08E-01
	356.01	62.05	-3.94E-02		8.18E-02
	383.85	8.94	2.25E-01		4.49E-01
Cs-134	475.36	1.48	-1.02E+00	5.06E-02	2.73E+00
	563.25	8.34	-1.74E-01		4.66E-01
	569.33	15.37	-3.90E-02		2.45E-01
	604.72	97.62	-1.60E-02		6.58E-02
	795.86	85.46	1.13E-02		5.06E-02
	801.95	8.69	3.35E-01		4.61E-01
	1038.61	0.99	2.32E-01		5.04E+00
	1167.97	1.79	1.44E+00		3.91E+00
	1365.19	3.02	1.12E+00		1.54E+00
Cs-137	661.66	85.10	-8.49E-03	6.28E-02	6.28E-02
Eu-152	121.78	28.67	3.86E-02	1.32E-01	1.45E-01
	244.70	7.61	2.31E-01		5.60E-01
	295.94	0.45	8.93E+00		9.93E+00
	344.28	26.60	-4.68E-02		1.32E-01
	367.79	0.86	2.25E+00		4.35E+00
	411.12	2.24	7.72E-02		1.70E+00
	443.96	2.83	1.01E-01		1.16E+00
	488.68	0.42	-1.67E+00		9.33E+00
	563.99	0.49	1.16E-01		7.82E+00
	586.26	0.46	1.03E+01		1.23E+01
	678.62	0.47	2.41E+00		8.37E+00
	688.67	0.86	-3.04E+00		4.64E+00
	719.35	0.28	1.49E+01		1.65E+01
	778.90	12.96	-3.09E-01		3.52E-01
	810.45	0.32	1.84E+00		1.30E+01
	867.37	4.26	-9.91E-01		1.10E+00
	919.33	0.43	-1.16E+00		1.08E+01
	964.08	14.65	2.10E-01		4.30E-01
	1085.87	10.24	-1.25E-01		5.75E-01
	1089.74	1.73	1.15E+00		3.65E+00
	1112.07	13.69	-6.62E-01		3.80E-01
	1212.95	1.43	-1.51E+00		4.79E+00
	1249.94	0.19	5.78E+00		3.20E+01
	1299.14	1.63	5.87E-01		3.37E+00
	1408.01	21.07	1.43E-01		2.49E-01
	1457.64	0.50	1.35E+02		3.82E+01
	1528.10	0.28	2.61E+00		1.58E+01
Eu-154	123.07	40.40	4.32E-02	1.01E-01	1.01E-01
	247.93	6.89	-3.86E-01		5.15E-01
	591.76	4.95	4.90E-02		8.38E-01
	692.42	1.78	-2.50E+00		2.19E+00
	723.30	20.06	1.78E-01		2.43E-01
	756.80	4.52	-2.64E-01		1.00E+00
	873.18	12.08	3.26E-03		3.43E-01

Analysis Report for 14-Aug-19-10004

L1-10208C-FSGS-004SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	1.85E-01	1.01E-01	5.26E-01
		1004.76		18.01	-9.83E-02		2.71E-01
		1274.43		34.80	2.55E-03		1.44E-01
		1596.48		1.80	-3.10E+00		2.05E+00
	Eu-155	45.30		1.31	1.46E+01	2.14E-01	2.21E+01
		60.01		1.22	-2.94E+00		2.30E+01
		86.55		30.70	4.86E-02		2.38E-01
		105.31		21.10	1.74E-02		2.14E-01
+	Ra-226	186.21	*	3.64	1.12E+00	9.12E-01	9.12E-01
	Pa-231	27.36		10.30	1.62E+00	1.59E+00	2.46E+00
		283.69		1.70	5.56E-01		2.09E+00
		300.07		2.47	4.28E-01		1.59E+00
		302.65		2.20	7.37E-01		1.74E+00
		330.06		1.40	2.02E+00		2.58E+00
+	U-235	143.76		10.96	-3.02E-02	5.81E-02	3.62E-01
		163.33		5.08	2.76E-01		7.33E-01
		185.71	*	57.20	7.10E-02		5.81E-02
		202.11		1.08	1.70E+00		3.50E+00
		205.31		5.01	-5.46E-01		7.22E-01
	Am-241	59.54		35.90	-7.06E-01	7.87E-01	7.87E-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-Aug-19-10005

L1-10208C-FSGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10005
Sample Description	: L1-10208C-FSGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.662E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:38:00AM
Acquisition Started	: 8/14/2019 10:13:20AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78753
Fill Height	: 1661.57 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:28:22AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10005

L1-10208C-FSGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.03	368 -	376	372.37	4.35E+01	17.31	1.20E+02	0.88
2	238.66	473 -	481	477.50	1.57E+02	20.87	1.27E+02	1.25
3	295.32	587 -	595	590.69	6.68E+01	13.83	5.82E+01	1.38
4	351.92	698 -	708	703.78	1.36E+02	15.38	4.15E+01	1.42
5	583.06	1161 -	1170	1165.72	5.52E+01	10.54	2.48E+01	1.11
6	609.20	1213 -	1223	1217.98	8.76E+01	10.95	1.34E+01	1.67
7	911.26	1818 -	1826	1821.97	4.24E+01	8.25	1.16E+01	1.26
8	968.82	1933 -	1943	1937.10	3.16E+01	9.72	2.44E+01	0.79
9	1460.59	2915 -	2928	2921.23	4.04E+02	20.68	8.56E+00	1.68

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.44E+00	4.99E-01
Tl-208	0.99	583.19	*	85.00	7.00E-02	1.40E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.17E-01	3.38E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.13E-01	2.96E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 14-Aug-19-10005

L1-10208C-FSGS-005SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.47E-01	5.47E-02
		351.93	*	35.60	2.95E-01	4.07E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	6.38E-01	2.59E-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	2.37E-01	4.72E-02
		964.77		4.99		
		968.97	*	15.80	3.00E-01	9.31E-02
		1588.20		3.22		
U-235	0.98	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.06E-02	1.65E-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-Aug-19-10005

L1-10208C-FSGS-005SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.991	7.44E+00	4.99E-01	
	Tl-208	0.997	7.00E-02	1.40E-02	
X	Bi-211	0.891			
	Pb-212	1.000	2.17E-01	3.38E-02	
	Bi-214	0.999	2.13E-01	2.96E-02	
	Pb-214	1.000	2.77E-01	3.27E-02	
?	Ra-226	0.995	6.38E-01	2.59E-01	
	Ac-228	0.999	2.50E-01	4.21E-02	
?	U-235	0.988	4.06E-02	1.65E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 14-Aug-19-10005

L1-10208C-FSGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:28:22AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.34E-02	5.32E-02	5.32E-02
	BE-7	477.60		10.44	3.82E-01	4.17E-01	4.17E-01
+	K-40	1460.82	*	10.66	7.44E+00	3.55E-01	3.55E-01
	Mn-54	834.85		99.98	1.64E-02	4.15E-02	4.15E-02
	Co-60	1173.23		99.85	2.92E-02	4.15E-02	5.81E-02
		1332.49		99.98	-1.21E-02		4.15E-02
	Nb-94	702.65		99.81	1.79E-02	4.08E-02	4.18E-02
		871.09		99.89	8.74E-03		4.08E-02
	Ag-108m	79.13		6.60	1.34E+00	3.36E-02	1.28E+00
		433.94		90.50	-2.77E-02		3.36E-02
		614.28		89.80	-2.61E-02		5.33E-02
		722.94		90.80	1.87E-02		4.92E-02
	Sb-125	176.31		6.84	1.58E-01	1.22E-01	5.05E-01
		380.45		1.52	-4.07E-01		2.04E+00
		427.87		29.60	6.02E-02		1.22E-01
		463.36		10.49	2.93E-01		3.72E-01
		600.60		17.65	4.66E-02		2.18E-01
		606.71		4.98	-3.25E-01		1.20E+00
		635.95		11.22	1.65E-01		3.45E-01

Analysis Report for 14-Aug-19-10005

L1-10208C-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.06E-01	1.22E-01	2.22E+00
Ba-133	79.61	2.65	1.79E+00	7.57E-02	2.95E+00
	81.00	32.90	-2.98E-01		1.88E-01
	276.40	7.16	2.23E-01		4.76E-01
	302.85	18.34	6.10E-02		1.81E-01
	356.01	62.05	-5.16E-02		7.57E-02
	383.85	8.94	-2.79E-02		3.36E-01
Cs-134	475.36	1.48	1.89E+00	4.89E-02	2.87E+00
	563.25	8.34	-2.45E-01		3.68E-01
	569.33	15.37	1.71E-01		2.39E-01
	604.72	97.62	-1.53E-02		5.44E-02
	795.86	85.46	2.19E-02		4.89E-02
	801.95	8.69	5.26E-02		3.95E-01
	1038.61	0.99	1.57E+00		5.01E+00
	1167.97	1.79	1.27E-01		3.09E+00
	1365.19	3.02	6.65E-01		1.40E+00
Cs-137	661.66	85.10	5.65E-03	4.72E-02	4.72E-02
Eu-152	121.78	28.67	3.84E-02	1.26E-01	1.26E-01
	244.70	7.61	-1.57E-01		4.59E-01
	295.94	0.45	4.77E+00		9.22E+00
	344.28	26.60	-1.18E-02		1.33E-01
	367.79	0.86	1.46E+00		3.98E+00
	411.12	2.24	1.02E+00		1.65E+00
	443.96	2.83	-2.53E-01		1.13E+00
	488.68	0.42	1.64E+00		9.06E+00
	563.99	0.49	-3.49E+00		6.35E+00
	586.26	0.46	-3.41E+00		1.18E+01
	678.62	0.47	1.05E+00		8.17E+00
	688.67	0.86	-1.85E+00		4.59E+00
	719.35	0.28	-8.90E+00		1.29E+01
	778.90	12.96	-1.45E-02		2.83E-01
	810.45	0.32	9.20E+00		1.15E+01
	867.37	4.26	-1.31E+00		7.78E-01
	919.33	0.43	-7.60E+00		9.87E+00
	964.08	14.65	-1.34E-01		4.33E-01
	1085.87	10.24	-9.35E-02		4.22E-01
	1089.74	1.73	-1.07E+00		2.41E+00
	1112.07	13.69	-6.90E-02		3.87E-01
	1212.95	1.43	-3.52E+00		3.63E+00
	1249.94	0.19	2.79E+00		2.54E+01
	1299.14	1.63	1.47E+00		3.19E+00
	1408.01	21.07	-6.86E-02		1.83E-01
	1457.64	0.50	-7.06E+00		3.94E+01
	1528.10	0.28	-3.06E+00		6.95E+00
Eu-154	123.07	40.40	-8.53E-03	8.51E-02	8.51E-02
	247.93	6.89	-1.02E-01		4.40E-01
	591.76	4.95	2.09E-01		7.54E-01
	692.42	1.78	2.13E-01		2.23E+00
	723.30	20.06	1.53E-01		2.27E-01
	756.80	4.52	3.90E-02		8.23E-01
	873.18	12.08	6.67E-02		3.57E-01

Analysis Report for 14-Aug-19-10005

L1-10208C-FSGS-005SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-5.59E-02	8.51E-02	3.77E-01
		1004.76		18.01	1.74E-01		2.63E-01
		1274.43		34.80	-8.51E-02		1.49E-01
		1596.48		1.80	9.72E-03		1.71E+00
	Eu-155	45.30		1.31	2.29E+00	1.90E-01	1.10E+01
		60.01		1.22	-4.36E+00		1.27E+01
		86.55		30.70	1.22E-01		1.96E-01
		105.31		21.10	-1.17E-01		1.90E-01
+	Ra-226	186.21	*	3.64	6.38E-01	8.39E-01	8.39E-01
	Pa-231	27.36		10.30	1.41E+00	1.33E+00	1.33E+00
		283.69		1.70	-6.20E-01		1.81E+00
		300.07		2.47	-1.11E-01		1.35E+00
		302.65		2.20	5.09E-01		1.50E+00
		330.06		1.40	9.90E-01		2.58E+00
+	U-235	143.76		10.96	1.13E-01	5.34E-02	2.85E-01
		163.33		5.08	-5.16E-02		7.03E-01
		185.71	*	57.20	4.06E-02		5.34E-02
		202.11		1.08	2.42E-01		3.32E+00
		205.31		5.01	-2.46E-01		7.09E-01
	Am-241	59.54		35.90	-1.37E-01	4.48E-01	4.48E-01

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

Apex-Gamma

Analysis Report for 14-Aug-19-10006

L1-10208C-FQGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10006
Sample Description	: L1-10208C-FQGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.433E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:38:00AM
Acquisition Started	: 8/14/2019 10:39:12AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78757
Fill Height	: 1432.78 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:54:15AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10006

L1-10208C-FQGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.57	474 -	481	477.33	1.47E+02	19.63	1.11E+02	1.29
2	295.17	585 -	594	590.40	5.22E+01	14.00	6.38E+01	1.33
3	351.81	698 -	708	703.57	1.37E+02	14.78	3.42E+01	1.31
4	583.01	1160 -	1171	1165.62	7.50E+01	10.96	1.80E+01	1.17
5	609.31	1214 -	1223	1218.20	8.33E+01	10.46	1.17E+01	1.21
6	911.06	1817 -	1826	1821.56	2.78E+01	7.92	1.52E+01	1.47
7	969.26	1933 -	1942	1937.99	3.24E+01	7.26	8.65E+00	0.76
8	1460.68	2915 -	2928	2921.41	3.57E+02	19.37	6.70E+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	0.99	1460.82	*	10.66	6.85E+00	4.76E-01
Tl-208	0.99	583.19	*	85.00	9.82E-02	1.55E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.09E-01	3.26E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.10E-01	2.92E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 14-Aug-19-10006

L1-10208C-FQGS-005SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.98E-01	5.54E-02
		351.93	*	35.60	3.04E-01	4.09E-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	1.61E-01	4.64E-02
		964.77		4.99		
		968.97	*	15.80	3.19E-01	7.29E-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 14-Aug-19-10006

L1-10208C-FQGS-005SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	6.85E+00	4.76E-01	
	Tl-208	0.995	9.82E-02	1.55E-02	
X	Bi-211	0.916			
	Pb-212	1.000	2.09E-01	3.26E-02	
	Bi-214	1.000	2.10E-01	2.92E-02	
	Pb-214	0.999	2.67E-01	3.29E-02	
	Ac-228	0.996	2.06E-01	3.91E-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 14-Aug-19-10006

L1-10208C-FQGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:54:15AM
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	4.93E-02	5.10E-02	5.10E-02
	BE-7	477.60		10.44	3.87E-01	4.15E-01	4.15E-01
+	K-40	1460.82	*	10.66	6.85E+00	3.31E-01	3.31E-01
	Mn-54	834.85		99.98	4.19E-03	4.24E-02	4.24E-02
	Co-60	1173.23		99.85	2.03E-02	4.64E-02	5.71E-02
		1332.49		99.98	1.43E-02		4.64E-02
	Nb-94	702.65		99.81	-1.26E-03	3.68E-02	3.68E-02
		871.09		99.89	-1.47E-02		3.75E-02
	Ag-108m	79.13		6.60	1.50E-01	3.75E-02	1.15E+00
		433.94		90.50	-8.80E-03		3.75E-02
		614.28		89.80	-3.29E-02		5.18E-02
		722.94		90.80	-2.26E-02		3.99E-02
	Sb-125	176.31		6.84	2.03E-01	1.13E-01	5.30E-01
		380.45		1.52	-6.99E-02		2.08E+00
		427.87		29.60	2.80E-02		1.13E-01
		463.36		10.49	1.71E-02		3.35E-01
		600.60		17.65	6.72E-02		2.14E-01
		606.71		4.98	-5.87E-01		1.22E+00
		635.95		11.22	-3.04E-02		3.16E-01

Analysis Report for 14-Aug-19-10006

L1-10208C-FQGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.10E-01	1.13E-01	1.87E+00
Ba-133	79.61	2.65	-1.81E-01	7.10E-02	2.73E+00
	81.00	32.90	-2.65E-01		1.83E-01
	276.40	7.16	1.69E-01		4.98E-01
	302.85	18.34	6.16E-02		1.93E-01
	356.01	62.05	-4.89E-02		7.10E-02
	383.85	8.94	7.21E-02		3.82E-01
Cs-134	475.36	1.48	1.37E+00	4.87E-02	2.81E+00
	563.25	8.34	1.01E-01		3.63E-01
	569.33	15.37	-4.16E-02		1.95E-01
	604.72	97.62	-5.37E-02		5.29E-02
	795.86	85.46	1.07E-02		4.87E-02
	801.95	8.69	-1.84E-02		4.61E-01
	1038.61	0.99	-4.77E+00		4.25E+00
	1167.97	1.79	-7.42E-01		2.85E+00
	1365.19	3.02	-2.43E-01		1.21E+00
Cs-137	661.66	85.10	2.15E-02	4.88E-02	4.88E-02
Eu-152	121.78	28.67	8.68E-03	1.17E-01	1.17E-01
	244.70	7.61	9.75E-02		4.87E-01
	295.94	0.45	-3.47E+00		9.06E+00
	344.28	26.60	-1.26E-01		1.24E-01
	367.79	0.86	3.22E+00		4.38E+00
	411.12	2.24	9.56E-01		1.62E+00
	443.96	2.83	-8.97E-01		1.10E+00
	488.68	0.42	4.70E-01		8.42E+00
	563.99	0.49	3.15E-01		5.96E+00
	586.26	0.46	-1.49E+00		1.27E+01
	678.62	0.47	-3.47E+00		7.00E+00
	688.67	0.86	-1.18E+00		4.64E+00
	719.35	0.28	7.67E+00		1.36E+01
	778.90	12.96	8.08E-02		3.29E-01
	810.45	0.32	-3.97E+00		1.09E+01
	867.37	4.26	6.84E-02		9.73E-01
	919.33	0.43	1.35E+00		1.05E+01
	964.08	14.65	-6.41E-02		4.00E-01
	1085.87	10.24	-1.39E-01		4.06E-01
	1089.74	1.73	2.03E+00		2.82E+00
	1112.07	13.69	-1.54E-01		3.45E-01
	1212.95	1.43	3.34E-01		4.13E+00
	1249.94	0.19	-1.45E+00		2.95E+01
	1299.14	1.63	4.55E-01		2.81E+00
	1408.01	21.07	9.20E-02		2.08E-01
	1457.64	0.50	-5.27E+00		3.86E+01
	1528.10	0.28	-3.19E+00		1.10E+01
Eu-154	123.07	40.40	2.55E-02	8.40E-02	8.40E-02
	247.93	6.89	-6.20E-02		4.53E-01
	591.76	4.95	-2.84E-01		7.10E-01
	692.42	1.78	9.65E-01		2.33E+00
	723.30	20.06	-6.45E-03		1.89E-01
	756.80	4.52	-1.73E-01		7.71E-01
	873.18	12.08	-5.85E-02		3.05E-01

Analysis Report for 14-Aug-19-10006

L1-10208C-FQGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.52E-02	8.40E-02	3.68E-01
	1004.76	18.01	-8.16E-02		2.05E-01
	1274.43	34.80	-8.93E-02		1.73E-01
	1596.48	1.80	6.96E-01		2.10E+00
Eu-155	45.30	1.31	2.31E+00	1.83E-01	1.13E+01
	60.01	1.22	-4.98E+00		1.30E+01
	86.55	30.70	-8.91E-04		1.83E-01
	105.31	21.10	-8.98E-02		1.87E-01
Ra-226	186.21	3.64	7.42E-01	1.04E+00	1.04E+00
Pa-231	27.36	10.30	5.82E-01	1.14E+00	1.14E+00
	283.69	1.70	-5.56E-01		1.83E+00
	300.07	2.47	-2.29E-01		1.47E+00
	302.65	2.20	5.13E-01		1.60E+00
	330.06	1.40	-5.86E-01		2.53E+00
U-235	143.76	10.96	1.08E-01	6.59E-02	2.87E-01
	163.33	5.08	-8.42E-02		6.66E-01
	185.71	57.20	4.41E-02		6.59E-02
	202.11	1.08	5.36E-01		3.27E+00
	205.31	5.01	-5.33E-01		6.94E-01
Am-241	59.54	35.90	-1.64E-01	4.52E-01	4.52E-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-Aug-19-10007

L1-10208C-FSGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10007
Sample Description	: L1-10208C-FSGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.337E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:42:00AM
Acquisition Started	: 8/14/2019 10:13:26AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.3 seconds
Dead Time	: 0.15 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78754
Fill Height	: 1336.53 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:28:30AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10007

L1-10208C-FSGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.57	948 -	960	954.37	1.56E+02	17.29	5.38E+01	0.61
2	338.29	1348 -	1358	1352.93	2.72E+01	9.04	2.28E+01	0.94
3	351.78	1399 -	1414	1406.85	9.52E+01	14.86	4.18E+01	0.97
4	609.22	2428 -	2443	2436.05	7.00E+01	12.42	2.80E+01	1.26
5	1460.40	5831 -	5852	5841.41	3.05E+02	17.73	2.54E+00	1.67
6	1763.78	7050 -	7063	7056.13	1.64E+01	4.55	1.58E+00	0.77

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	0.97	1460.82	*	10.66	7.96E+00	5.77E-01
Bi-211	0.92	351.07	*	13.02	7.54E-01	1.32E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.88E-01	3.94E-02
		300.09		3.30		
Bi-214	0.98	609.32	*	45.49	2.34E-01	4.38E-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-Aug-19-10007

L1-10208C-FSGS-006SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.98	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49	*	15.30	3.46E-01	9.69E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.76E-01	4.84E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.41E-01	8.27E-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 14-Aug-19-10007

L1-10208C-FSGS-006SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.971	7.96E+00	5.77E-01	
?	Bi-211	0.923	7.54E-01	1.32E-01	
	Pb-212	0.999	2.88E-01	3.94E-02	
	Bi-214	0.988	2.53E-01	3.99E-02	
?	Pb-214	0.511	2.76E-01	4.84E-02	
	Ac-228	1.000	2.41E-01	8.27E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 14-Aug-19-10007

L1-10208C-FSGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:28:30AM
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	1.02E-01	6.83E-02	6.83E-02
	BE-7	477.60		10.44	3.90E-01	5.06E-01	5.06E-01
+	K-40	1460.82	*	10.66	7.96E+00	3.41E-01	3.41E-01
	Mn-54	834.85		99.98	-4.11E-02	5.07E-02	5.07E-02
	Co-60	1173.23		99.85	3.47E-03	6.28E-02	6.28E-02
		1332.49		99.98	4.10E-02		6.44E-02
	Nb-94	702.65		99.81	6.58E-03	4.92E-02	5.57E-02
		871.09		99.89	7.03E-03		4.92E-02
	Ag-108m	79.13		6.60	1.61E+00	4.73E-02	2.05E+00
		433.94		90.50	-2.11E-02		4.73E-02
		614.28		89.80	-3.84E-02		6.81E-02
		722.94		90.80	-3.09E-02		5.14E-02
	Sb-125	176.31		6.84	-1.07E-01	1.48E-01	5.82E-01
		380.45		1.52	8.11E-01		2.74E+00
		427.87		29.60	-4.45E-02		1.48E-01
		463.36		10.49	2.81E-01		4.32E-01
		600.60		17.65	-2.35E-01		2.33E-01
		606.71		4.98	2.31E+00		1.68E+00
		635.95		11.22	2.19E-01		4.36E-01

Analysis Report for 14-Aug-19-10007

L1-10208C-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	6.72E-01	1.48E-01	2.94E+00
Ba-133	79.61	2.65	-1.97E-01	8.36E-02	4.72E+00
	81.00	32.90	-2.24E-02		3.28E-01
	276.40	7.16	-3.12E-01		5.77E-01
	302.85	18.34	1.32E-01		2.44E-01
	356.01	62.05	-4.91E-02		8.36E-02
	383.85	8.94	1.59E-01		4.69E-01
Cs-134	475.36	1.48	2.81E+00	5.73E-02	3.57E+00
	563.25	8.34	7.34E-02		5.18E-01
	569.33	15.37	-2.83E-02		2.91E-01
	604.72	97.62	-1.08E-02		8.02E-02
	795.86	85.46	-5.98E-04		5.73E-02
	801.95	8.69	-9.35E-02		5.25E-01
	1038.61	0.99	4.27E-01		5.95E+00
	1167.97	1.79	1.37E+00		3.80E+00
	1365.19	3.02	-3.50E-02		1.58E+00
Cs-137	661.66	85.10	2.60E-02	6.62E-02	6.62E-02
Eu-152	121.78	28.67	1.94E-02	1.50E-01	1.65E-01
	244.70	7.61	2.10E-01		6.29E-01
	295.94	0.45	5.82E-02		1.11E+01
	344.28	26.60	1.43E-02		1.50E-01
	367.79	0.86	-2.69E-01		4.10E+00
	411.12	2.24	5.72E-01		1.95E+00
	443.96	2.83	4.23E-01		1.54E+00
	488.68	0.42	-1.00E+01		8.33E+00
	563.99	0.49	-6.42E+00		8.42E+00
	586.26	0.46	1.36E+01		1.38E+01
	678.62	0.47	5.22E+00		9.95E+00
	688.67	0.86	2.89E-01		4.78E+00
	719.35	0.28	-7.34E+00		1.38E+01
	778.90	12.96	1.04E-01		3.92E-01
	810.45	0.32	8.83E+00		1.70E+01
	867.37	4.26	5.78E-01		1.20E+00
	919.33	0.43	5.13E+00		1.31E+01
	964.08	14.65	5.75E-01		5.13E-01
	1085.87	10.24	2.45E-01		6.23E-01
	1089.74	1.73	2.93E+00		3.69E+00
	1112.07	13.69	-2.39E-01		3.59E-01
	1212.95	1.43	-1.03E+00		4.58E+00
	1249.94	0.19	2.55E+01		4.21E+01
	1299.14	1.63	2.39E+00		3.89E+00
	1408.01	21.07	6.41E-02		1.74E-01
	1457.64	0.50	1.64E+02		4.83E+01
	1528.10	0.28	-2.25E+00		1.49E+01
Eu-154	123.07	40.40	1.66E-02	1.20E-01	1.20E-01
	247.93	6.89	-1.90E-01		5.53E-01
	591.76	4.95	3.32E-01		9.87E-01
	692.42	1.78	-1.45E+00		2.27E+00
	723.30	20.06	8.94E-02		2.52E-01
	756.80	4.52	7.68E-01		1.03E+00
	873.18	12.08	1.62E-01		3.82E-01

Analysis Report for 14-Aug-19-10007

L1-10208C-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.61E-02	1.20E-01	5.36E-01
	1004.76	18.01	1.24E-01		3.31E-01
	1274.43	34.80	-1.13E-01		1.87E-01
	1596.48	1.80	1.07E+00		3.35E+00
Eu-155	45.30	1.31	-4.65E-01	2.55E-01	2.95E+01
	60.01	1.22	1.35E+01		3.39E+01
	86.55	30.70	-4.93E-02		2.55E-01
	105.31	21.10	6.69E-03		3.01E-01
Ra-226	186.21	3.64	2.12E-01	1.23E+00	1.23E+00
Pa-231	27.36	10.30	9.74E-01	1.71E+00	3.35E+00
	283.69	1.70	-3.98E-01		2.24E+00
	300.07	2.47	-2.16E+00		1.71E+00
	302.65	2.20	9.87E-01		2.01E+00
	330.06	1.40	6.15E-01		3.05E+00
U-235	143.76	10.96	-1.68E-01	7.87E-02	3.99E-01
	163.33	5.08	6.62E-02		8.39E-01
	185.71	57.20	1.73E-02		7.87E-02
	202.11	1.08	-3.21E+00		3.57E+00
	205.31	5.01	-3.11E-01		8.06E-01
Am-241	59.54	35.90	2.57E-01	1.22E+00	1.22E+00

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

Apex-Gamma

Analysis Report for 14-Aug-19-10008

L1-10208C-FSGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10008
Sample Description	: L1-10208C-FSGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.512E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:44:00AM
Acquisition Started	: 8/14/2019 10:13:33AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78755
Fill Height	: 1512.27 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:28:46AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10008

L1-10208C-FSGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.38	305 -	316	310.05	4.52E+01	17.78	1.06E+02	0.40
2	238.85	948 -	961	954.96	1.50E+02	18.44	6.86E+01	1.03
3	351.80	1401 -	1414	1406.20	9.23E+01	12.14	1.87E+01	1.42
4	583.10	2323 -	2339	2330.52	6.14E+01	10.35	1.46E+01	0.36
5	609.15	2427 -	2443	2434.64	9.59E+01	11.75	1.31E+01	1.22
6	910.74	3633 -	3646	3640.43	2.98E+01	7.60	1.02E+01	0.76
7	1119.91	4472 -	4483	4477.05	1.62E+01	5.56	5.77E+00	0.28
8	1460.06	5826 -	5851	5838.18	3.43E+02	18.84	2.98E+00	1.18

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.91	1460.82	*	10.66	7.72E+00	5.40E-01
Tl-208	0.99	583.19	*	85.00	9.26E-02	1.66E-02
Bi-211	0.91	351.07	*	13.02	6.37E-01	9.82E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.39E-01	3.51E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.17E-01	1.29E-01
		87.35		3.97		

Analysis Report for 14-Aug-19-10008

L1-10208C-FSGS-007SS

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	2.79E-01	3.80E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.17E-01	7.49E-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		
		351.93	*	35.60	2.33E-01	3.59E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	5.58E-01	2.29E-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	2.01E-01	5.20E-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 14-Aug-19-10008

L1-10208C-FSGS-007SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.911	7.72E+00	5.40E-01	
	Tl-208	0.999	9.26E-02	1.66E-02	
?	Bi-211	0.919	6.37E-01	9.82E-02	
	Pb-212	0.993	2.39E-01	3.51E-02	
?	Pb212-XR	0.994	3.17E-01	1.29E-01	
	Bi-214	0.995	2.66E-01	3.39E-02	
?	Pb-214	0.998	2.33E-01	3.59E-02	
?	Pb214-XR	0.994	5.58E-01	2.29E-01	
	Ac-228	0.990	2.01E-01	5.20E-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-Aug-19-10008

L1-10208C-FSGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:28:46AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.35E-02	5.17E-02	5.17E-02
	BE-7	477.60		10.44	-1.39E-01	3.34E-01	3.34E-01
+	K-40	1460.82	*	10.66	7.72E+00	3.28E-01	3.28E-01
	Mn-54	834.85		99.98	3.39E-02	5.19E-02	5.19E-02
	Co-60	1173.23		99.85	2.59E-02	5.07E-02	6.44E-02
		1332.49		99.98	-3.00E-02		5.07E-02
	Nb-94	702.65		99.81	-8.09E-03	3.85E-02	3.85E-02
		871.09		99.89	-1.30E-02		4.76E-02
	Ag-108m	79.13		6.60	-4.42E-02	3.87E-02	1.20E+00
		433.94		90.50	-1.36E-02		3.87E-02
		614.28		89.80	-2.22E-02		6.28E-02
		722.94		90.80	6.64E-03		5.49E-02
	Sb-125	176.31		6.84	-1.31E-01	1.25E-01	4.81E-01
		380.45		1.52	-2.09E-01		2.47E+00
		427.87		29.60	3.70E-02		1.25E-01
		463.36		10.49	-3.78E-02		3.94E-01
		600.60		17.65	-2.51E-01		2.26E-01
		606.71		4.98	-1.49E-01		1.56E+00
		635.95		11.22	4.27E-02		3.43E-01

Analysis Report for 14-Aug-19-10008

L1-10208C-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	3.08E-01	1.25E-01	2.44E+00
Ba-133	79.61	2.65	9.07E-02	6.72E-02	2.90E+00
	81.00	32.90	-1.41E-01		1.80E-01
	276.40	7.16	-2.21E-01		4.59E-01
	302.85	18.34	6.50E-02		1.98E-01
	356.01	62.05	-2.78E-02		6.72E-02
	383.85	8.94	8.94E-02		4.19E-01
Cs-134	475.36	1.48	5.42E-01	5.95E-02	2.45E+00
	563.25	8.34	-9.15E-01		4.38E-01
	569.33	15.37	3.56E-02		2.32E-01
	604.72	97.62	1.14E-02		6.92E-02
	795.86	85.46	4.02E-02		5.95E-02
	801.95	8.69	-1.71E-01		5.10E-01
	1038.61	0.99	1.32E+00		4.97E+00
	1167.97	1.79	-2.02E+00		3.02E+00
	1365.19	3.02	-4.95E-01		1.42E+00
Cs-137	661.66	85.10	5.92E-02	6.32E-02	6.32E-02
Eu-152	121.78	28.67	-5.03E-02	1.20E-01	1.23E-01
	244.70	7.61	2.03E-01		5.31E-01
	295.94	0.45	8.09E+00		1.08E+01
	344.28	26.60	8.67E-04		1.20E-01
	367.79	0.86	1.38E-01		4.17E+00
	411.12	2.24	1.91E-01		1.71E+00
	443.96	2.83	-1.41E+00		1.24E+00
	488.68	0.42	2.40E+00		9.27E+00
	563.99	0.49	-9.42E+00		7.22E+00
	586.26	0.46	-1.03E-01		1.35E+01
	678.62	0.47	-1.51E+00		9.30E+00
	688.67	0.86	-9.67E-01		4.73E+00
	719.35	0.28	-2.70E+00		1.57E+01
	778.90	12.96	-4.27E-01		3.00E-01
	810.45	0.32	9.16E-01		1.16E+01
	867.37	4.26	-7.36E-01		1.10E+00
	919.33	0.43	-5.22E+00		9.95E+00
	964.08	14.65	1.97E-01		4.98E-01
	1085.87	10.24	1.08E-01		5.49E-01
	1089.74	1.73	1.63E+00		3.45E+00
	1112.07	13.69	1.49E-01		4.54E-01
	1212.95	1.43	3.52E-01		4.84E+00
	1249.94	0.19	1.06E+01		3.15E+01
	1299.14	1.63	1.79E+00		3.70E+00
	1408.01	21.07	5.88E-02		2.23E-01
	1457.64	0.50	1.49E+02		4.42E+01
	1528.10	0.28	-6.61E-01		1.37E+01
Eu-154	123.07	40.40	2.89E-02	8.97E-02	8.97E-02
	247.93	6.89	2.96E-01		5.00E-01
	591.76	4.95	-2.90E-01		7.63E-01
	692.42	1.78	-1.42E+00		2.02E+00
	723.30	20.06	-4.19E-02		2.49E-01
	756.80	4.52	1.80E-01		9.88E-01
	873.18	12.08	1.33E-01		4.19E-01

Analysis Report for 14-Aug-19-10008

L1-10208C-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.44E-01	8.97E-02	4.29E-01
	1004.76	18.01	-9.98E-02		2.72E-01
	1274.43	34.80	2.33E-02		1.68E-01
	1596.48	1.80	1.00E+00		2.23E+00
Eu-155	45.30	1.31	1.87E+00	1.94E-01	1.14E+01
	60.01	1.22	1.91E+00		1.26E+01
	86.55	30.70	7.33E-02		1.94E-01
	105.31	21.10	1.40E-01		2.09E-01
Ra-226	186.21	3.64	4.07E-01	9.97E-01	9.97E-01
Pa-231	27.36	10.30	1.69E+00	1.43E+00	1.43E+00
	283.69	1.70	4.66E-01		1.87E+00
	300.07	2.47	-5.10E+00		1.45E+00
	302.65	2.20	4.95E-01		1.65E+00
	330.06	1.40	5.53E-01		2.66E+00
U-235	143.76	10.96	1.47E-01	6.30E-02	3.08E-01
	163.33	5.08	-3.89E-01		6.01E-01
	185.71	57.20	3.42E-02		6.30E-02
	202.11	1.08	1.71E+00		3.06E+00
	205.31	5.01	1.74E-01		6.69E-01
Am-241	59.54	35.90	-2.09E-01	4.19E-01	4.19E-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-Aug-19-10009

L1-10208C-FSGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10009
Sample Description	: L1-10208C-FSGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.485E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:46:00AM
Acquisition Started	: 8/14/2019 10:13:41AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78756
Fill Height	: 1485.18 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:28:45AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10009

L1-10208C-FSGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.66	948 -	961	955.12	1.40E+02	18.72	7.56E+01	1.10
2	295.32	1176 -	1187	1181.52	3.77E+01	12.40	4.63E+01	0.58
3	338.41	1349 -	1358	1353.70	2.07E+01	9.00	2.53E+01	0.42
4	351.94	1399 -	1414	1407.74	8.70E+01	12.61	2.40E+01	0.89
5	583.33	2322 -	2339	2332.64	5.98E+01	11.79	2.42E+01	1.29
6	609.45	2429 -	2444	2437.08	7.36E+01	10.38	1.14E+01	1.31
7	911.39	3638 -	3652	3644.58	4.36E+01	7.67	5.36E+00	0.43
8	968.94	3869 -	3880	3874.83	3.06E+01	5.84	1.41E+00	0.97
9	1460.84	5831 -	5856	5843.74	3.54E+02	19.14	3.04E+00	1.96

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	7.47E+00	5.18E-01
Tl-208	0.99	583.19	*	85.00	8.61E-02	1.78E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.21E-01	3.45E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.04E-01	3.13E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 14-Aug-19-10009

L1-10208C-FSGS-008SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.58E-01	5.34E-02
		351.93	*	35.60	2.13E-01	3.53E-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	1.55E-01	6.89E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.78E-01	5.03E-02
		964.77		4.99		
		968.97	*	15.80	3.31E-01	6.49E-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 14-Aug-19-10009

L1-10208C-FSGS-008SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	7.47E+00	5.18E-01	
	Tl-208	0.997	8.61E-02	1.78E-02	
X	Bi-211	0.887			
	Pb-212	1.000	2.21E-01	3.45E-02	
	Bi-214	0.999	2.04E-01	3.13E-02	
	Pb-214	1.000	1.96E-01	2.94E-02	
	Ac-228	0.998	2.62E-01	3.44E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 14-Aug-19-10009

L1-10208C-FSGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:28:45AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.80E-02	5.26E-02	5.26E-02
	BE-7	477.60		10.44	2.67E-01	4.39E-01	4.39E-01
+	K-40	1460.82	*	10.66	7.47E+00	3.12E-01	3.12E-01
	Mn-54	834.85		99.98	-1.40E-02	4.39E-02	4.39E-02
	Co-60	1173.23		99.85	1.45E-03	5.34E-02	6.58E-02
		1332.49		99.98	-1.37E-02		5.34E-02
	Nb-94	702.65		99.81	-1.11E-02	4.28E-02	4.55E-02
		871.09		99.89	2.03E-02		4.28E-02
	Ag-108m	79.13		6.60	1.44E-01	4.16E-02	1.62E+00
		433.94		90.50	-1.80E-02		4.16E-02
		614.28		89.80	-7.98E-03		7.04E-02
		722.94		90.80	3.18E-04		5.10E-02
	Sb-125	176.31		6.84	-4.46E-01	1.24E-01	4.51E-01
		380.45		1.52	1.03E+00		2.21E+00
		427.87		29.60	-1.83E-01		1.24E-01
		463.36		10.49	2.90E-01		3.75E-01
		600.60		17.65	-8.26E-02		2.38E-01
		606.71		4.98	1.62E+00		1.33E+00
		635.95		11.22	-1.85E-01		3.21E-01

Analysis Report for 14-Aug-19-10009

L1-10208C-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	7.88E-01	1.24E-01	2.28E+00
Ba-133	79.61	2.65	2.31E+00	7.66E-02	3.90E+00
	81.00	32.90	-3.31E-01		2.64E-01
	276.40	7.16	-2.36E-01		5.13E-01
	302.85	18.34	-1.93E-01		1.80E-01
	356.01	62.05	-3.48E-02		7.66E-02
	383.85	8.94	1.09E-01		4.08E-01
Cs-134	475.36	1.48	1.28E+00	5.64E-02	2.99E+00
	563.25	8.34	4.55E-01		5.24E-01
	569.33	15.37	1.91E-01		2.69E-01
	604.72	97.62	-2.22E-02		6.35E-02
	795.86	85.46	1.29E-02		5.64E-02
	801.95	8.69	2.55E-02		5.14E-01
	1038.61	0.99	1.54E+00		5.58E+00
	1167.97	1.79	1.39E+00		3.58E+00
	1365.19	3.02	-2.93E-01		1.65E+00
Cs-137	661.66	85.10	3.77E-02	5.59E-02	5.59E-02
Eu-152	121.78	28.67	-9.94E-02	1.34E-01	1.34E-01
	244.70	7.61	1.54E-01		5.30E-01
	295.94	0.45	6.65E+00		1.04E+01
	344.28	26.60	3.28E-02		1.49E-01
	367.79	0.86	-1.20E-01		4.14E+00
	411.12	2.24	-6.14E-01		1.60E+00
	443.96	2.83	6.34E-01		1.32E+00
	488.68	0.42	-2.99E-01		9.71E+00
	563.99	0.49	6.46E+00		8.72E+00
	586.26	0.46	-1.96E+00		1.39E+01
	678.62	0.47	2.13E+00		8.96E+00
	688.67	0.86	-1.47E+00		4.57E+00
	719.35	0.28	6.19E+00		1.67E+01
	778.90	12.96	-2.00E-01		3.79E-01
	810.45	0.32	-1.96E+00		1.20E+01
	867.37	4.26	-1.64E+00		9.65E-01
	919.33	0.43	-1.43E+00		1.09E+01
	964.08	14.65	4.02E-02		4.80E-01
	1085.87	10.24	-4.19E-01		4.65E-01
	1089.74	1.73	2.00E+00		3.20E+00
	1112.07	13.69	-3.31E-01		4.64E-01
	1212.95	1.43	-4.17E+00		3.66E+00
	1249.94	0.19	5.05E+00		3.50E+01
	1299.14	1.63	1.37E+00		3.42E+00
	1408.01	21.07	1.11E-01		2.47E-01
	1457.64	0.50	1.62E+02		4.21E+01
	1528.10	0.28	5.78E+00		1.29E+01
Eu-154	123.07	40.40	1.64E-03	9.98E-02	9.98E-02
	247.93	6.89	-5.72E-01		4.77E-01
	591.76	4.95	3.42E-01		8.30E-01
	692.42	1.78	-1.20E+00		2.18E+00
	723.30	20.06	1.23E-01		2.34E-01
	756.80	4.52	8.43E-01		1.04E+00
	873.18	12.08	1.98E-02		3.61E-01

Analysis Report for 14-Aug-19-10009

L1-10208C-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.67E-01	9.98E-02	4.77E-01
	1004.76	18.01	1.74E-02		3.04E-01
	1274.43	34.80	-3.61E-03		1.66E-01
	1596.48	1.80	1.47E+00		2.52E+00
Eu-155	45.30	1.31	3.66E+00	2.18E-01	2.07E+01
	60.01	1.22	-1.48E+01		2.27E+01
	86.55	30.70	1.15E-01		2.39E-01
	105.31	21.10	-1.81E-01		2.18E-01
Ra-226	186.21	3.64	-1.27E-02	1.08E+00	1.08E+00
Pa-231	27.36	10.30	1.57E+00	1.53E+00	2.33E+00
	283.69	1.70	1.89E+00		2.20E+00
	300.07	2.47	-1.03E+00		1.61E+00
	302.65	2.20	-8.71E-01		1.53E+00
	330.06	1.40	1.27E+00		2.59E+00
U-235	143.76	10.96	-3.37E-01	6.92E-02	3.28E-01
	163.33	5.08	-1.10E-01		7.53E-01
	185.71	57.20	3.18E-02		6.92E-02
	202.11	1.08	-5.42E-02		3.26E+00
	205.31	5.01	-9.91E-01		7.04E-01
Am-241	59.54	35.90	-3.37E-01	7.89E-01	7.89E-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 14-Aug-19-10010

L1-10208C-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10010
Sample Description	: L1-10208C-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.517E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:48:00AM
Acquisition Started	: 8/14/2019 10:39:18AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78758
Fill Height	: 1516.70 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:54:23AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10010

L1-10208C-FSGS-009SS

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	954.52	1.26E+02	18.29	7.43E+01	1.17
2	295.27	1176 -	1189	1180.98	6.46E+01	11.60	2.54E+01	0.51
3	338.17	1348 -	1357	1352.45	2.86E+01	9.92	3.04E+01	0.67
4	351.78	1401 -	1415	1406.87	7.45E+01	12.91	3.15E+01	0.88
5	583.11	2325 -	2337	2331.66	3.37E+01	8.46	1.43E+01	1.22
6	609.17	2429 -	2441	2435.86	6.48E+01	10.36	1.63E+01	0.90
7	911.32	3638 -	3652	3644.23	3.30E+01	6.88	4.95E+00	0.43
8	968.46	3867 -	3878	3872.83	2.55E+01	6.13	4.50E+00	0.32
9	1460.41	5830 -	5852	5841.48	3.47E+02	19.19	5.52E+00	1.77

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.82	*	10.66	8.68E+00	6.10E-01
Tl-208	0.99	583.19	*	85.00	5.63E-02	1.45E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.25E-01	3.75E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.08E-01	3.56E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 14-Aug-19-10010

L1-10208C-FSGS-009SS

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	3.08E-01	6.06E-02
		351.93	*	35.60	2.09E-01	3.99E-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	2.46E-01	8.77E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.47E-01	5.25E-02
		964.77		4.99		
		968.97	*	15.80	3.24E-01	7.92E-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 14-Aug-19-10010

L1-10208C-FSGS-009SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.973	8.68E+00	6.10E-01	
	Tl-208	0.999	5.63E-02	1.45E-02	
X	Bi-211	0.922			
	Pb-212	1.000	2.25E-01	3.75E-02	
	Bi-214	0.999	2.08E-01	3.56E-02	
	Pb-214	0.998	2.39E-01	3.33E-02	
	Ac-228	0.991	2.66E-01	3.91E-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 14-Aug-19-10010

L1-10208C-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:54:23AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.62E-02	6.13E-02	6.13E-02
	BE-7	477.60		10.44	1.81E-01	4.26E-01	4.26E-01
+	K-40	1460.82	*	10.66	8.68E+00	4.59E-01	4.59E-01
	Mn-54	834.85		99.98	6.55E-03	4.32E-02	4.32E-02
	Co-60	1173.23		99.85	5.93E-02	5.33E-02	6.86E-02
		1332.49		99.98	-1.57E-02		5.33E-02
	Nb-94	702.65		99.81	-2.10E-02	5.06E-02	5.06E-02
		871.09		99.89	-3.36E-02		5.19E-02
	Ag-108m	79.13		6.60	1.25E+00	4.05E-02	2.22E+00
		433.94		90.50	-2.07E-02		4.05E-02
		614.28		89.80	-4.04E-02		6.36E-02
		722.94		90.80	2.41E-02		6.29E-02
	Sb-125	176.31		6.84	-1.11E-01	1.58E-01	5.93E-01
		380.45		1.52	1.02E+00		3.00E+00
		427.87		29.60	9.60E-03		1.58E-01
		463.36		10.49	1.31E-01		3.88E-01
		600.60		17.65	1.61E-02		2.64E-01
		606.71		4.98	1.31E+00		1.49E+00
		635.95		11.22	-3.03E-02		3.74E-01

Analysis Report for 14-Aug-19-10010

L1-10208C-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.14E-01	1.58E-01	2.43E+00
Ba-133	79.61	2.65	4.94E-01	8.14E-02	5.34E+00
	81.00	32.90	-3.00E-01		3.72E-01
	276.40	7.16	-1.26E-01		5.39E-01
	302.85	18.34	5.77E-02		2.21E-01
	356.01	62.05	3.14E-02		8.14E-02
	383.85	8.94	1.18E-01		4.87E-01
Cs-134	475.36	1.48	7.77E-01	6.17E-02	3.05E+00
	563.25	8.34	9.36E-02		5.41E-01
	569.33	15.37	2.24E-01		2.95E-01
	604.72	97.62	-6.62E-02		7.38E-02
	795.86	85.46	5.32E-02		6.17E-02
	801.95	8.69	-2.32E-01		4.23E-01
	1038.61	0.99	-4.48E+00		5.82E+00
	1167.97	1.79	-1.71E+00		3.59E+00
	1365.19	3.02	5.13E-01		1.58E+00
Cs-137	661.66	85.10	2.43E-02	5.84E-02	5.84E-02
Eu-152	121.78	28.67	1.29E-01	1.51E-01	1.63E-01
	244.70	7.61	-1.65E-01		5.99E-01
	295.94	0.45	4.20E+00		1.11E+01
	344.28	26.60	-3.81E-02		1.51E-01
	367.79	0.86	2.44E+00		4.15E+00
	411.12	2.24	1.08E+00		1.87E+00
	443.96	2.83	9.58E-02		1.35E+00
	488.68	0.42	-5.66E+00		1.03E+01
	563.99	0.49	2.62E+00		9.07E+00
	586.26	0.46	-4.93E+00		1.35E+01
	678.62	0.47	3.51E+00		9.74E+00
	688.67	0.86	-2.78E+00		5.32E+00
	719.35	0.28	1.11E+01		2.04E+01
	778.90	12.96	-7.73E-01		3.46E-01
	810.45	0.32	8.19E+00		1.61E+01
	867.37	4.26	-4.08E-01		1.15E+00
	919.33	0.43	8.81E-01		1.17E+01
	964.08	14.65	-2.82E-02		5.34E-01
	1085.87	10.24	3.38E-01		6.44E-01
	1089.74	1.73	6.50E-03		3.61E+00
	1112.07	13.69	1.04E-01		4.76E-01
	1212.95	1.43	1.16E+00		5.24E+00
	1249.94	0.19	2.45E+01		3.44E+01
	1299.14	1.63	1.87E+00		3.57E+00
	1408.01	21.07	-1.29E-01		2.64E-01
	1457.64	0.50	1.86E+02		4.97E+01
	1528.10	0.28	1.10E+00		1.43E+01
Eu-154	123.07	40.40	4.76E-02	1.14E-01	1.14E-01
	247.93	6.89	1.51E-01		5.89E-01
	591.76	4.95	-3.81E-01		9.07E-01
	692.42	1.78	-1.90E+00		2.85E+00
	723.30	20.06	2.09E-01		2.91E-01
	756.80	4.52	-6.92E-01		1.06E+00
	873.18	12.08	3.87E-01		4.83E-01

Analysis Report for 14-Aug-19-10010

L1-10208C-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.91E-01	1.14E-01	5.15E-01
	1004.76	18.01	1.36E-01		3.28E-01
	1274.43	34.80	-1.52E-01		1.76E-01
	1596.48	1.80	1.11E+00		2.47E+00
Eu-155	45.30	1.31	-2.89E+01	2.86E-01	3.15E+01
	60.01	1.22	2.75E-02		3.04E+01
	86.55	30.70	5.39E-02		2.95E-01
	105.31	21.10	3.20E-03		2.86E-01
Ra-226	186.21	3.64	7.41E-01	1.23E+00	1.23E+00
Pa-231	27.36	10.30	3.20E+00	1.64E+00	3.81E+00
	283.69	1.70	8.11E-02		2.47E+00
	300.07	2.47	-4.35E-01		1.64E+00
	302.65	2.20	7.67E-01		1.85E+00
	330.06	1.40	8.14E-01		2.93E+00
U-235	143.76	10.96	1.38E-01	7.64E-02	4.20E-01
	163.33	5.08	-7.09E-01		7.87E-01
	185.71	57.20	3.48E-03		7.64E-02
	202.11	1.08	2.33E+00		3.91E+00
	205.31	5.01	-5.14E-01		8.16E-01
Am-241	59.54	35.90	-4.31E-01	1.05E+00	1.05E+00

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

Apex-Gamma

Analysis Report for 16-Aug-19-10018

L1-10208C-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 16-Aug-19-10018
Sample Description	: L1-10208C-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.517E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:48:00AM
Acquisition Started	: 8/16/2019 10:59:00AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1800.7 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	: 8/16/2019
Efficiency Calibration Description	:
Sample Number	: 78887
Fill Height	: 1516.70 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/16/2019 11:29:04AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated
1430 8-16-19

Analysis Report for 16-Aug-19-10018

L1-10208C-FSGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	473 -	481	477.49	2.72E+02	29.18	2.64E+02	1.19
2	295.21	585 -	595	590.48	1.40E+02	22.38	1.51E+02	1.20
3	338.18	671 -	681	676.32	7.76E+01	17.73	9.94E+01	1.27
4	351.91	698 -	708	703.76	2.29E+02	22.21	1.11E+02	1.28
5	462.65	920 -	930	925.06	3.29E+01	13.16	5.91E+01	0.87
6	583.17	1160 -	1171	1165.94	1.45E+02	16.22	4.68E+01	0.92
7	609.26	1212 -	1222	1218.10	2.03E+02	17.57	4.43E+01	1.63
8	911.28	1816 -	1826	1822.01	7.08E+01	12.62	3.72E+01	1.31
9	968.77	1933 -	1942	1937.01	4.54E+01	10.93	3.26E+01	1.54
10	1120.19	2236 -	2244	2239.93	3.45E+01	9.89	2.95E+01	1.59
11	1460.60	2914 -	2928	2921.26	9.79E+02	31.78	1.10E+01	1.94
12	1764.31	3524 -	3534	3529.47	2.97E+01	5.72	1.27E+00	1.21

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.22E+00	5.00E-01
Tl-208	1.00	583.19	*	85.00	9.38E-02	1.19E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.91E-01	2.57E-02
		300.09		3.30		

Analysis Report for 16-Aug-19-10018

L1-10208C-FSGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	609.32	*	45.49	2.52E-01	2.66E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	1.95E-01	5.63E-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	2.25E-01	4.42E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.63E-01	4.70E-02
		351.93	*	35.60	2.51E-01	3.16E-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	2.62E-01	6.35E-02
		409.46		1.92		
		463.00	*	4.40	3.53E-01	1.44E-01
		794.95		4.25		
		911.20	*	25.80	2.02E-01	3.70E-02
		964.77		4.99		
		968.97	*	15.80	2.20E-01	5.39E-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 16-Aug-19-10018

L1-10208C-FSGS-009SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.992	9.22E+00	5.00E-01	
	Tl-208	1.000	9.38E-02	1.19E-02	
X	Bi-211	0.893			
	Pb-212	1.000	1.91E-01	2.57E-02	
	Bi-214	0.999	2.38E-01	2.11E-02	
	Pb-214	1.000	2.55E-01	2.62E-02	
	Ac-228	0.997	2.23E-01	2.70E-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 16-Aug-19-10018

L1-10208C-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/16/2019 11:29:04AM
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	6.55E-02	3.66E-02	3.66E-02
	BE-7	477.60		10.44	8.76E-02	2.32E-01	2.32E-01
+	K-40	1460.82	*	10.66	9.22E+00	2.05E-01	2.05E-01
	Mn-54	834.85		99.98	6.32E-03	2.82E-02	2.82E-02
	Co-60	1173.23		99.85	1.23E-02	3.26E-02	4.30E-02
		1332.49		99.98	1.79E-02		3.26E-02
	Nb-94	702.65		99.81	4.66E-03	2.53E-02	2.53E-02
		871.09		99.89	1.86E-02		3.15E-02
	Ag-108m	79.13		6.60	3.17E-01	2.54E-02	8.25E-01
		433.94		90.50	-5.68E-03		2.54E-02
		614.28		89.80	-8.01E-02		3.68E-02
		722.94		90.80	1.91E-03		3.42E-02
	Sb-125	176.31		6.84	1.11E-01	7.70E-02	3.69E-01
		380.45		1.52	-4.39E-01		1.49E+00
		427.87		29.60	4.85E-02		7.70E-02
		463.36		10.49	1.01E-01		2.45E-01
		600.60		17.65	7.15E-03		1.48E-01
		606.71		4.98	-5.53E-02		9.54E-01
		635.95		11.22	-1.50E-01		2.17E-01

Analysis Report for 16-Aug-19-10018

L1-10208C-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.68E-01	7.70E-02	1.39E+00
Ba-133	79.61	2.65	1.77E-01	5.34E-02	1.93E+00
	81.00	32.90	-2.75E-01		1.30E-01
	276.40	7.16	3.61E-02		3.44E-01
	302.85	18.34	4.73E-02		1.26E-01
	356.01	62.05	-2.76E-02		5.34E-02
	383.85	8.94	1.04E-02		2.71E-01
Cs-134	475.36	1.48	-3.84E-01	3.63E-02	1.54E+00
	563.25	8.34	-9.56E-02		2.97E-01
	569.33	15.37	8.74E-02		1.74E-01
	604.72	97.62	1.51E-03		4.28E-02
	795.86	85.46	2.65E-02		3.63E-02
	801.95	8.69	-1.54E-01		2.92E-01
	1038.61	0.99	6.08E-02		3.35E+00
	1167.97	1.79	-1.30E+00		2.17E+00
	1365.19	3.02	2.24E-01		1.03E+00
Cs-137	661.66	85.10	9.48E-03	3.19E-02	3.19E-02
Eu-152	121.78	28.67	-3.34E-03	8.17E-02	8.17E-02
	244.70	7.61	1.10E-02		3.38E-01
	295.94	0.45	-4.85E-01		6.85E+00
	344.28	26.60	9.78E-03		8.63E-02
	367.79	0.86	-1.55E+00		2.52E+00
	411.12	2.24	1.69E-01		1.03E+00
	443.96	2.83	-3.29E-02		8.32E-01
	488.68	0.42	3.67E-01		5.75E+00
	563.99	0.49	-1.86E+00		5.10E+00
	586.26	0.46	-3.10E+00		8.55E+00
	678.62	0.47	-7.03E-01		5.82E+00
	688.67	0.86	-2.30E+00		3.05E+00
	719.35	0.28	2.07E+00		1.09E+01
	778.90	12.96	-1.70E-01		2.10E-01
	810.45	0.32	2.18E+00		8.29E+00
	867.37	4.26	-4.09E-01		6.74E-01
	919.33	0.43	-3.48E+00		6.25E+00
	964.08	14.65	-7.48E-02		2.69E-01
	1085.87	10.24	6.66E-03		3.34E-01
	1089.74	1.73	-1.02E+00		1.90E+00
	1112.07	13.69	-8.10E-02		2.75E-01
	1212.95	1.43	4.22E-01		3.00E+00
	1249.94	0.19	-3.68E+00		2.24E+01
	1299.14	1.63	-3.73E-01		1.95E+00
	1408.01	21.07	3.93E-02		1.27E-01
	1457.64	0.50	-4.95E+00		3.08E+01
	1528.10	0.28	-4.12E+00		6.65E+00
Eu-154	123.07	40.40	2.09E-04	5.81E-02	5.81E-02
	247.93	6.89	-6.62E-02		3.13E-01
	591.76	4.95	-8.25E-02		5.01E-01
	692.42	1.78	-1.94E-01		1.42E+00
	723.30	20.06	6.79E-02		1.57E-01
	756.80	4.52	8.21E-02		6.07E-01
	873.18	12.08	2.64E-02		2.55E-01

Analysis Report for 16-Aug-19-10018

L1-10208C-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.85E-01	5.81E-02	3.07E-01
	1004.76	18.01	-1.77E-02		1.81E-01
	1274.43	34.80	-3.03E-02		1.02E-01
	1596.48	1.80	-3.27E-01		1.35E+00
Eu-155	45.30	1.31	-3.69E+00	1.33E-01	8.61E+00
	60.01	1.22	-5.62E+00		8.53E+00
	86.55	30.70	6.18E-02		1.33E-01
	105.31	21.10	4.76E-03		1.33E-01
Ra-226	186.21	3.64	8.31E-01	7.51E-01	7.51E-01
Pa-231	27.36	10.30	9.99E-01	8.45E-01	8.45E-01
	283.69	1.70	8.48E-01		1.43E+00
	300.07	2.47	1.24E-01		9.66E-01
	302.65	2.20	3.94E-01		1.05E+00
	330.06	1.40	2.10E-01		1.68E+00
U-235	143.76	10.96	-1.37E-02	4.79E-02	2.04E-01
	163.33	5.08	-8.35E-02		4.92E-01
	185.71	57.20	5.30E-02		4.79E-02
	202.11	1.08	9.89E-01		2.32E+00
	205.31	5.01	-3.25E-01		4.94E-01
Am-241	59.54	35.90	-1.38E-01	3.02E-01	3.02E-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-Aug-19-10011

L1-10208C-FSGS-010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10011
Sample Description	: L1-10208C-FSGS-010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.614E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:50:00AM
Acquisition Started	: 8/14/2019 10:39:25AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78759
Fill Height	: 1614.37 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:54:39AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10011

L1-10208C-FSGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.36	306 -	316	309.98	5.22E+01	16.36	8.98E+01	0.70
2	238.81	948 -	962	954.80	1.65E+02	19.03	6.80E+01	1.14
3	295.52	1173 -	1189	1181.35	6.32E+01	13.45	3.68E+01	0.50
4	338.39	1347 -	1357	1352.66	3.09E+01	9.27	2.31E+01	0.60
5	351.96	1399 -	1415	1406.86	1.06E+02	14.42	3.22E+01	1.00
6	609.28	2426 -	2442	2435.15	9.11E+01	11.48	1.29E+01	1.18
7	1460.14	5825 -	5850	5838.51	3.94E+02	19.85	0.00E+00	1.24

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.92	1460.82	*	10.66	8.71E+00	5.79E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.60E-01	3.66E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.64E-01	1.20E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	2.61E-01	3.64E-02
		768.36		4.89		

Analysis Report for 14-Aug-19-10011

L1-10208C-FSGS-010SS

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	2.68E-01	6.08E-02
		351.93	*	35.60	2.63E-01	4.16E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	6.42E-01	2.14E-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	2.36E-01	7.34E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

Analysis Report for 14-Aug-19-10011

L1-10208C-FSGS-010SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.929	8.71E+00	5.79E-01	
X	Bi-211	0.880			
	Pb-212	0.996	2.60E-01	3.66E-02	
?	Pb212-XR	0.995	3.64E-01	1.20E-01	
	Bi-214	1.000	2.61E-01	3.64E-02	
	Pb-214	0.996	2.65E-01	3.44E-02	
?	Pb214-XR	0.995	6.42E-01	2.14E-01	
	Ac-228	1.000	2.36E-01	7.34E-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 14-Aug-19-10011

L1-10208C-FSGS-010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:54:39AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.47E-02	5.51E-02	5.51E-02
	BE-7	477.60		10.44	1.05E-01	3.34E-01	3.34E-01
+	K-40	1460.82	*	10.66	8.71E+00	6.36E-02	6.36E-02
	Mn-54	834.85		99.98	-5.53E-03	5.17E-02	5.17E-02
	Co-60	1173.23		99.85	2.07E-02	5.80E-02	6.16E-02
		1332.49		99.98	5.28E-02		5.80E-02
	Nb-94	702.65		99.81	-3.65E-02	4.25E-02	4.25E-02
		871.09		99.89	1.77E-02		4.61E-02
	Ag-108m	79.13		6.60	1.23E-01	3.99E-02	1.23E+00
		433.94		90.50	-3.63E-03		3.99E-02
		614.28		89.80	-2.51E-02		6.06E-02
		722.94		90.80	-2.46E-02		5.10E-02
	Sb-125	176.31		6.84	-3.11E-01	1.27E-01	4.56E-01
		380.45		1.52	1.26E+00		2.26E+00
		427.87		29.60	2.48E-02		1.27E-01
		463.36		10.49	-2.81E-02		3.45E-01
		600.60		17.65	-2.63E-02		2.22E-01
		606.71		4.98	1.73E+00		1.44E+00
		635.95		11.22	-1.77E-01		3.43E-01

Analysis Report for 14-Aug-19-10011

L1-10208C-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.31E-01	1.27E-01	2.37E+00
Ba-133	79.61	2.65	-1.36E-01	6.97E-02	3.02E+00
	81.00	32.90	-8.92E-02		1.92E-01
	276.40	7.16	3.01E-03		4.79E-01
	302.85	18.34	-8.69E-02		1.71E-01
	356.01	62.05	-2.57E-02		6.97E-02
	383.85	8.94	1.27E-01		3.85E-01
Cs-134	475.36	1.48	7.32E-02	5.63E-02	2.23E+00
	563.25	8.34	-1.21E-01		5.40E-01
	569.33	15.37	-2.14E-02		2.36E-01
	604.72	97.62	-3.08E-03		6.43E-02
	795.86	85.46	3.79E-03		5.63E-02
	801.95	8.69	-3.90E-02		4.67E-01
	1038.61	0.99	1.14E+00		4.88E+00
	1167.97	1.79	-2.43E+00		3.13E+00
	1365.19	3.02	1.11E+00		1.59E+00
Cs-137	661.66	85.10	1.39E-02	4.93E-02	4.93E-02
Eu-152	121.78	28.67	2.90E-02	1.21E-01	1.22E-01
	244.70	7.61	1.70E-01		4.91E-01
	295.94	0.45	4.19E+00		9.92E+00
	344.28	26.60	-2.25E-03		1.21E-01
	367.79	0.86	4.43E+00		3.84E+00
	411.12	2.24	6.10E-01		1.70E+00
	443.96	2.83	-5.02E-01		1.16E+00
	488.68	0.42	-4.25E+00		7.99E+00
	563.99	0.49	-1.19E+01		8.16E+00
	586.26	0.46	1.27E+01		1.34E+01
	678.62	0.47	-6.95E+00		8.25E+00
	688.67	0.86	3.67E+00		4.94E+00
	719.35	0.28	7.72E+00		1.52E+01
	778.90	12.96	1.57E-02		3.24E-01
	810.45	0.32	-1.80E-01		1.34E+01
	867.37	4.26	-2.23E-01		1.04E+00
	919.33	0.43	2.88E-01		1.15E+01
	964.08	14.65	-2.39E-01		4.42E-01
	1085.87	10.24	2.67E-02		4.46E-01
	1089.74	1.73	2.08E-01		3.04E+00
	1112.07	13.69	1.34E-01		4.34E-01
	1212.95	1.43	2.53E+00		5.23E+00
	1249.94	0.19	-1.30E+00		3.48E+01
	1299.14	1.63	1.10E+00		3.31E+00
	1408.01	21.07	-9.13E-02		2.12E-01
	1457.64	0.50	1.82E+02		4.61E+01
	1528.10	0.28	8.65E+00		1.56E+01
Eu-154	123.07	40.40	-2.85E-02	8.53E-02	8.53E-02
	247.93	6.89	-2.33E-01		4.52E-01
	591.76	4.95	8.87E-02		8.17E-01
	692.42	1.78	7.89E-01		2.50E+00
	723.30	20.06	-2.19E-02		2.37E-01
	756.80	4.52	3.01E-01		1.00E+00
	873.18	12.08	-1.91E-01		3.55E-01

Analysis Report for 14-Aug-19-10011

L1-10208C-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	6.07E-02	8.53E-02	4.74E-01
	1004.76	18.01	9.66E-02		2.82E-01
	1274.43	34.80	1.18E-01		1.84E-01
	1596.48	1.80	3.69E-01		2.53E+00
Eu-155	45.30	1.31	-3.97E+00	2.00E-01	1.13E+01
	60.01	1.22	4.19E+00		1.32E+01
	86.55	30.70	-5.22E-02		2.00E-01
	105.31	21.10	-3.52E-02		2.07E-01
Ra-226	186.21	3.64	6.17E-01	1.04E+00	1.04E+00
Pa-231	27.36	10.30	1.26E+00	1.28E+00	1.28E+00
	283.69	1.70	7.46E-02		1.83E+00
	300.07	2.47	3.40E-03		1.33E+00
	302.65	2.20	-2.30E-01		1.47E+00
	330.06	1.40	1.59E+00		2.68E+00
U-235	143.76	10.96	-7.82E-02	6.67E-02	3.26E-01
	163.33	5.08	-2.56E-01		6.25E-01
	185.71	57.20	5.89E-02		6.67E-02
	202.11	1.08	-1.93E+00		2.93E+00
	205.31	5.01	-1.03E-01		6.43E-01
Am-241	59.54	35.90	-7.18E-02	4.57E-01	4.57E-01

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

Apex-Gamma

Analysis Report for 14-Aug-19-10012

L1-10208C-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10012
Sample Description	: L1-10208C-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.517E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:52:00AM
Acquisition Started	: 8/14/2019 10:39:34AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78760
Fill Height	: 1517.35 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 10:54:37AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10012

L1-10208C-FSGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.76	949 -	963	955.52	1.44E+02	19.44	7.87E+01	0.87
2	295.08	1173 -	1186	1180.56	6.85E+01	10.80	1.75E+01	1.07
3	338.30	1349 -	1359	1353.24	2.56E+01	8.69	2.04E+01	0.68
4	351.90	1399 -	1416	1407.60	1.23E+02	13.19	1.56E+01	1.08
5	583.03	2324 -	2339	2331.45	7.02E+01	9.98	9.77E+00	1.59
6	609.35	2428 -	2445	2436.68	8.04E+01	10.08	6.58E+00	1.89
7	968.75	3867 -	3880	3874.08	2.83E+01	5.74	1.67E+00	0.76
8	1460.77	5831 -	5856	5843.43	3.23E+02	19.45	1.30E+01	1.73

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	6.78E+00	5.03E-01
Tl-208	0.99	583.19	*	85.00	1.01E-01	1.55E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.26E-01	3.56E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.22E-01	3.08E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 14-Aug-19-10012

L1-10208C-FSGS-011SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.85E-01	5.05E-02
		351.93	*	35.60	3.01E-01	4.02E-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	1.91E-01	6.69E-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	3.05E-01	6.32E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 14-Aug-19-10012

L1-10208C-FSGS-011SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	6.78E+00	5.03E-01	
	Tl-208	0.996	1.01E-01	1.55E-02	
X	Bi-211	0.895			
	Pb-212	0.997	2.26E-01	3.56E-02	
	Bi-214	1.000	2.22E-01	3.08E-02	
	Pb-214	0.999	2.95E-01	3.14E-02	
	Ac-228	0.999	2.51E-01	4.59E-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-Aug-19-10012

L1-10208C-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 10:54:37AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.13E-02	5.86E-02	5.86E-02
	BE-7	477.60		10.44	1.68E-02	4.55E-01	4.55E-01
+	K-40	1460.82	*	10.66	6.78E+00	5.90E-01	5.90E-01
	Mn-54	834.85		99.98	-3.74E-02	4.76E-02	4.76E-02
	Co-60	1173.23		99.85	8.09E-02	5.71E-02	6.54E-02
		1332.49		99.98	2.46E-02		5.71E-02
	Nb-94	702.65		99.81	-3.17E-02	3.90E-02	3.90E-02
		871.09		99.89	-2.56E-03		4.48E-02
	Ag-108m	79.13		6.60	6.57E-01	4.03E-02	1.58E+00
		433.94		90.50	-1.86E-04		4.03E-02
		614.28		89.80	-1.26E-02		6.93E-02
		722.94		90.80	3.13E-02		5.89E-02
	Sb-125	176.31		6.84	1.53E-01	1.14E-01	5.07E-01
		380.45		1.52	7.35E-01		2.30E+00
		427.87		29.60	-5.93E-02		1.14E-01
		463.36		10.49	-8.05E-03		4.02E-01
		600.60		17.65	7.06E-02		2.39E-01
		606.71		4.98	1.79E+00		1.32E+00
		635.95		11.22	-1.53E-02		3.14E-01

Analysis Report for 14-Aug-19-10012

L1-10208C-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.23E+00	1.14E-01	2.27E+00
Ba-133	79.61	2.65	2.55E+00	8.38E-02	3.88E+00
	81.00	32.90	-4.08E-01		2.55E-01
	276.40	7.16	8.09E-02		5.13E-01
	302.85	18.34	-4.36E-02		1.96E-01
	356.01	62.05	1.62E-02		8.38E-02
	383.85	8.94	1.61E-01		3.86E-01
Cs-134	475.36	1.48	3.51E+00	4.94E-02	3.26E+00
	563.25	8.34	-3.18E-02		4.52E-01
	569.33	15.37	-1.35E-01		2.41E-01
	604.72	97.62	-2.12E-02		6.16E-02
	795.86	85.46	7.87E-03		4.94E-02
	801.95	8.69	-3.46E-01		4.81E-01
	1038.61	0.99	1.66E+00		4.56E+00
	1167.97	1.79	2.11E+00		3.60E+00
	1365.19	3.02	6.94E-01		1.56E+00
Cs-137	661.66	85.10	3.76E-02	5.23E-02	5.23E-02
Eu-152	121.78	28.67	-9.54E-02	1.26E-01	1.35E-01
	244.70	7.61	3.94E-01		5.45E-01
	295.94	0.45	1.26E+01		9.92E+00
	344.28	26.60	-4.79E-04		1.26E-01
	367.79	0.86	6.18E-01		3.37E+00
	411.12	2.24	-7.23E-02		1.59E+00
	443.96	2.83	8.98E-03		1.31E+00
	488.68	0.42	-3.41E+00		8.47E+00
	563.99	0.49	1.87E+00		7.78E+00
	586.26	0.46	-5.15E+00		1.34E+01
	678.62	0.47	2.14E+00		8.91E+00
	688.67	0.86	3.96E+00		5.07E+00
	719.35	0.28	-9.86E+00		1.63E+01
	778.90	12.96	-1.56E-01		3.21E-01
	810.45	0.32	-1.77E+00		1.31E+01
	867.37	4.26	6.49E-02		1.11E+00
	919.33	0.43	-1.15E+01		1.05E+01
	964.08	14.65	1.38E-01		4.67E-01
	1085.87	10.24	-4.37E-01		5.44E-01
	1089.74	1.73	-1.17E+00		3.31E+00
	1112.07	13.69	-7.93E-02		4.35E-01
	1212.95	1.43	-2.43E+00		4.25E+00
	1249.94	0.19	-2.32E+00		3.23E+01
	1299.14	1.63	2.54E+00		3.52E+00
	1408.01	21.07	8.83E-02		2.34E-01
	1457.64	0.50	1.39E+02		4.08E+01
	1528.10	0.28	4.92E+00		1.20E+01
Eu-154	123.07	40.40	-1.99E-02	9.65E-02	9.65E-02
	247.93	6.89	-9.32E-02		5.08E-01
	591.76	4.95	2.11E-02		8.35E-01
	692.42	1.78	1.12E+00		2.30E+00
	723.30	20.06	8.19E-02		2.69E-01
	756.80	4.52	-4.70E-01		7.78E-01
	873.18	12.08	-9.42E-02		3.40E-01

Analysis Report for 14-Aug-19-10012

L1-10208C-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.13E-03	9.65E-02	5.36E-01
	1004.76	18.01	2.44E-01		3.14E-01
	1274.43	34.80	1.08E-01		1.73E-01
	1596.48	1.80	-1.18E+00		2.50E+00
Eu-155	45.30	1.31	-1.14E+01	2.26E-01	1.82E+01
	60.01	1.22	-6.94E+00		2.08E+01
	86.55	30.70	2.87E-02		2.31E-01
	105.31	21.10	-1.04E-01		2.26E-01
Ra-226	186.21	3.64	5.04E-01	1.07E+00	1.07E+00
Pa-231	27.36	10.30	1.34E+00	1.50E+00	2.25E+00
	283.69	1.70	-1.49E+00		1.97E+00
	300.07	2.47	-4.48E-01		1.50E+00
	302.65	2.20	8.84E-01		1.67E+00
	330.06	1.40	2.33E-01		2.70E+00
U-235	143.76	10.96	-1.48E-01	6.71E-02	3.19E-01
	163.33	5.08	-3.93E-01		7.05E-01
	185.71	57.20	3.83E-02		6.71E-02
	202.11	1.08	2.95E-01		3.15E+00
	205.31	5.01	-6.73E-01		6.90E-01
Am-241	59.54	35.90	-1.26E-02	7.27E-01	7.27E-01

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

Apex-Gamma

Analysis Report for 16-Aug-19-10019

L1-10208C-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 16-Aug-19-10019
Sample Description	: L1-10208C-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.517E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:52:00AM
Acquisition Started	: 8/16/2019 11:23:05AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1802.7 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	: 8/16/2019
Efficiency Calibration Description	:
Sample Number	: 78888
Fill Height	: 1517.35 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/16/2019 12:06:52PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated
1430 8-16-19

Analysis Report for 16-Aug-19-10019

L1-10208C-FSGS-011SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.16	305 -	312	309.36	3.24E+01	16.04	1.11E+02	0.69
M	2	238.51	947 -	974	954.13	2.65E+02	47.89	1.07E+02	0.96
m	3	241.77	947 -	974	967.14	6.48E+01	14.69	9.74E+01	0.97
	4	295.23	1175 -	1186	1180.82	8.53E+01	16.52	7.47E+01	1.07
	5	338.20	1348 -	1360	1352.56	6.86E+01	14.33	5.14E+01	1.40
	6	351.75	1401 -	1413	1406.73	1.27E+02	17.65	6.91E+01	0.72
	7	477.12	1903 -	1913	1907.88	3.10E+01	9.29	2.30E+01	0.38
	8	582.93	2324 -	2338	2330.93	8.48E+01	12.43	2.42E+01	0.81
	9	609.06	2427 -	2443	2435.40	1.29E+02	14.91	2.98E+01	1.07
	10	727.23	2903 -	2913	2907.97	2.55E+01	8.62	2.05E+01	1.41
	11	910.79	3634 -	3648	3642.11	7.67E+01	10.17	9.33E+00	1.50
	12	968.66	3867 -	3882	3873.61	4.38E+01	8.81	1.12E+01	1.00
	13	1119.79	4473 -	4485	4478.25	1.65E+01	8.32	1.95E+01	0.34
	14	1459.98	5826 -	5852	5839.76	5.49E+02	25.51	2.34E+01	1.25

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.96	477.60	*	10.44	1.92E-01	5.91E-02
K-40	0.89	1460.82	*	10.66	6.85E+00	4.36E-01
Tl-208	0.98	583.19	*	85.00	7.09E-02	1.12E-02

Analysis Report for 16-Aug-19-10019

L1-10208C-FSGS-011SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	3.16E-01	1.08E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.37E-01	4.69E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	1.98E-01	1.00E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.08E-01	2.71E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	1.22E-01	6.19E-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	3.51E-01	8.44E-02
		295.22	*	18.42	2.04E-01	4.27E-02
		351.93	*	35.60	1.78E-01	2.86E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	3.48E-01	1.77E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.95E-01	6.62E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.86E-01	4.00E-02
		964.77		4.99		
		968.97	*	15.80	2.78E-01	5.73E-02
		1588.20		3.22		

Analysis Report for 16-Aug-19-10019

L1-10208C-FSGS-011SS

* = 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	0.963	1.92E-01	5.91E-02	
	K-40	0.893	6.85E+00	4.36E-01	
	Tl-208	0.989	7.09E-02	1.12E-02	
X	Bi-211	0.929			
	Bi-212	0.999	3.16E-01	1.08E-01	
	Pb-212	0.998	2.37E-01	4.69E-02	
?	Pb212-XR	1.000	1.98E-01	1.00E-01	
	Bi-214	0.990	1.94E-01	2.48E-02	
	Pb-214	0.996	1.98E-01	2.28E-02	
?	Pb214-XR	1.000	3.48E-01	1.77E-01	
	Ac-228	0.988	2.86E-01	2.94E-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 16-Aug-19-10019

L1-10208C-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/16/2019 12:06:52PM
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	4.16E-02	4.16E-02
+	BE-7	477.60	*	10.44	1.92E-01	1.74E-01	1.74E-01
+	K-40	1460.82	*	10.66	6.85E+00	4.64E-01	4.64E-01
	Mn-54	834.85		99.98	-1.79E-02	3.68E-02	3.68E-02
	Co-60	1173.23		99.85	7.57E-03	3.83E-02	4.72E-02
		1332.49		99.98	7.59E-03		3.83E-02
	Nb-94	702.65		99.81	-4.83E-02	3.06E-02	3.06E-02
		871.09		99.89	1.22E-02		3.56E-02
	Ag-108m	79.13		6.60	-1.03E+00	3.33E-02	1.23E+00
		433.94		90.50	-1.12E-02		3.33E-02
		614.28		89.80	-2.35E-03		4.32E-02
		722.94		90.80	-2.17E-02		4.34E-02
	Sb-125	176.31		6.84	-4.83E-02	1.03E-01	4.05E-01
		380.45		1.52	-7.94E-01		1.78E+00
		427.87		29.60	8.22E-02		1.03E-01
		463.36		10.49	1.60E-01		2.73E-01
		600.60		17.65	-1.25E-01		1.71E-01
		606.71		4.98	1.91E+00		1.02E+00
		635.95		11.22	8.08E-02		2.50E-01

Analysis Report for 16-Aug-19-10019

L1-10208C-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-4.17E-01	1.03E-01	1.74E+00
Ba-133	79.61	2.65	-3.15E+00	5.10E-02	2.93E+00
	81.00	32.90	-1.88E-01		2.03E-01
	276.40	7.16	2.55E-01		4.14E-01
	302.85	18.34	-2.78E-02		1.48E-01
	356.01	62.05	-2.62E-02		5.10E-02
	383.85	8.94	-1.18E-01		2.98E-01
Cs-134	475.36	1.48	1.02E+00	4.03E-02	2.16E+00
	563.25	8.34	1.00E-02		3.61E-01
	569.33	15.37	-1.28E-01		1.95E-01
	604.72	97.62	-2.62E-02		4.91E-02
	795.86	85.46	1.40E-02		4.03E-02
	801.95	8.69	5.69E-02		4.17E-01
	1038.61	0.99	-1.24E+00		3.54E+00
	1167.97	1.79	-1.55E+00		2.41E+00
	1365.19	3.02	-3.32E-01		1.11E+00
Cs-137	661.66	85.10	2.94E-02	4.20E-02	4.20E-02
Eu-152	121.78	28.67	3.18E-04	1.00E-01	1.16E-01
	244.70	7.61	-6.50E-03		4.20E-01
	295.94	0.45	3.45E+00		7.79E+00
	344.28	26.60	-9.10E-02		1.00E-01
	367.79	0.86	-6.38E-01		3.00E+00
	411.12	2.24	1.15E+00		1.41E+00
	443.96	2.83	-6.79E-02		1.02E+00
	488.68	0.42	2.32E+00		6.54E+00
	563.99	0.49	-2.67E+00		6.09E+00
	586.26	0.46	-7.99E-01		9.28E+00
	678.62	0.47	-2.49E+00		6.21E+00
	688.67	0.86	-3.33E+00		3.41E+00
	719.35	0.28	-6.53E+00		1.10E+01
	778.90	12.96	-4.34E-02		2.57E-01
	810.45	0.32	-4.83E+00		1.01E+01
	867.37	4.26	-3.74E-01		8.11E-01
	919.33	0.43	-3.13E+00		7.35E+00
	964.08	14.65	-3.72E-02		3.31E-01
	1085.87	10.24	3.15E-01		4.24E-01
	1089.74	1.73	6.34E-01		2.48E+00
	1112.07	13.69	-4.45E-02		2.91E-01
	1212.95	1.43	-1.29E+00		3.52E+00
	1249.94	0.19	-5.90E+00		2.52E+01
	1299.14	1.63	1.78E+00		2.58E+00
	1408.01	21.07	-3.03E-01		1.77E-01
	1457.64	0.50	1.52E+02		3.16E+01
	1528.10	0.28	-4.07E+00		8.05E+00
Eu-154	123.07	40.40	1.97E-02	8.28E-02	8.28E-02
	247.93	6.89	3.28E-02		3.88E-01
	591.76	4.95	-9.81E-02		5.77E-01
	692.42	1.78	-4.95E-01		1.95E+00
	723.30	20.06	-7.36E-02		1.99E-01
	756.80	4.52	4.97E-01		7.92E-01
	873.18	12.08	-2.87E-01		2.77E-01

Analysis Report for 16-Aug-19-10019

L1-10208C-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.06E-01	8.28E-02	3.94E-01
	1004.76	18.01	-4.30E-02		1.98E-01
	1274.43	34.80	-1.49E-02		1.24E-01
	1596.48	1.80	2.20E-01		1.49E+00
Eu-155	45.30	1.31	-2.99E+00	1.95E-01	2.22E+01
	60.01	1.22	-1.02E+01		2.17E+01
	86.55	30.70	-3.90E-02		1.95E-01
	105.31	21.10	1.31E-01		2.07E-01
Ra-226	186.21	3.64	1.14E+00	8.77E-01	8.77E-01
Pa-231	27.36	10.30	2.89E+00	1.13E+00	2.46E+00
	283.69	1.70	-9.37E-01		1.42E+00
	300.07	2.47	3.45E-02		1.13E+00
	302.65	2.20	4.11E-02		1.24E+00
	330.06	1.40	5.20E-01		2.02E+00
U-235	143.76	10.96	-5.56E-02	5.56E-02	2.90E-01
	163.33	5.08	-6.57E-02		5.80E-01
	185.71	57.20	3.58E-02		5.56E-02
	202.11	1.08	-3.64E+00		2.43E+00
	205.31	5.01	-5.54E-02		5.49E-01
Am-241	59.54	35.90	-2.47E-01	7.71E-01	7.71E-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 14-Aug-19-10013

L1-10208C-FSGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10013
Sample Description	: L1-10208C-FSGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.795E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:54:00AM
Acquisition Started	: 8/14/2019 11:00:50AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78761
Fill Height	: 1795.21 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 11:15:53AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10013

L1-10208C-FSGS-012SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	473 -	481	477.48	1.62E+02	21.43	1.36E+02	1.33
2	295.10	585 -	594	590.26	8.03E+01	15.36	6.88E+01	1.45
3	338.13	671 -	681	676.22	8.57E+01	13.99	4.63E+01	1.17
4	351.99	699 -	708	703.92	1.36E+02	15.84	5.12E+01	1.36
5	583.09	1161 -	1171	1165.79	9.20E+01	11.44	1.60E+01	1.55
6	609.32	1212 -	1221	1218.21	9.59E+01	11.09	1.21E+01	1.46
7	911.00	1816 -	1827	1821.46	5.93E+01	10.75	2.17E+01	1.28
8	968.84	1934 -	1943	1937.15	3.28E+01	7.91	1.32E+01	0.96
9	1460.68	2913 -	2927	2921.41	4.03E+02	20.44	5.41E+00	2.31

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.27E+00	4.86E-01
Tl-208	0.99	583.19	*	85.00	1.15E-01	1.59E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.21E-01	3.44E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.30E-01	3.00E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 14-Aug-19-10013

L1-10208C-FSGS-012SS

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	2.93E-01	6.07E-02
		351.93	*	35.60	2.90E-01	4.10E-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	5.61E-01	1.03E-01
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.26E-01	6.07E-02
		964.77		4.99		
		968.97	*	15.80	3.06E-01	7.51E-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 14-Aug-19-10013

L1-10208C-FSGS-012SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	7.27E+00	4.86E-01	
	Tl-208	0.999	1.15E-01	1.59E-02	
X	Bi-211	0.873			
	Pb-212	1.000	2.21E-01	3.44E-02	
	Bi-214	1.000	2.30E-01	3.00E-02	
	Pb-214	0.999	2.91E-01	3.40E-02	
	Ac-228	0.997	3.61E-01	4.29E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 14-Aug-19-10013

L1-10208C-FSGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 11:15:53AM
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	9.61E-02	5.67E-02	5.67E-02
	BE-7	477.60		10.44	1.07E-02	3.20E-01	3.20E-01
+	K-40	1460.82	*	10.66	7.27E+00	2.92E-01	2.92E-01
	Mn-54	834.85		99.98	1.91E-02	4.25E-02	4.25E-02
	Co-60	1173.23		99.85	-1.80E-02	4.29E-02	5.33E-02
		1332.49		99.98	-4.24E-03		4.29E-02
	Nb-94	702.65		99.81	-1.11E-02	3.60E-02	3.60E-02
		871.09		99.89	-6.51E-03		3.63E-02
	Ag-108m	79.13		6.60	8.99E-01	3.81E-02	1.25E+00
		433.94		90.50	-7.13E-03		3.81E-02
		614.28		89.80	-1.71E-01		5.47E-02
		722.94		90.80	-2.23E-02		4.15E-02
	Sb-125	176.31		6.84	-1.48E-02	1.17E-01	5.19E-01
		380.45		1.52	-1.30E-01		2.08E+00
		427.87		29.60	-2.20E-02		1.17E-01
		463.36		10.49	-3.87E-02		3.12E-01
		600.60		17.65	7.79E-02		1.99E-01
		606.71		4.98	1.95E+00		1.22E+00
		635.95		11.22	-9.05E-02		2.59E-01

Analysis Report for 14-Aug-19-10013

L1-10208C-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.92E-01	1.17E-01	2.16E+00
Ba-133	79.61	2.65	6.34E-01	7.86E-02	2.88E+00
	81.00	32.90	-3.11E-01		1.90E-01
	276.40	7.16	9.99E-02		4.77E-01
	302.85	18.34	7.52E-02		1.94E-01
	356.01	62.05	-5.82E-02		7.86E-02
	383.85	8.94	-2.71E-02		3.58E-01
Cs-134	475.36	1.48	7.44E-02	5.16E-02	2.18E+00
	563.25	8.34	4.53E-02		4.32E-01
	569.33	15.37	-6.98E-02		2.34E-01
	604.72	97.62	-8.61E-03		5.28E-02
	795.86	85.46	2.46E-02		5.16E-02
	801.95	8.69	-1.16E-01		4.70E-01
	1038.61	0.99	-3.22E+00		4.40E+00
	1167.97	1.79	8.10E-02		2.93E+00
	1365.19	3.02	-6.29E-01		8.27E-01
Cs-137	661.66	85.10	5.52E-02	5.71E-02	5.71E-02
Eu-152	121.78	28.67	-1.19E-01	1.13E-01	1.13E-01
	244.70	7.61	-3.75E-01		4.71E-01
	295.94	0.45	-2.57E+00		9.86E+00
	344.28	26.60	-6.19E-02		1.16E-01
	367.79	0.86	4.55E-01		3.93E+00
	411.12	2.24	9.43E-03		1.44E+00
	443.96	2.83	1.64E-01		1.35E+00
	488.68	0.42	-1.73E+00		7.56E+00
	563.99	0.49	2.98E+00		7.50E+00
	586.26	0.46	-2.94E+00		1.30E+01
	678.62	0.47	4.37E+00		8.61E+00
	688.67	0.86	-2.66E+00		4.13E+00
	719.35	0.28	-4.93E+00		1.19E+01
	778.90	12.96	-3.42E-01		2.56E-01
	810.45	0.32	1.42E+00		1.24E+01
	867.37	4.26	-2.21E-01		8.95E-01
	919.33	0.43	6.46E-01		1.01E+01
	964.08	14.65	-2.00E-01		3.83E-01
	1085.87	10.24	3.12E-03		4.57E-01
	1089.74	1.73	-5.73E-01		2.46E+00
	1112.07	13.69	-3.19E-01		3.85E-01
	1212.95	1.43	9.79E-01		3.72E+00
	1249.94	0.19	-5.29E+00		2.82E+01
	1299.14	1.63	7.09E-01		2.59E+00
	1408.01	21.07	1.00E-01		2.43E-01
	1457.64	0.50	-1.67E+00		3.83E+01
	1528.10	0.28	-5.23E+00		1.27E+01
Eu-154	123.07	40.40	-5.42E-03	8.55E-02	8.55E-02
	247.93	6.89	1.14E-02		4.91E-01
	591.76	4.95	3.60E-01		7.75E-01
	692.42	1.78	-2.84E-01		2.24E+00
	723.30	20.06	2.04E-02		2.04E-01
	756.80	4.52	6.61E-01		9.02E-01
	873.18	12.08	6.84E-02		3.06E-01

Analysis Report for 14-Aug-19-10013

L1-10208C-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.31E-01	8.55E-02	4.30E-01
	1004.76	18.01	-3.22E-02		2.08E-01
	1274.43	34.80	-6.30E-02		1.20E-01
	1596.48	1.80	-1.12E+00		1.98E+00
Eu-155	45.30	1.31	-1.36E+00	1.84E-01	1.17E+01
	60.01	1.22	-2.54E+00		1.34E+01
	86.55	30.70	-4.11E-02		1.84E-01
	105.31	21.10	7.05E-02		2.00E-01
Ra-226	186.21	3.64	5.60E-01	1.07E+00	1.07E+00
Pa-231	27.36	10.30	4.52E-01	1.17E+00	1.17E+00
	283.69	1.70	-5.76E-01		1.81E+00
	300.07	2.47	-6.85E-01		1.46E+00
	302.65	2.20	6.27E-01		1.62E+00
	330.06	1.40	8.44E-01		2.60E+00
U-235	143.76	10.96	-1.65E-01	6.80E-02	2.69E-01
	163.33	5.08	-1.13E-01		7.30E-01
	185.71	57.20	3.63E-02		6.80E-02
	202.11	1.08	-9.88E-01		3.36E+00
	205.31	5.01	1.97E-01		7.50E-01
Am-241	59.54	35.90	1.78E-03	4.72E-01	4.72E-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 14-Aug-19-10014

L1-10208C-FSGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10014
Sample Description	: L1-10208C-FSGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.517E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:56:00AM
Acquisition Started	: 8/14/2019 11:01:04AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78762
Fill Height	: 1517.23 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 11:16:11AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10014

L1-10208C-FSGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.62	949 -	960	954.56	1.13E+02	16.53	6.15E+01	1.14
2	295.32	1175 -	1186	1181.20	3.62E+01	11.87	4.18E+01	1.41
3	338.31	1346 -	1360	1353.03	3.71E+01	11.89	3.59E+01	0.92
4	351.87	1402 -	1413	1407.23	6.06E+01	11.76	3.04E+01	0.85
5	583.06	2325 -	2337	2331.45	3.76E+01	8.69	1.44E+01	0.30
6	609.16	2427 -	2443	2435.79	7.33E+01	10.34	1.07E+01	1.23
7	911.05	3638 -	3649	3643.17	2.45E+01	6.19	5.55E+00	0.83
8	1460.35	5829 -	5852	5841.24	3.04E+02	17.44	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	0.96	1460.82	*	10.66	7.60E+00	5.46E-01
Tl-208	0.99	583.19	*	85.00	6.30E-02	1.50E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.03E-01	3.39E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.36E-01	3.62E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 14-Aug-19-10014

L1-10208C-FSGS-013SS

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	1.73E-01	5.83E-02
		351.93	*	35.60	1.70E-01	3.57E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.20E-01	1.06E-01
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.83E-01	4.69E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 14-Aug-19-10014

L1-10208C-FSGS-013SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.965	7.60E+00	5.46E-01	
	Tl-208	0.997	6.30E-02	1.50E-02	
X	Bi-211	0.902			
	Pb-212	1.000	2.03E-01	3.39E-02	
	Bi-214	0.998	2.36E-01	3.62E-02	
	Pb-214	0.999	1.71E-01	3.04E-02	
	Ac-228	0.999	2.05E-01	4.29E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 14-Aug-19-10014

L1-10208C-FSGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 11:16:11AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.90E-02	6.78E-02	6.78E-02
	BE-7	477.60		10.44	4.20E-02	3.95E-01	3.95E-01
+	K-40	1460.82	*	10.66	7.60E+00	7.19E-02	7.19E-02
	Mn-54	834.85		99.98	2.12E-02	5.45E-02	5.45E-02
	Co-60	1173.23		99.85	-1.16E-02	6.43E-02	6.66E-02
		1332.49		99.98	1.13E-02		6.43E-02
	Nb-94	702.65		99.81	1.65E-02	5.05E-02	5.05E-02
		871.09		99.89	2.99E-02		5.28E-02
	Ag-108m	79.13		6.60	3.45E-01	4.20E-02	2.01E+00
		433.94		90.50	1.63E-02		4.20E-02
		614.28		89.80	7.24E-03		6.52E-02
		722.94		90.80	2.08E-02		5.74E-02
	Sb-125	176.31		6.84	6.37E-02	1.33E-01	5.76E-01
		380.45		1.52	1.74E-01		2.61E+00
		427.87		29.60	-1.81E-02		1.33E-01
		463.36		10.49	-1.70E-02		4.05E-01
		600.60		17.65	5.84E-02		2.50E-01
		606.71		4.98	2.13E+00		1.55E+00
		635.95		11.22	-9.47E-02		3.80E-01

Analysis Report for 14-Aug-19-10014

L1-10208C-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-9.55E-01	1.33E-01	2.77E+00
Ba-133	79.61	2.65	-9.90E-01	7.93E-02	4.79E+00
	81.00	32.90	-1.67E-01		3.40E-01
	276.40	7.16	2.84E-01		6.02E-01
	302.85	18.34	1.06E-01		2.28E-01
	356.01	62.05	2.98E-02		7.93E-02
	383.85	8.94	3.69E-02		4.65E-01
Cs-134	475.36	1.48	-1.30E-01	6.59E-02	2.71E+00
	563.25	8.34	4.25E-02		5.21E-01
	569.33	15.37	-8.54E-02		3.06E-01
	604.72	97.62	-7.47E-03		7.49E-02
	795.86	85.46	6.45E-02		6.59E-02
	801.95	8.69	-2.86E-01		6.10E-01
	1038.61	0.99	-2.31E+00		5.51E+00
	1167.97	1.79	2.45E+00		3.87E+00
	1365.19	3.02	8.36E-01		1.90E+00
Cs-137	661.66	85.10	2.37E-02	6.52E-02	6.52E-02
Eu-152	121.78	28.67	6.84E-02	1.38E-01	1.60E-01
	244.70	7.61	8.90E-02		5.74E-01
	295.94	0.45	9.70E-01		1.09E+01
	344.28	26.60	-1.01E-01		1.38E-01
	367.79	0.86	-1.13E+00		4.40E+00
	411.12	2.24	-2.67E-01		1.75E+00
	443.96	2.83	-5.61E-01		1.37E+00
	488.68	0.42	-3.05E+00		9.72E+00
	563.99	0.49	6.77E-01		8.84E+00
	586.26	0.46	-5.04E-01		1.39E+01
	678.62	0.47	4.34E+00		1.04E+01
	688.67	0.86	-1.97E+00		4.89E+00
	719.35	0.28	-1.05E+01		1.52E+01
	778.90	12.96	-4.09E-01		3.32E-01
	810.45	0.32	4.15E+00		1.56E+01
	867.37	4.26	4.49E-01		1.21E+00
	919.33	0.43	-4.68E+00		1.05E+01
	964.08	14.65	4.76E-01		5.03E-01
	1085.87	10.24	4.66E-01		7.03E-01
	1089.74	1.73	8.73E-01		4.03E+00
	1112.07	13.69	2.81E-02		5.16E-01
	1212.95	1.43	-1.31E+00		5.49E+00
	1249.94	0.19	-4.00E+01		3.26E+01
	1299.14	1.63	-6.39E-01		3.74E+00
	1408.01	21.07	6.71E-02		2.40E-01
	1457.64	0.50	1.62E+02		4.60E+01
	1528.10	0.28	-1.14E+00		1.43E+01
Eu-154	123.07	40.40	2.08E-02	1.13E-01	1.13E-01
	247.93	6.89	-6.11E-01		4.88E-01
	591.76	4.95	6.66E-01		8.46E-01
	692.42	1.78	-1.79E+00		2.24E+00
	723.30	20.06	-1.33E-01		2.57E-01
	756.80	4.52	-9.88E-01		1.03E+00
	873.18	12.08	2.84E-01		4.37E-01

Analysis Report for 14-Aug-19-10014

L1-10208C-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	4.89E-02	1.13E-01	5.25E-01
	1004.76	18.01	1.18E-01		3.18E-01
	1274.43	34.80	-1.94E-02		1.96E-01
	1596.48	1.80	1.03E+00		2.87E+00
Eu-155	45.30	1.31	8.49E-01	2.70E-01	3.25E+01
	60.01	1.22	1.32E+01		3.38E+01
	86.55	30.70	-7.23E-02		2.70E-01
	105.31	21.10	-7.13E-02		2.79E-01
Ra-226	186.21	3.64	3.57E-01	1.21E+00	1.21E+00
Pa-231	27.36	10.30	4.63E+00	1.65E+00	3.96E+00
	283.69	1.70	-8.59E-01		1.98E+00
	300.07	2.47	-1.15E+00		1.65E+00
	302.65	2.20	1.44E+00		1.90E+00
	330.06	1.40	1.34E+00		2.95E+00
U-235	143.76	10.96	2.18E-02	7.64E-02	4.05E-01
	163.33	5.08	-6.52E-03		8.29E-01
	185.71	57.20	-8.43E-03		7.64E-02
	202.11	1.08	4.08E-02		3.56E+00
	205.31	5.01	-5.85E-01		7.54E-01
Am-241	59.54	35.90	4.36E-01	1.24E+00	1.24E+00

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

Apex-Gamma

Analysis Report for 14-Aug-19-10015

L1-10208C-FSGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10015
Sample Description	: L1-10208C-FSGS-014SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.446E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 8:58:00AM
Acquisition Started	: 8/14/2019 11:01:11AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78763
Fill Height	: 1445.54 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 11:16:24AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10015

L1-10208C-FSGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.79	948 -	960	954.73	1.37E+02	18.36	7.64E+01	0.65
2	295.30	1173 -	1187	1180.48	5.03E+01	13.76	4.67E+01	0.52
3	338.39	1347 -	1357	1352.65	3.45E+01	8.59	1.65E+01	0.99
4	351.85	1400 -	1413	1406.40	9.03E+01	13.11	2.97E+01	1.25
5	609.35	2427 -	2442	2435.42	7.40E+01	10.50	1.20E+01	0.76
6	795.38	3174 -	3184	3179.11	1.78E+01	4.54	1.21E+00	1.23
7	910.99	3635 -	3647	3641.42	4.88E+01	7.57	3.25E+00	0.70
8	1460.13	5827 -	5849	5838.45	2.66E+02	16.96	5.55E+00	1.83

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.92	1460.82	*	10.66	6.08E+00	4.68E-01
Cs-134	0.98	475.36		1.48		
		563.25		8.34		
		569.33		15.37		
		604.72		97.62		
		795.86	*	85.46	3.35E-02	8.73E-03
		801.95		8.69		
		1038.61		0.99		
		1167.97		1.79		

Analysis Report for 14-Aug-19-10015

L1-10208C-FSGS-014SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Cs-134	0.98	1365.19		3.02		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.19E-01	3.44E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.17E-01	3.35E-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	2.17E-01	6.20E-02
		351.93	*	35.60	2.30E-01	3.82E-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	2.70E-01	7.07E-02
		409.46		1.92		
		463.00		4.40		
		794.95	*	4.25	6.72E-01	1.76E-01
		911.20	*	25.80	3.33E-01	5.36E-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 14-Aug-19-10015

L1-10208C-FSGS-014SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.926	6.08E+00	4.68E-01	
	Cs-134	0.985	1.80E-02	8.98E-03	
X	Bi-211	0.908			
	Pb-212	0.996	2.19E-01	3.44E-02	
	Bi-214	1.000	2.17E-01	3.35E-02	
	Pb-214	0.999	2.27E-01	3.25E-02	
	Ac-228	0.996	3.10E-01	4.26E-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-Aug-19-10015

L1-10208C-FSGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 11:16:24AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.59E-02	6.16E-02	6.16E-02
	BE-7	477.60		10.44	-1.88E-02	3.34E-01	3.34E-01
+	K-40	1460.82	*	10.66	6.08E+00	4.21E-01	4.21E-01
	Mn-54	834.85		99.98	-4.57E-03	4.70E-02	4.70E-02
	Co-60	1173.23		99.85	5.61E-02	5.76E-02	7.68E-02
		1332.49		99.98	4.67E-03		5.76E-02
	Nb-94	702.65		99.81	2.78E-03	4.50E-02	4.68E-02
		871.09		99.89	7.29E-03		4.50E-02
	Ag-108m	79.13		6.60	1.45E+00	3.35E-02	1.22E+00
		433.94		90.50	-4.55E-02		3.35E-02
		614.28		89.80	-2.24E-02		6.22E-02
		722.94		90.80	-3.39E-02		4.29E-02
	Sb-125	176.31		6.84	8.96E-02	1.29E-01	4.26E-01
		380.45		1.52	2.11E-01		2.33E+00
		427.87		29.60	5.52E-02		1.29E-01
		463.36		10.49	2.27E-01		3.46E-01
		600.60		17.65	-1.68E-01		2.19E-01
		606.71		4.98	2.08E+00		1.41E+00
		635.95		11.22	-8.19E-02		3.42E-01

Analysis Report for 14-Aug-19-10015

L1-10208C-FSGS-014SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-9.79E-01	1.29E-01	2.36E+00
	Ba-133	79.61		2.65	3.02E+00	6.79E-02	2.92E+00
		81.00		32.90	-3.06E-01		1.81E-01
		276.40		7.16	3.36E-01		4.66E-01
		302.85		18.34	9.33E-02		1.97E-01
		356.01		62.05	-3.79E-02		6.79E-02
		383.85		8.94	1.26E-01		4.27E-01
+	Cs-134	475.36		1.48	2.13E-01	1.61E-02	2.44E+00
		563.25		8.34	-4.37E-01		5.28E-01
		569.33		15.37	1.61E-01		2.85E-01
		604.72		97.62	-2.22E-02		6.02E-02
		795.86	*	85.46	3.35E-02		1.61E-02
		801.95		8.69	-5.35E-01		4.21E-01
		1038.61		0.99	-2.92E-01		4.84E+00
		1167.97		1.79	2.09E+00		4.16E+00
		1365.19		3.02	-5.82E-01		1.55E+00
	Cs-137	661.66		85.10	2.25E-03	4.78E-02	4.78E-02
	Eu-152	121.78		28.67	-8.33E-02	1.11E-01	1.11E-01
		244.70		7.61	5.73E-01		5.46E-01
		295.94		0.45	6.49E+00		1.05E+01
		344.28		26.60	-1.31E-02		1.25E-01
		367.79		0.86	2.97E-01		3.81E+00
		411.12		2.24	2.67E-01		1.56E+00
		443.96		2.83	-5.37E-01		1.23E+00
		488.68		0.42	5.53E+00		8.75E+00
		563.99		0.49	-1.13E+01		8.38E+00
		586.26		0.46	1.68E+01		1.36E+01
		678.62		0.47	8.72E-01		9.03E+00
		688.67		0.86	-3.66E+00		3.74E+00
		719.35		0.28	8.47E+00		1.47E+01
		778.90		12.96	-6.97E-02		2.84E-01
		810.45		0.32	6.97E+00		1.34E+01
		867.37		4.26	-4.71E-01		9.50E-01
		919.33		0.43	3.62E+00		1.01E+01
		964.08		14.65	3.38E-01		4.89E-01
		1085.87		10.24	-3.49E-01		5.01E-01
		1089.74		1.73	4.02E-01		3.19E+00
		1112.07		13.69	2.87E-01		4.41E-01
		1212.95		1.43	-2.16E+00		4.73E+00
		1249.94		0.19	-1.43E+01		3.35E+01
		1299.14		1.63	-1.34E+00		3.26E+00
		1408.01		21.07	1.46E-01		2.27E-01
		1457.64		0.50	1.34E+02		4.00E+01
		1528.10		0.28	7.15E+00		1.47E+01
	Eu-154	123.07		40.40	-2.44E-02	8.08E-02	8.08E-02
		247.93		6.89	1.04E-01		4.93E-01
		591.76		4.95	1.80E-01		7.72E-01
		692.42		1.78	-1.77E+00		1.91E+00
		723.30		20.06	-1.44E-02		2.02E-01
		756.80		4.52	-2.13E-01		8.17E-01
		873.18		12.08	1.69E-01		4.06E-01

Analysis Report for 14-Aug-19-10015

L1-10208C-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.31E-02	8.08E-02	4.53E-01
	1004.76	18.01	5.12E-02		3.00E-01
	1274.43	34.80	3.32E-02		1.47E-01
	1596.48	1.80	1.16E+00		2.39E+00
Eu-155	45.30	1.31	-1.47E+00	1.93E-01	1.17E+01
	60.01	1.22	-2.75E+00		1.23E+01
	86.55	30.70	1.47E-01		1.97E-01
	105.31	21.10	-1.16E-01		1.93E-01
Ra-226	186.21	3.64	1.18E-01	9.78E-01	9.78E-01
Pa-231	27.36	10.30	6.84E-01	1.30E+00	1.30E+00
	283.69	1.70	4.00E-02		1.89E+00
	300.07	2.47	-2.07E-01		1.46E+00
	302.65	2.20	7.40E-01		1.63E+00
	330.06	1.40	-7.11E-01		2.59E+00
U-235	143.76	10.96	-5.45E-02	6.22E-02	2.81E-01
	163.33	5.08	3.75E-01		6.06E-01
	185.71	57.20	1.10E-02		6.22E-02
	202.11	1.08	2.46E+00		2.95E+00
	205.31	5.01	-2.90E-01		6.01E-01
Am-241	59.54	35.90	-2.49E-01	4.20E-01	4.20E-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-Aug-19-10016

L1-10208C-FSGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10016
Sample Description	: L1-10208C-FSGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.383E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 9:00:00AM
Acquisition Started	: 8/14/2019 11:01:21AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78764
Fill Height	: 1382.76 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 11:16:24AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10016

L1-10208C-FSGS-015SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	74.79	298 -	304	300.50	2.16E+01	9.80	3.84E+01	0.63
2	238.66	950 -	961	955.10	1.30E+02	16.44	5.42E+01	1.14
3	295.33	1177 -	1189	1181.52	4.92E+01	11.43	3.08E+01	0.48
4	338.35	1349 -	1360	1353.45	3.24E+01	9.17	2.06E+01	1.08
5	352.01	1399 -	1416	1408.04	9.37E+01	12.43	1.83E+01	0.94
6	583.23	2325 -	2339	2332.25	4.68E+01	8.89	1.13E+01	0.36
7	609.24	2429 -	2443	2436.22	8.00E+01	10.84	1.30E+01	1.05
8	911.14	3637 -	3650	3643.58	2.44E+01	8.21	1.56E+01	1.08
9	968.90	3869 -	3880	3874.67	3.17E+01	6.51	4.31E+00	0.49
10	1460.75	5832 -	5853	5843.38	2.79E+02	17.60	8.23E+00	0.98

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.01E+00	4.61E-01
Tl-208	1.00	583.19	*	85.00	6.86E-02	1.37E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.07E-01	3.12E-02
		300.09		3.30		
Pb212-XR	1.00	74.82	*	10.28	3.79E-01	1.76E-01
		77.11		17.10		

Analysis Report for 14-Aug-19-10016

L1-10208C-FSGS-015SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	1.00	87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	2.25E-01	3.34E-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	2.09E-01	5.14E-02
		351.93	*	35.60	2.33E-01	3.61E-02
		785.96		1.06		
Pb214-XR	1.00	74.82	*	5.80	6.71E-01	3.14E-01
		77.11		9.70		
		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	2.47E-01	7.29E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.58E-01	5.38E-02
		964.77		4.99		
		968.97	*	15.80	3.50E-01	7.36E-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 14-Aug-19-10016

L1-10208C-FSGS-015SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	6.01E+00	4.61E-01	
	Tl-208	1.000	6.86E-02	1.37E-02	
X	Bi-211	0.867			
	Pb-212	1.000	2.07E-01	3.12E-02	
?	Pb212-XR	1.000	3.79E-01	1.76E-01	
	Bi-214	1.000	2.25E-01	3.34E-02	
	Pb-214	0.999	2.25E-01	2.95E-02	
?	Pb214-XR	1.000	6.71E-01	3.14E-01	
	Ac-228	1.000	2.31E-01	3.73E-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-Aug-19-10016

L1-10208C-FSGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 11:16:24AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.21E-02	5.48E-02	5.48E-02
	BE-7	477.60		10.44	-3.83E-02	3.64E-01	3.64E-01
+	K-40	1460.82	*	10.66	6.01E+00	4.68E-01	4.68E-01
	Mn-54	834.85		99.98	-1.60E-03	4.40E-02	4.40E-02
	Co-60	1173.23		99.85	-5.81E-03	5.56E-02	5.94E-02
		1332.49		99.98	9.20E-03		5.56E-02
	Nb-94	702.65		99.81	-1.52E-02	3.66E-02	3.66E-02
		871.09		99.89	-1.48E-02		4.74E-02
	Ag-108m	79.13		6.60	-7.19E-01	4.12E-02	1.36E+00
		433.94		90.50	-2.17E-02		4.12E-02
		614.28		89.80	-3.65E-02		7.34E-02
		722.94		90.80	-4.75E-03		5.37E-02
	Sb-125	176.31		6.84	4.50E-02	1.35E-01	5.11E-01
		380.45		1.52	-1.94E+00		2.12E+00
		427.87		29.60	1.03E-01		1.35E-01
		463.36		10.49	2.48E-02		3.54E-01
		600.60		17.65	-4.32E-02		2.25E-01
		606.71		4.98	2.28E+00		1.40E+00
		635.95		11.22	-7.41E-03		3.27E-01

Analysis Report for 14-Aug-19-10016

L1-10208C-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.68E-01	1.35E-01	2.09E+00
Ba-133	79.61	2.65	1.31E+00	7.69E-02	3.38E+00
	81.00	32.90	-1.72E-01		2.41E-01
	276.40	7.16	5.27E-02		4.86E-01
	302.85	18.34	-2.76E-02		1.74E-01
	356.01	62.05	-7.13E-03		7.69E-02
	383.85	8.94	5.60E-03		3.77E-01
Cs-134	475.36	1.48	-3.10E-01	5.45E-02	2.45E+00
	563.25	8.34	-1.84E-01		5.07E-01
	569.33	15.37	-2.08E-01		2.83E-01
	604.72	97.62	-2.90E-02		6.66E-02
	795.86	85.46	-4.02E-03		5.45E-02
	801.95	8.69	-2.07E-02		5.47E-01
	1038.61	0.99	7.27E-01		4.87E+00
	1167.97	1.79	-3.62E-01		3.26E+00
	1365.19	3.02	6.29E-01		1.46E+00
Cs-137	661.66	85.10	-9.36E-03	5.23E-02	5.23E-02
Eu-152	121.78	28.67	6.98E-04	1.18E-01	1.46E-01
	244.70	7.61	1.22E-03		5.28E-01
	295.94	0.45	9.52E+00		1.01E+01
	344.28	26.60	-5.32E-02		1.18E-01
	367.79	0.86	-3.29E-01		3.79E+00
	411.12	2.24	2.72E-01		1.83E+00
	443.96	2.83	-7.22E-01		1.19E+00
	488.68	0.42	3.19E-01		8.35E+00
	563.99	0.49	-5.20E+00		8.70E+00
	586.26	0.46	1.71E+01		1.30E+01
	678.62	0.47	-6.55E+00		6.78E+00
	688.67	0.86	-3.73E+00		4.11E+00
	719.35	0.28	-1.37E+01		1.47E+01
	778.90	12.96	-3.42E-01		3.29E-01
	810.45	0.32	-1.22E+01		1.30E+01
	867.37	4.26	1.35E+00		1.28E+00
	919.33	0.43	-7.13E+00		1.17E+01
	964.08	14.65	-6.33E-02		4.97E-01
	1085.87	10.24	-1.12E-01		4.75E-01
	1089.74	1.73	-9.34E-01		2.65E+00
	1112.07	13.69	-8.64E-01		3.88E-01
	1212.95	1.43	2.82E-01		5.21E+00
	1249.94	0.19	-9.76E+00		3.62E+01
	1299.14	1.63	-5.01E-01		2.94E+00
	1408.01	21.07	5.31E-02		2.47E-01
	1457.64	0.50	1.21E+02		3.89E+01
	1528.10	0.28	-2.18E+00		1.23E+01
Eu-154	123.07	40.40	1.32E-02	1.03E-01	1.03E-01
	247.93	6.89	-2.24E-01		4.86E-01
	591.76	4.95	3.37E-01		8.82E-01
	692.42	1.78	3.54E-01		2.19E+00
	723.30	20.06	2.35E-01		2.51E-01
	756.80	4.52	-1.64E-01		1.04E+00
	873.18	12.08	-4.05E-02		3.87E-01

Analysis Report for 14-Aug-19-10016

L1-10208C-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.28E-02	1.03E-01	5.23E-01
	1004.76	18.01	5.22E-02		2.67E-01
	1274.43	34.80	-1.10E-01		1.61E-01
	1596.48	1.80	-9.54E-01		2.94E+00
Eu-155	45.30	1.31	1.23E+00	2.10E-01	1.96E+01
	60.01	1.22	-1.44E+00		2.25E+01
	86.55	30.70	-1.65E-01		2.10E-01
	105.31	21.10	5.64E-02		2.21E-01
Ra-226	186.21	3.64	1.11E+00	1.12E+00	1.12E+00
Pa-231	27.36	10.30	1.20E+00	1.44E+00	2.18E+00
	283.69	1.70	7.99E-02		2.06E+00
	300.07	2.47	4.42E-02		1.52E+00
	302.65	2.20	-3.98E-01		1.44E+00
	330.06	1.40	5.67E-02		2.51E+00
U-235	143.76	10.96	-3.26E-01	6.97E-02	3.12E-01
	163.33	5.08	-3.56E-01		6.78E-01
	185.71	57.20	5.47E-02		6.97E-02
	202.11	1.08	-2.66E-01		3.18E+00
	205.31	5.01	-6.91E-01		6.79E-01
Am-241	59.54	35.90	6.68E-02	7.82E-01	7.82E-01

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

Apex-Gamma

Analysis Report for 14-Aug-19-10017

L1-10208C-FSGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10017
Sample Description	: L1-10208C-FSGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.665E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 9:02:00AM
Acquisition Started	: 8/14/2019 11:20:25AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78765
Fill Height	: 1665.84 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 11:35:28AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10017

L1-10208C-FSGS-016SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.63	472 -	481	477.44	1.71E+02	22.36	1.42E+02	1.09
2	295.38	586 -	594	590.81	7.56E+01	13.29	4.74E+01	1.21
3	338.29	671 -	681	676.54	5.91E+01	14.06	5.79E+01	1.08
4	351.90	700 -	707	703.74	1.18E+02	14.23	4.20E+01	1.17
5	583.07	1162 -	1171	1165.74	7.04E+01	11.34	2.56E+01	1.93
6	609.17	1214 -	1223	1217.91	8.38E+01	11.58	2.22E+01	1.19
7	768.67	1533 -	1540	1536.81	1.76E+01	6.30	1.04E+01	1.46
8	911.25	1815 -	1827	1821.95	5.10E+01	9.98	1.80E+01	0.84
9	968.99	1934 -	1942	1937.44	3.58E+01	8.32	1.52E+01	1.38
10	1120.46	2234 -	2246	2240.47	2.63E+01	8.07	1.47E+01	0.64
11	1460.67	2913 -	2928	2921.40	4.26E+02	21.07	5.93E+00	1.76

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.84E+00	5.16E-01
Tl-208	0.99	583.19	*	85.00	8.92E-02	1.53E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.36E-01	3.64E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.04E-01	3.08E-02

Analysis Report for 14-Aug-19-10017

L1-10208C-FSGS-016SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	768.36	*	4.89	4.65E-01	1.68E-01
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.90E-01	8.97E-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	2.79E-01	5.39E-02
		351.93	*	35.60	2.55E-01	3.69E-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	3.92E-01	9.86E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.85E-01	5.70E-02
		964.77		4.99		
		968.97	*	15.80	3.39E-01	8.03E-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 14-Aug-19-10017

L1-10208C-FSGS-016SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.996	7.84E+00	5.16E-01	
	Tl-208	0.998	8.92E-02	1.53E-02	
X	Bi-211	0.896			
	Pb-212	1.000	2.36E-01	3.64E-02	
	Bi-214	0.997	2.20E-01	2.87E-02	
	Pb-214	0.999	2.63E-01	3.04E-02	
	Ac-228	1.000	3.19E-01	4.21E-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-Aug-19-10017

L1-10208C-FSGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 11:35:28AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	9.20E-02	5.81E-02	5.81E-02
	BE-7	477.60		10.44	-8.53E-02	3.37E-01	3.37E-01
+	K-40	1460.82	*	10.66	7.84E+00	3.15E-01	3.15E-01
	Mn-54	834.85		99.98	-1.38E-02	3.97E-02	3.97E-02
	Co-60	1173.23		99.85	4.92E-02	4.36E-02	6.05E-02
		1332.49		99.98	-1.20E-02		4.36E-02
	Nb-94	702.65		99.81	-2.72E-02	3.55E-02	3.55E-02
		871.09		99.89	-8.91E-03		3.76E-02
	Ag-108m	79.13		6.60	3.95E-01	3.32E-02	1.23E+00
		433.94		90.50	-1.02E-02		3.32E-02
		614.28		89.80	-2.82E-02		5.00E-02
		722.94		90.80	1.06E-02		4.74E-02
	Sb-125	176.31		6.84	8.14E-02	1.13E-01	5.19E-01
		380.45		1.52	7.24E-01		2.27E+00
		427.87		29.60	1.71E-02		1.13E-01
		463.36		10.49	2.36E-01		3.59E-01
		600.60		17.65	-1.29E-01		1.97E-01
		606.71		4.98	-6.49E-01		1.28E+00
		635.95		11.22	2.55E-02		3.18E-01

Analysis Report for 14-Aug-19-10017

L1-10208C-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.54E-01	1.13E-01	2.22E+00
Ba-133	79.61	2.65	-2.49E-01	7.37E-02	2.84E+00
	81.00	32.90	-3.13E-01		1.91E-01
	276.40	7.16	-1.37E-01		4.50E-01
	302.85	18.34	1.54E-01		2.04E-01
	356.01	62.05	-8.78E-02		7.37E-02
	383.85	8.94	-2.24E-02		3.74E-01
Cs-134	475.36	1.48	1.39E+00	4.64E-02	2.57E+00
	563.25	8.34	-9.18E-02		4.05E-01
	569.33	15.37	-7.84E-02		2.10E-01
	604.72	97.62	-4.42E-02		5.83E-02
	795.86	85.46	8.61E-03		4.64E-02
	801.95	8.69	-1.88E-02		4.25E-01
	1038.61	0.99	-7.31E-01		4.02E+00
	1167.97	1.79	2.72E+00		3.23E+00
	1365.19	3.02	6.54E-01		1.47E+00
Cs-137	661.66	85.10	9.10E-03	5.29E-02	5.29E-02
Eu-152	121.78	28.67	-2.57E-02	1.17E-01	1.17E-01
	244.70	7.61	-1.65E-01		4.81E-01
	295.94	0.45	6.00E+00		9.10E+00
	344.28	26.60	-6.70E-02		1.24E-01
	367.79	0.86	3.30E-01		3.93E+00
	411.12	2.24	5.65E-02		1.53E+00
	443.96	2.83	2.22E-01		1.23E+00
	488.68	0.42	3.90E+00		8.92E+00
	563.99	0.49	-1.78E+00		6.71E+00
	586.26	0.46	-3.31E+00		1.25E+01
	678.62	0.47	-1.25E+00		8.37E+00
	688.67	0.86	1.89E-01		4.14E+00
	719.35	0.28	-2.53E+00		1.37E+01
	778.90	12.96	-1.16E-01		2.55E-01
	810.45	0.32	-2.35E-01		1.08E+01
	867.37	4.26	-4.17E-01		8.13E-01
	919.33	0.43	-1.10E+00		1.07E+01
	964.08	14.65	-2.80E-01		3.89E-01
	1085.87	10.24	1.30E-01		5.04E-01
	1089.74	1.73	6.48E-01		2.99E+00
	1112.07	13.69	-5.04E-03		3.78E-01
	1212.95	1.43	3.91E-01		4.06E+00
	1249.94	0.19	1.95E+00		3.06E+01
	1299.14	1.63	6.94E-01		2.98E+00
	1408.01	21.07	5.24E-02		1.89E-01
	1457.64	0.50	-2.14E+00		4.00E+01
	1528.10	0.28	-7.82E+00		1.05E+01
Eu-154	123.07	40.40	-2.04E-02	8.18E-02	8.18E-02
	247.93	6.89	2.53E-02		4.53E-01
	591.76	4.95	-1.02E-01		6.50E-01
	692.42	1.78	-9.30E-01		1.79E+00
	723.30	20.06	5.85E-02		2.17E-01
	756.80	4.52	-2.42E-01		7.86E-01
	873.18	12.08	-1.74E-02		3.22E-01

Analysis Report for 14-Aug-19-10017

L1-10208C-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.90E-01	8.18E-02	5.10E-01
	1004.76	18.01	-1.11E-01		2.41E-01
	1274.43	34.80	6.81E-02		1.47E-01
	1596.48	1.80	-3.09E-01		2.10E+00
Eu-155	45.30	1.31	-2.22E+00	1.84E-01	1.11E+01
	60.01	1.22	-2.28E+00		1.32E+01
	86.55	30.70	-2.98E-02		1.84E-01
	105.31	21.10	1.24E-01		2.11E-01
Ra-226	186.21	3.64	9.25E-01	1.09E+00	1.09E+00
Pa-231	27.36	10.30	6.73E-01	1.14E+00	1.14E+00
	283.69	1.70	4.42E-01		1.94E+00
	300.07	2.47	-1.98E+00		1.32E+00
	302.65	2.20	1.28E+00		1.70E+00
	330.06	1.40	8.64E-01		2.50E+00
U-235	143.76	10.96	9.76E-02	6.90E-02	3.06E-01
	163.33	5.08	-3.97E-02		7.31E-01
	185.71	57.20	6.21E-02		6.90E-02
	202.11	1.08	-1.03E+00		3.18E+00
	205.31	5.01	-3.76E-01		6.97E-01
Am-241	59.54	35.90	-1.85E-01	4.46E-01	4.46E-01

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

Apex-Gamma

Analysis Report for 14-Aug-19-10018

L1-10208C-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10018
Sample Description	: L1-10208C-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.554E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 9:04:00AM
Acquisition Started	: 8/14/2019 11:20:32AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78766
Fill Height	: 1554.38 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 11:35:36AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10018

L1-10208C-FSGS-017SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.58	949 -	960	954.43	1.20E+02	17.20	7.02E+01	0.79
2	295.35	1172 -	1186	1181.29	6.18E+01	11.72	2.63E+01	0.56
3	338.22	1347 -	1357	1352.64	2.67E+01	9.91	2.93E+01	0.73
4	351.94	1401 -	1413	1407.49	8.13E+01	12.42	2.77E+01	1.05
5	462.94	1846 -	1856	1851.19	1.53E+01	6.20	9.67E+00	0.94
6	583.09	2325 -	2338	2331.59	5.41E+01	9.32	1.19E+01	1.23
7	609.25	2429 -	2442	2436.18	6.72E+01	10.53	1.58E+01	1.17
8	910.94	3637 -	3648	3642.70	1.55E+01	7.48	1.55E+01	0.62
9	1460.29	5830 -	5852	5840.99	2.90E+02	17.34	2.76E+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	0.95	1460.82	*	10.66	7.20E+00	5.32E-01
Tl-208	0.99	583.19	*	85.00	8.99E-02	1.64E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.14E-01	3.52E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.15E-01	3.61E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 14-Aug-19-10018

L1-10208C-FSGS-017SS

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	2.93E-01	6.04E-02
		351.93	*	35.60	2.27E-01	3.91E-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	2.28E-01	8.69E-02
		409.46		1.92		
		463.00	*	4.40	4.21E-01	1.73E-01
		794.95		4.25		
		911.20	*	25.80	1.15E-01	5.57E-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-Aug-19-10018

L1-10208C-FSGS-017SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.956	7.20E+00	5.32E-01	
X	Sb-125	0.416			
	Tl-208	0.999	8.99E-02	1.64E-02	
X	Bi-211	0.886			
	Pb-212	1.000	2.14E-01	3.52E-02	
	Bi-214	1.000	2.15E-01	3.61E-02	
	Pb-214	0.999	2.46E-01	3.28E-02	
	Ac-228	0.996	1.67E-01	4.53E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 14-Aug-19-10018

L1-10208C-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 11:35:36AM
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	7.34E-02	6.27E-02	6.27E-02
	BE-7	477.60		10.44	-2.58E-01	4.16E-01	4.16E-01
+	K-40	1460.82	*	10.66	7.20E+00	3.43E-01	3.43E-01
	Mn-54	834.85		99.98	3.57E-02	5.26E-02	5.26E-02
	Co-60	1173.23		99.85	9.27E-02	6.63E-02	9.02E-02
		1332.49		99.98	4.41E-02		6.63E-02
	Nb-94	702.65		99.81	-1.35E-03	5.02E-02	5.02E-02
		871.09		99.89	4.92E-03		5.41E-02
	Ag-108m	79.13		6.60	9.07E-01	4.33E-02	1.94E+00
		433.94		90.50	-4.16E-02		4.33E-02
		614.28		89.80	-5.87E-02		6.77E-02
		722.94		90.80	1.14E-02		5.77E-02
	Sb-125	176.31		6.84	-1.57E-01	1.34E-01	5.80E-01
		380.45		1.52	1.41E+00		2.62E+00
		427.87		29.60	5.17E-02		1.34E-01
		463.36	*	10.49	1.77E-01		2.21E-01
		600.60		17.65	7.36E-02		2.65E-01
		606.71		4.98	2.10E+00		1.56E+00
		635.95		11.22	-7.02E-02		3.53E-01

Analysis Report for 14-Aug-19-10018

L1-10208C-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	5.89E-01	1.34E-01	2.72E+00
Ba-133	79.61	2.65	-2.70E+00	8.25E-02	4.41E+00
	81.00	32.90	-3.53E-01		3.10E-01
	276.40	7.16	-2.70E-01		5.79E-01
	302.85	18.34	1.03E-01		2.12E-01
	356.01	62.05	-2.79E-02		8.25E-02
	383.85	8.94	-5.92E-04		4.15E-01
Cs-134	475.36	1.48	-7.73E-01	6.47E-02	2.98E+00
	563.25	8.34	3.14E-01		5.38E-01
	569.33	15.37	-1.99E-01		2.60E-01
	604.72	97.62	-1.93E-02		7.19E-02
	795.86	85.46	2.08E-02		6.47E-02
	801.95	8.69	-3.99E-01		5.71E-01
	1038.61	0.99	1.33E-01		5.68E+00
	1167.97	1.79	4.71E-01		4.86E+00
	1365.19	3.02	3.20E-01		1.57E+00
Cs-137	661.66	85.10	4.75E-02	6.08E-02	6.08E-02
Eu-152	121.78	28.67	3.98E-02	1.44E-01	1.68E-01
	244.70	7.61	4.70E-01		5.92E-01
	295.94	0.45	6.46E+00		1.05E+01
	344.28	26.60	-1.48E-02		1.44E-01
	367.79	0.86	2.49E+00		4.25E+00
	411.12	2.24	9.38E-01		1.92E+00
	443.96	2.83	-1.24E+00		1.47E+00
	488.68	0.42	2.41E+00		1.02E+01
	563.99	0.49	6.37E+00		9.02E+00
	586.26	0.46	-8.08E+00		1.45E+01
	678.62	0.47	8.77E+00		9.83E+00
	688.67	0.86	-5.41E+00		5.29E+00
	719.35	0.28	1.30E+01		1.90E+01
	778.90	12.96	1.14E-01		3.75E-01
	810.45	0.32	1.56E+01		1.67E+01
	867.37	4.26	-1.32E-01		1.17E+00
	919.33	0.43	-9.45E+00		1.19E+01
	964.08	14.65	5.50E-01		5.56E-01
	1085.87	10.24	-5.61E-01		5.85E-01
	1089.74	1.73	1.62E+00		3.64E+00
	1112.07	13.69	-8.62E-02		4.21E-01
	1212.95	1.43	3.25E+00		5.21E+00
	1249.94	0.19	-6.89E+00		3.53E+01
	1299.14	1.63	-7.66E-02		3.55E+00
	1408.01	21.07	5.10E-02		2.29E-01
	1457.64	0.50	1.47E+02		4.50E+01
	1528.10	0.28	3.52E+00		1.60E+01
Eu-154	123.07	40.40	-5.08E-02	1.15E-01	1.15E-01
	247.93	6.89	-3.88E-01		5.80E-01
	591.76	4.95	3.17E-01		9.13E-01
	692.42	1.78	-2.28E+00		2.83E+00
	723.30	20.06	7.66E-02		2.58E-01
	756.80	4.52	2.10E-01		1.02E+00
	873.18	12.08	1.57E-01		4.68E-01

Analysis Report for 14-Aug-19-10018

L1-10208C-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	5.30E-02	1.15E-01	5.12E-01
	1004.76	18.01	-2.59E-01		3.11E-01
	1274.43	34.80	9.26E-02		2.09E-01
	1596.48	1.80	1.58E+00		2.85E+00
Eu-155	45.30	1.31	1.16E+01	2.62E-01	3.42E+01
	60.01	1.22	-5.14E+00		3.15E+01
	86.55	30.70	-1.57E-01		2.78E-01
	105.31	21.10	-7.56E-02		2.62E-01
Ra-226	186.21	3.64	7.39E-01	1.20E+00	1.20E+00
Pa-231	27.36	10.30	4.36E+00	1.48E+00	3.90E+00
	283.69	1.70	1.62E+00		2.57E+00
	300.07	2.47	-3.88E-01		1.48E+00
	302.65	2.20	1.14E+00		1.76E+00
	330.06	1.40	2.01E+00		3.19E+00
U-235	143.76	10.96	-1.29E-01	7.56E-02	4.19E-01
	163.33	5.08	-3.91E-01		8.17E-01
	185.71	57.20	2.04E-02		7.56E-02
	202.11	1.08	-1.24E+00		3.39E+00
	205.31	5.01	-7.54E-02		7.60E-01
Am-241	59.54	35.90	-7.35E-01	1.07E+00	1.07E+00

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

Apex-Gamma

Analysis Report for 16-Aug-19-10020

L1-10208C-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 16-Aug-19-10020
Sample Description	: L1-10208C-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.554E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 9:04:00AM
Acquisition Started	: 8/16/2019 12:19:26PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1802.8 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 8/16/2019
Efficiency Calibration Description	:
Sample Number	: 78891
Fill Height	: 1554.38 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/16/2019 12:49:31PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated
1430 8-16-19

Analysis Report for 16-Aug-19-10020

L1-10208C-FSGS-017SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	238.56	948 -	959	954.35	2.76E+02	24.30	1.25E+02	0.95
M	2	295.20	1173 -	1207	1180.69	7.82E+01	31.14	8.61E+01	0.70
m	3	300.21	1173 -	1207	1200.73	2.84E+01	12.51	6.41E+01	0.70
	4	351.88	1400 -	1416	1407.24	1.97E+02	19.36	5.58E+01	1.13
	5	462.75	1846 -	1857	1850.45	3.09E+01	10.69	3.31E+01	0.51
	6	582.78	2322 -	2339	2330.32	9.94E+01	14.88	3.76E+01	0.88
	7	608.95	2427 -	2442	2434.99	1.51E+02	14.92	2.39E+01	1.12
	8	910.85	3635 -	3650	3642.38	5.94E+01	10.29	1.56E+01	1.21
	9	968.48	3867 -	3878	3872.88	3.19E+01	9.24	2.11E+01	0.78
	10	1460.07	5827 -	5851	5840.09	6.26E+02	26.81	2.22E+01	1.82
	11	1587.32	6344 -	6355	6349.55	1.30E+01	3.61	0.00E+00	0.56

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.91	1460.82	*	10.66	7.76E+00	4.73E-01
Tl-208	0.97	583.19	*	85.00	8.26E-02	1.33E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.46E-01	2.94E-02
		300.09	*	3.30	3.81E-01	1.70E-01
Bi-214	0.99	609.32	*	45.49	2.42E-01	2.79E-02

Analysis Report for 16-Aug-19-10020

L1-10208C-FSGS-017SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.86E-01	7.54E-02
		351.93	*	35.60	2.75E-01	3.48E-02
		785.96		1.06		
Ac-228	0.71	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	4.23E-01	1.50E-01
		794.95		4.25		
		911.20	*	25.80	2.20E-01	3.94E-02
		964.77		4.99		
		968.97	*	15.80	2.02E-01	5.90E-02
		1588.20	*	3.22	5.69E-01	1.60E-01

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 16-Aug-19-10020

L1-10208C-FSGS-017SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.913	7.76E+00	4.73E-01	
	Tl-208	0.973	8.26E-02	1.33E-02	
X	Bi-211	0.901			
	Pb-212	0.999	2.50E-01	2.89E-02	
	Bi-214	0.991	2.42E-01	2.79E-02	
	Pb-214	1.000	2.59E-01	3.16E-02	
	Ac-228	0.719	2.37E-01	3.14E-02	
X	Pa-231	1.000			

? = 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 16-Aug-19-10020

L1-10208C-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/16/2019 12:49:31PM
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	6.36E-02	4.17E-02	4.17E-02
	BE-7	477.60		10.44	8.09E-02	2.85E-01	2.85E-01
+	K-40	1460.82	*	10.66	7.76E+00	4.42E-01	4.42E-01
	Mn-54	834.85		99.98	-6.54E-03	3.31E-02	3.31E-02
	Co-60	1173.23		99.85	2.14E-02	5.09E-02	5.75E-02
		1332.49		99.98	6.33E-02		5.09E-02
	Nb-94	702.65		99.81	3.41E-03	3.59E-02	3.59E-02
		871.09		99.89	7.91E-03		3.94E-02
	Ag-108m	79.13		6.60	8.99E-01	3.48E-02	1.42E+00
		433.94		90.50	2.12E-02		3.48E-02
		614.28		89.80	-7.08E-03		4.11E-02
		722.94		90.80	-1.09E-02		4.22E-02
	Sb-125	176.31		6.84	-3.25E-02	9.74E-02	4.17E-01
		380.45		1.52	1.76E+00		1.93E+00
		427.87		29.60	-2.17E-02		9.74E-02
		463.36		10.49	3.70E-01		3.21E-01
		600.60		17.65	-8.27E-03		1.68E-01
		606.71		4.98	2.24E+00		1.04E+00
		635.95		11.22	1.67E-01		2.66E-01

Analysis Report for 16-Aug-19-10020

L1-10208C-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-6.26E-01	9.74E-02	1.72E+00
Ba-133	79.61	2.65	4.00E-01	5.86E-02	3.36E+00
	81.00	32.90	-3.66E-01		2.28E-01
	276.40	7.16	-6.54E-03		3.92E-01
	302.85	18.34	1.77E-02		1.56E-01
	356.01	62.05	1.12E-02		5.86E-02
	383.85	8.94	-1.61E-01		3.20E-01
Cs-134	475.36	1.48	4.28E-01	3.73E-02	1.97E+00
	563.25	8.34	-8.30E-03		3.64E-01
	569.33	15.37	-2.33E-03		1.94E-01
	604.72	97.62	-2.61E-02		5.13E-02
	795.86	85.46	-8.83E-03		3.73E-02
	801.95	8.69	9.17E-03		3.65E-01
	1038.61	0.99	-2.00E+00		3.75E+00
	1167.97	1.79	7.29E-01		3.08E+00
	1365.19	3.02	-1.76E-01		1.16E+00
Cs-137	661.66	85.10	4.52E-02	4.24E-02	4.24E-02
Eu-152	121.78	28.67	-2.72E-02	1.02E-01	1.17E-01
	244.70	7.61	-8.61E-02		4.18E-01
	295.94	0.45	4.22E-01		7.94E+00
	344.28	26.60	-5.94E-02		1.02E-01
	367.79	0.86	1.56E+00		3.18E+00
	411.12	2.24	1.10E+00		1.34E+00
	443.96	2.83	-1.40E-02		1.10E+00
	488.68	0.42	-9.70E-01		6.87E+00
	563.99	0.49	1.50E+00		6.25E+00
	586.26	0.46	6.04E-01		1.01E+01
	678.62	0.47	4.09E+00		6.55E+00
	688.67	0.86	1.97E+00		3.60E+00
	719.35	0.28	-4.63E-02		1.17E+01
	778.90	12.96	-2.82E-01		2.66E-01
	810.45	0.32	6.46E+00		1.12E+01
	867.37	4.26	1.03E-01		8.75E-01
	919.33	0.43	8.61E+00		9.81E+00
	964.08	14.65	3.91E-02		3.52E-01
	1085.87	10.24	-6.64E-01		3.98E-01
	1089.74	1.73	-4.49E-01		2.46E+00
	1112.07	13.69	-2.70E-01		3.07E-01
	1212.95	1.43	8.04E-01		3.65E+00
	1249.94	0.19	-1.16E+01		2.34E+01
	1299.14	1.63	-9.91E-01		2.21E+00
	1408.01	21.07	6.87E-02		1.61E-01
	1457.64	0.50	1.72E+02		3.31E+01
	1528.10	0.28	-8.85E-01		1.01E+01
Eu-154	123.07	40.40	-1.48E-02	8.28E-02	8.28E-02
	247.93	6.89	1.46E-01		4.06E-01
	591.76	4.95	1.45E-01		6.72E-01
	692.42	1.78	-6.24E-01		1.68E+00
	723.30	20.06	1.70E-01		1.96E-01
	756.80	4.52	-1.55E-02		7.36E-01
	873.18	12.08	-4.91E-02		3.22E-01

Analysis Report for 16-Aug-19-10020

L1-10208C-FSGS-017SS

Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29		10.48	2.75E-01	8.28E-02	4.12E-01
	1004.76		18.01	-6.07E-02		1.97E-01
	1274.43		34.80	4.29E-03		1.36E-01
	1596.48		1.80	1.74E-01		1.42E+00
Eu-155	45.30		1.31	-6.27E+00	1.95E-01	2.29E+01
	60.01		1.22	-1.83E+01		2.20E+01
	86.55		30.70	-3.68E-03		1.95E-01
	105.31		21.10	1.14E-02		2.00E-01
Ra-226	186.21		3.64	2.47E-01	8.50E-01	8.50E-01
Pa-231	27.36		10.30	2.53E+00	7.39E-01	2.56E+00
	283.69		1.70	-1.87E+00		1.50E+00
	300.07	*	2.47	5.09E-01		7.39E-01
	302.65		2.20	4.02E-01		1.30E+00
	330.06		1.40	1.50E+00		2.13E+00
U-235	143.76		10.96	-7.60E-03	5.38E-02	2.97E-01
	163.33		5.08	2.33E-01		6.05E-01
	185.71		57.20	2.55E-02		5.38E-02
	202.11		1.08	-7.31E-01		2.57E+00
	205.31		5.01	-7.30E-02		5.81E-01
Am-241	59.54		35.90	-4.76E-01	7.99E-01	7.99E-01

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

Apex-Gamma

Analysis Report for 06-Sep-19-10037

L1-10208C-FSGS-009SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 06-Sep-19-10037
Sample Description	: L1-10208C-FSGS-009SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.589E+03 grams
Facility	: Default
Sample Taken On	: 9/5/2019 8:45:00AM
Acquisition Started	: 9/6/2019 2:23:38PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 9/6/2019
Efficiency Calibration Description	:
Sample Number	: 79314
Fill Height	: 1589.23 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/6/2019 2:38:49PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

1330 9/6/19

Analysis Report for 06-Sep-19-10037

L1-10208C-FSGS-009SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.72	950 -	962	954.47	1.18E+02	18.08	7.80E+01	0.89
2	295.39	1177 -	1189	1180.84	7.74E+01	12.77	3.16E+01	1.14
3	351.86	1400 -	1415	1406.45	1.02E+02	14.53	3.60E+01	1.01
4	609.26	2427 -	2443	2435.08	8.13E+01	11.27	1.47E+01	1.51
5	1460.10	5826 -	5850	5838.34	3.73E+02	20.59	1.24E+01	1.97

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.92	1460.82	*	10.66	8.27E+00	5.81E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.86E-01	3.22E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.34E-01	3.53E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		

Analysis Report for 06-Sep-19-10037

L1-10208C-FSGS-009SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	3.28E-01	6.02E-02
		351.93	*	35.60	2.55E-01	4.16E-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	0.920	8.27E+00	5.81E-01	
X	Bi-211	0.905			
	Pb-212	0.999	1.86E-01	3.22E-02	
	Bi-214	1.000	2.34E-01	3.53E-02	
	Pb-214	0.998	2.79E-01	3.42E-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 06-Sep-19-10037

L1-10208C-FSGS-009SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/6/2019 2:38:49PM
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	8.41E-02	6.28E-02	6.28E-02
	BE-7	477.60		10.44	3.69E-01	3.99E-01	3.99E-01
+	K-40	1460.82	*	10.66	8.27E+00	6.02E-01	6.02E-01
	Mn-54	834.85		99.98	-1.83E-02	5.00E-02	5.00E-02
	Co-60	1173.23		99.85	-2.68E-02	5.37E-02	6.51E-02
		1332.49		99.98	-1.94E-02		5.37E-02
	Nb-94	702.65		99.81	-3.18E-03	3.35E-02	3.35E-02
		871.09		99.89	-1.55E-02		5.06E-02
	Ag-108m	79.13		6.60	1.46E+00	4.50E-02	1.25E+00
		433.94		90.50	-2.37E-02		4.50E-02
		614.28		89.80	1.06E-02		6.08E-02
		722.94		90.80	-1.74E-02		5.37E-02
	Sb-125	176.31		6.84	-4.64E-01	1.39E-01	4.39E-01
		380.45		1.52	-1.71E+00		2.43E+00
		427.87		29.60	4.50E-02		1.39E-01
		463.36		10.49	1.30E-01		3.69E-01
		600.60		17.65	1.25E-02		2.26E-01
		606.71		4.98	-4.53E-01		1.43E+00
		635.95		11.22	-2.60E-01		3.55E-01

Analysis Report for 06-Sep-19-10037

L1-10208C-FSGS-009SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.10E-01	1.39E-01	2.06E+00
Ba-133	79.61	2.65	2.09E+00	7.28E-02	3.00E+00
	81.00	32.90	-5.21E-01		1.86E-01
	276.40	7.16	1.15E-01		4.48E-01
	302.85	18.34	1.66E-01		1.90E-01
	356.01	62.05	-2.26E-02		7.28E-02
	383.85	8.94	-4.14E-01		3.97E-01
Cs-134	475.36	1.48	4.66E-01	5.88E-02	2.74E+00
	563.25	8.34	-2.49E-01		4.99E-01
	569.33	15.37	-2.34E-01		2.33E-01
	604.72	97.62	-2.95E-02		6.35E-02
	795.86	85.46	3.96E-02		5.88E-02
	801.95	8.69	-2.15E-01		5.20E-01
	1038.61	0.99	-2.28E-01		5.18E+00
	1167.97	1.79	-1.06E+00		3.63E+00
	1365.19	3.02	-2.19E-01		1.65E+00
Cs-137	661.66	85.10	2.20E-02	5.27E-02	5.27E-02
Eu-152	121.78	28.67	-1.02E-01	1.28E-01	1.28E-01
	244.70	7.61	4.49E-02		5.56E-01
	295.94	0.45	6.27E+00		1.07E+01
	344.28	26.60	9.37E-02		1.32E-01
	367.79	0.86	7.52E-01		4.03E+00
	411.12	2.24	8.70E-01		1.62E+00
	443.96	2.83	-4.17E-01		1.31E+00
	488.68	0.42	-1.59E+00		8.97E+00
	563.99	0.49	-6.53E+00		7.68E+00
	586.26	0.46	1.85E+01		1.37E+01
	678.62	0.47	1.95E+00		9.55E+00
	688.67	0.86	-2.41E+00		4.75E+00
	719.35	0.28	-1.34E+01		1.55E+01
	778.90	12.96	-2.94E-01		2.83E-01
	810.45	0.32	1.10E+01		1.58E+01
	867.37	4.26	2.11E-01		1.15E+00
	919.33	0.43	-2.23E+00		1.06E+01
	964.08	14.65	-1.21E-01		4.40E-01
	1085.87	10.24	1.41E-01		5.57E-01
	1089.74	1.73	1.23E-01		3.31E+00
	1112.07	13.69	-7.51E-02		4.17E-01
	1212.95	1.43	2.26E+00		5.15E+00
	1249.94	0.19	-3.20E+00		3.54E+01
	1299.14	1.63	-3.99E+00		3.65E+00
	1408.01	21.07	1.07E-01		2.34E-01
	1457.64	0.50	1.74E+02		4.62E+01
	1528.10	0.28	-3.69E+00		1.50E+01
Eu-154	123.07	40.40	6.87E-03	9.58E-02	9.58E-02
	247.93	6.89	6.00E-01		5.75E-01
	591.76	4.95	5.65E-01		8.19E-01
	692.42	1.78	-6.33E-02		2.19E+00
	723.30	20.06	1.52E-02		2.43E-01
	756.80	4.52	-2.85E-01		9.46E-01
	873.18	12.08	8.91E-02		4.58E-01

Analysis Report for 06-Sep-19-10037

L1-10208C-FSGS-009SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.05E-02	9.58E-02	5.22E-01
	1004.76	18.01	4.60E-02		3.01E-01
	1274.43	34.80	-8.16E-02		1.65E-01
	1596.48	1.80	9.87E-01		2.20E+00
Eu-155	45.30	1.31	-6.98E-01	1.96E-01	1.19E+01
	60.01	1.22	-5.58E+00		1.19E+01
	86.55	30.70	-1.98E-02		2.04E-01
	105.31	21.10	-9.90E-02		1.96E-01
Ra-226	186.21	3.64	3.32E-01	9.96E-01	9.96E-01
Pa-231	27.36	10.30	6.76E-01	1.31E+00	1.31E+00
	283.69	1.70	3.53E-01		1.93E+00
	300.07	2.47	4.73E-01		1.51E+00
	302.65	2.20	1.15E+00		1.60E+00
	330.06	1.40	6.90E-01		2.72E+00
U-235	143.76	10.96	2.30E-01	6.35E-02	3.26E-01
	163.33	5.08	-1.74E-01		6.13E-01
	185.71	57.20	3.61E-02		6.35E-02
	202.11	1.08	-1.08E+00		2.64E+00
	205.31	5.01	-3.03E-01		6.01E-01
Am-241	59.54	35.90	-1.49E-01	4.18E-01	4.18E-01

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

Apex-Gamma

Analysis Report for 06-Sep-19-10038

L1-10208C-FSGS-016SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 06-Sep-19-10038
Sample Description	: L1-10208C-FSGS-016SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.647E+03 grams
Facility	: Default
Sample Taken On	: 9/5/2019 9:00:00AM
Acquisition Started	: 9/6/2019 2:23:47PM
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	: 9/6/2019
Efficiency Calibration Description	:
Sample Number	: 79315
Fill Height	: 1646.87 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/6/2019 2:38:53PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

1330 9/18/19

Analysis Report for 06-Sep-19-10038

L1-10208C-FSGS-016SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.64	738 -	750	743.27	7.34E+01	13.70	4.06E+01	0.97
2	209.18	833 -	842	837.35	2.73E+01	9.25	2.57E+01	0.57
3	238.59	950 -	962	954.84	8.60E+01	18.97	9.90E+01	1.01
4	295.27	1173 -	1187	1181.28	7.13E+01	12.97	3.38E+01	0.77
5	338.26	1346 -	1359	1353.07	3.48E+01	10.47	2.52E+01	0.75
6	351.88	1400 -	1415	1407.53	9.19E+01	11.59	1.41E+01	1.25
7	583.17	2326 -	2338	2331.99	4.74E+01	8.97	1.26E+01	0.38
8	609.03	2427 -	2442	2435.40	6.01E+01	11.34	2.29E+01	1.86
9	911.20	3638 -	3651	3643.84	3.15E+01	6.44	3.50E+00	0.90
10	968.86	3869 -	3881	3874.52	2.11E+01	7.94	1.59E+01	0.51
11	1460.63	5832 -	5855	5842.88	3.27E+02	20.08	1.96E+01	2.06

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.72E+00	5.05E-01
Tl-208	1.00	583.19	*	85.00	6.67E-02	1.33E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.33E-01	3.13E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.63E-01	3.22E-02

Analysis Report for 06-Sep-19-10038

L1-10208C-FSGS-016SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.93E-01	5.82E-02
		351.93	*	35.60	2.21E-01	3.30E-02
		785.96		1.06		
Ra-226	0.94	186.21	*	3.64	1.22E+00	2.48E-01
Ac-228	1.00	129.07		2.42		
		209.25	*	3.89	4.46E-01	1.55E-01
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.56E-01	8.01E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.96E-01	4.09E-02
		964.77		4.99		
		968.97	*	15.80	2.22E-01	8.44E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	7.74E-02	1.58E-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 06-Sep-19-10038

L1-10208C-FSGS-016SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.994	6.72E+00	5.05E-01	
	Tl-208	1.000	6.67E-02	1.33E-02	
X	Bi-211	0.899			
	Pb-212	1.000	1.33E-01	3.13E-02	
	Bi-214	0.995	1.63E-01	3.22E-02	
	Pb-214	1.000	2.38E-01	2.87E-02	
?	Ra-226	0.949	1.22E+00	2.48E-01	
	Ac-228	1.000	2.21E-01	3.27E-02	
?	U-235	0.999	7.74E-02	1.58E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 06-Sep-19-10038

L1-10208C-FSGS-016SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/6/2019 2:38:53PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.63E-02	5.75E-02	5.75E-02
	BE-7	477.60		10.44	-1.60E-02	3.72E-01	3.72E-01
+	K-40	1460.82	*	10.66	6.72E+00	6.65E-01	6.65E-01
	Mn-54	834.85		99.98	4.94E-03	4.68E-02	4.68E-02
	Co-60	1173.23		99.85	-2.36E-03	4.87E-02	6.27E-02
		1332.49		99.98	-1.80E-02		4.87E-02
	Nb-94	702.65		99.81	2.10E-03	4.23E-02	4.23E-02
		871.09		99.89	-1.59E-02		4.39E-02
	Ag-108m	79.13		6.60	9.23E-02	4.46E-02	1.59E+00
		433.94		90.50	1.01E-02		4.46E-02
		614.28		89.80	-2.54E-02		6.95E-02
		722.94		90.80	2.50E-02		5.48E-02
	Sb-125	176.31		6.84	-1.36E-01	1.33E-01	4.79E-01
		380.45		1.52	-8.93E-02		2.27E+00
		427.87		29.60	1.59E-01		1.33E-01
		463.36		10.49	2.55E-01		3.93E-01
		600.60		17.65	3.60E-03		2.22E-01
		606.71		4.98	1.51E+00		1.34E+00
		635.95		11.22	1.85E-01		3.44E-01

Analysis Report for 06-Sep-19-10038

L1-10208C-FSGS-016SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.82E+00	1.33E-01	2.20E+00
Ba-133	79.61	2.65	2.85E+00	7.61E-02	3.85E+00
	81.00	32.90	-3.32E-01		2.63E-01
	276.40	7.16	-5.20E-03		5.28E-01
	302.85	18.34	-1.33E-01		1.95E-01
	356.01	62.05	-1.26E-02		7.61E-02
	383.85	8.94	-2.14E-01		4.00E-01
Cs-134	475.36	1.48	-6.47E-01	5.29E-02	2.49E+00
	563.25	8.34	-9.64E-03		4.61E-01
	569.33	15.37	1.24E-01		2.88E-01
	604.72	97.62	1.32E-02		6.15E-02
	795.86	85.46	5.30E-04		5.29E-02
	801.95	8.69	-5.13E-01		4.31E-01
	1038.61	0.99	-9.26E-01		5.37E+00
	1167.97	1.79	-1.41E+00		3.28E+00
	1365.19	3.02	7.91E-01		1.60E+00
Cs-137	661.66	85.10	1.61E-02	5.30E-02	5.30E-02
Eu-152	121.78	28.67	4.39E-02	1.25E-01	1.46E-01
	244.70	7.61	7.30E-02		5.40E-01
	295.94	0.45	7.02E+00		1.06E+01
	344.28	26.60	3.80E-02		1.25E-01
	367.79	0.86	-4.12E-01		3.93E+00
	411.12	2.24	1.37E+00		1.78E+00
	443.96	2.83	-6.17E-01		1.26E+00
	488.68	0.42	-8.31E+00		8.33E+00
	563.99	0.49	-7.63E+00		7.74E+00
	586.26	0.46	3.04E+00		1.24E+01
	678.62	0.47	-2.92E-01		8.64E+00
	688.67	0.86	2.56E+00		5.10E+00
	719.35	0.28	6.00E+00		1.52E+01
	778.90	12.96	-1.77E-01		3.00E-01
	810.45	0.32	-2.66E-01		1.20E+01
	867.37	4.26	-3.58E-01		1.09E+00
	919.33	0.43	-1.64E+00		1.03E+01
	964.08	14.65	-3.17E-01		4.65E-01
	1085.87	10.24	-1.46E-03		4.62E-01
	1089.74	1.73	1.50E+00		2.58E+00
	1112.07	13.69	-1.94E-01		4.42E-01
	1212.95	1.43	2.68E-02		4.16E+00
	1249.94	0.19	5.19E-01		2.93E+01
	1299.14	1.63	-1.95E+00		3.44E+00
	1408.01	21.07	7.08E-02		1.57E-01
	1457.64	0.50	1.55E+02		4.11E+01
	1528.10	0.28	5.62E+00		1.25E+01
Eu-154	123.07	40.40	3.99E-02	1.03E-01	1.03E-01
	247.93	6.89	-2.02E-01		4.86E-01
	591.76	4.95	2.52E-01		8.30E-01
	692.42	1.78	-4.07E-01		2.36E+00
	723.30	20.06	-8.75E-02		2.46E-01
	756.80	4.52	-3.32E-01		9.81E-01
	873.18	12.08	3.84E-02		3.64E-01

Analysis Report for 06-Sep-19-10038

L1-10208C-FSGS-016SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	2.79E-01	1.03E-01	5.20E-01
		1004.76		18.01	2.56E-01		2.85E-01
		1274.43		34.80	1.30E-01		1.79E-01
		1596.48		1.80	7.10E-01		2.45E+00
	Eu-155	45.30		1.31	-8.11E-01	2.12E-01	2.02E+01
		60.01		1.22	-1.39E+01		2.22E+01
		86.55		30.70	3.24E-02		2.29E-01
		105.31		21.10	-9.34E-02		2.12E-01
+	Ra-226	186.21	*	3.64	1.22E+00	6.49E-01	6.49E-01
	Pa-231	27.36		10.30	2.15E+00	1.58E+00	2.32E+00
		283.69		1.70	-2.85E+00		1.89E+00
		300.07		2.47	3.06E-01		1.58E+00
		302.65		2.20	-3.42E-01		1.64E+00
		330.06		1.40	7.72E-01		2.74E+00
+	U-235	143.76		10.96	8.64E-02	4.13E-02	3.31E-01
		163.33		5.08	-1.21E-01		6.59E-01
		185.71	*	57.20	7.74E-02		4.13E-02
		202.11		1.08	2.07E-01		3.20E+00
		205.31		5.01	-4.21E-01		6.57E-01
	Am-241	59.54		35.90	-3.72E-01	7.96E-01	7.96E-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-Aug-19-10019

L1-10208C-FIGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10019
Sample Description	: L1-10208C-FIGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.603E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 1:10:00PM
Acquisition Started	: 8/14/2019 11:20:45AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78767
Fill Height	: 1603.39 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 11:35:55AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10019

L1-10208C-FIGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.22	306 -	315	309.41	3.72E+01	15.88	9.08E+01	0.73
2	238.75	948 -	961	954.58	1.26E+02	19.47	8.89E+01	1.36
3	295.39	1175 -	1188	1180.85	5.58E+01	12.06	3.22E+01	0.96
4	352.08	1399 -	1413	1407.33	9.26E+01	13.23	2.84E+01	0.97
5	582.90	2323 -	2336	2329.70	5.75E+01	10.29	1.75E+01	1.20
6	609.15	2428 -	2441	2434.65	6.46E+01	10.87	1.94E+01	0.52
7	911.07	3635 -	3647	3641.72	3.83E+01	7.11	4.74E+00	0.67
8	1460.30	5826 -	5850	5839.16	3.86E+02	20.95	1.26E+01	1.67

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.95	1460.82	*	10.66	8.55E+00	5.94E-01
Tl-208	0.98	583.19	*	85.00	8.55E-02	1.62E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.99E-01	3.46E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.60E-01	1.14E-01
		87.35		3.97		
		89.78		1.46		

Analysis Report for 14-Aug-19-10019

L1-10208C-FIGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	609.32	*	45.49	1.85E-01	3.31E-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	2.36E-01	5.45E-02
		351.93	*	35.60	2.31E-01	3.78E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	4.59E-01	2.03E-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	2.54E-01	4.85E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

Analysis Report for 14-Aug-19-10019

L1-10208C-FIGS-001SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.958	8.55E+00	5.94E-01	
	Tl-208	0.987	8.55E-02	1.62E-02	
	Pb-212	0.998	1.99E-01	3.46E-02	
?	Pb212-XR	0.999	2.60E-01	1.14E-01	
	Bi-214	0.998	1.85E-01	3.31E-02	
	Pb-214	0.997	2.33E-01	3.11E-02	
?	Pb214-XR	0.999	4.59E-01	2.03E-01	
	Ac-228	0.999	2.54E-01	4.85E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 14-Aug-19-10019

L1-10208C-FIGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 11:35:55AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	2.54E-02	5.16E-02	5.16E-02
	BE-7	477.60		10.44	-8.62E-02	3.82E-01	3.82E-01
+	K-40	1460.82	*	10.66	8.55E+00	6.08E-01	6.08E-01
	Mn-54	834.85		99.98	-2.78E-02	4.64E-02	4.64E-02
	Co-60	1173.23		99.85	2.54E-02	5.47E-02	6.25E-02
		1332.49		99.98	-7.03E-03		5.47E-02
	Nb-94	702.65		99.81	1.58E-02	4.20E-02	4.20E-02
		871.09		99.89	4.44E-02		5.32E-02
	Ag-108m	79.13		6.60	-3.02E-01	3.32E-02	1.19E+00
		433.94		90.50	-6.80E-03		3.32E-02
		614.28		89.80	-3.64E-02		5.93E-02
		722.94		90.80	1.72E-02		5.17E-02
	Sb-125	176.31		6.84	-2.21E-01	1.12E-01	4.63E-01
		380.45		1.52	-9.42E-01		2.22E+00
		427.87		29.60	-6.58E-03		1.12E-01
		463.36		10.49	2.26E-01		3.57E-01
		600.60		17.65	-1.01E-01		2.26E-01
		606.71		4.98	2.01E+00		1.39E+00
		635.95		11.22	1.23E-01		3.84E-01

Analysis Report for 14-Aug-19-10019

L1-10208C-FIGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-4.59E-01	1.12E-01	2.20E+00
Ba-133	79.61	2.65	-4.52E-01	7.06E-02	2.89E+00
	81.00	32.90	-9.21E-02		1.93E-01
	276.40	7.16	-2.36E-01		4.77E-01
	302.85	18.34	4.63E-02		1.88E-01
	356.01	62.05	-3.52E-02		7.06E-02
	383.85	8.94	1.68E-01		3.71E-01
Cs-134	475.36	1.48	2.82E-01	4.91E-02	2.79E+00
	563.25	8.34	-5.92E-01		4.98E-01
	569.33	15.37	-1.56E-01		2.29E-01
	604.72	97.62	-2.79E-02		5.91E-02
	795.86	85.46	4.57E-02		4.91E-02
	801.95	8.69	-3.66E-01		5.19E-01
	1038.61	0.99	1.13E+00		5.34E+00
	1167.97	1.79	-1.09E-01		3.24E+00
	1365.19	3.02	8.97E-01		1.73E+00
Cs-137	661.66	85.10	-7.63E-04	5.00E-02	5.00E-02
Eu-152	121.78	28.67	-2.99E-02	1.19E-01	1.19E-01
	244.70	7.61	-1.05E-01		5.40E-01
	295.94	0.45	7.27E+00		9.86E+00
	344.28	26.60	4.46E-02		1.43E-01
	367.79	0.86	2.07E+00		4.45E+00
	411.12	2.24	3.30E-01		1.54E+00
	443.96	2.83	3.98E-01		1.19E+00
	488.68	0.42	5.71E+00		8.75E+00
	563.99	0.49	-1.12E+01		7.87E+00
	586.26	0.46	-6.93E+00		1.38E+01
	678.62	0.47	4.97E+00		8.80E+00
	688.67	0.86	-1.37E+00		4.59E+00
	719.35	0.28	3.79E+00		1.50E+01
	778.90	12.96	5.24E-02		3.94E-01
	810.45	0.32	-8.79E-01		1.54E+01
	867.37	4.26	4.67E-01		1.21E+00
	919.33	0.43	-9.98E-01		1.02E+01
	964.08	14.65	4.91E-01		4.86E-01
	1085.87	10.24	-2.52E-01		5.23E-01
	1089.74	1.73	1.40E+00		3.25E+00
	1112.07	13.69	-1.46E-01		3.90E-01
	1212.95	1.43	-5.93E-01		4.76E+00
	1249.94	0.19	-2.71E+01		3.05E+01
	1299.14	1.63	4.33E-01		2.94E+00
	1408.01	21.07	-6.26E-02		1.70E-01
	1457.64	0.50	1.89E+02		4.65E+01
	1528.10	0.28	3.79E-01		1.43E+01
Eu-154	123.07	40.40	3.62E-03	8.37E-02	8.37E-02
	247.93	6.89	-8.27E-02		4.93E-01
	591.76	4.95	-1.11E-01		7.97E-01
	692.42	1.78	-2.31E-01		2.44E+00
	723.30	20.06	5.29E-02		2.37E-01
	756.80	4.52	1.75E-01		1.06E+00
	873.18	12.08	-8.40E-02		4.62E-01

Analysis Report for 14-Aug-19-10019

L1-10208C-FIGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.71E-02	8.37E-02	4.66E-01
	1004.76	18.01	1.73E-01		2.83E-01
	1274.43	34.80	-5.94E-02		1.79E-01
	1596.48	1.80	-8.09E-01		1.36E+00
Eu-155	45.30	1.31	-7.60E+00	1.83E-01	1.15E+01
	60.01	1.22	1.98E+00		1.22E+01
	86.55	30.70	-1.93E-01		1.83E-01
	105.31	21.10	-1.71E-02		2.01E-01
Ra-226	186.21	3.64	6.94E-01	9.85E-01	9.85E-01
Pa-231	27.36	10.30	1.38E+00	1.34E+00	1.48E+00
	283.69	1.70	1.82E-01		1.96E+00
	300.07	2.47	4.87E-01		1.34E+00
	302.65	2.20	-3.98E-01		1.52E+00
	330.06	1.40	-5.03E-01		2.65E+00
U-235	143.76	10.96	-9.21E-02	6.19E-02	3.15E-01
	163.33	5.08	5.08E-01		6.59E-01
	185.71	57.20	3.10E-02		6.19E-02
	202.11	1.08	-1.79E+00		3.06E+00
	205.31	5.01	-6.15E-01		6.82E-01
Am-241	59.54	35.90	1.01E-01	4.28E-01	4.28E-01

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

Apex-Gamma

Analysis Report for 14-Aug-19-10020

L1-10208C-FIGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10020
Sample Description	: L1-10208C-FIGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.721E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 1:12:00PM
Acquisition Started	: 8/14/2019 11:20:57AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78768
Fill Height	: 1721.46 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 11:36:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10020

L1-10208C-FIGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.64	947 -	972	955.02	1.69E+02	24.81	9.69E+01	1.19
2	295.03	1175 -	1187	1180.33	6.20E+01	11.69	2.80E+01	0.79
3	338.37	1349 -	1360	1353.52	2.82E+01	9.12	2.18E+01	1.12
4	351.99	1401 -	1414	1407.97	1.12E+02	13.35	2.41E+01	0.93
5	583.23	2326 -	2338	2332.26	4.70E+01	8.71	1.10E+01	0.77
6	609.23	2428 -	2443	2436.17	7.59E+01	11.47	1.81E+01	0.98
7	1052.00	4202 -	4213	4207.17	7.73E+00	4.30	4.27E+00	0.55
8	1460.87	5829 -	5855	5843.86	3.46E+02	19.42	6.95E+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	1.00	1460.82	*	10.66	7.03E+00	4.99E-01
Tl-208	1.00	583.19	*	85.00	6.57E-02	1.28E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.60E-01	4.36E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.04E-01	3.32E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 14-Aug-19-10020

L1-10208C-FIGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.53E-01	5.18E-02
		351.93	*	35.60	2.67E-01	3.83E-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	2.07E-01	6.89E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 14-Aug-19-10020

L1-10208C-FIGS-002SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	7.03E+00	4.99E-01	
	Tl-208	1.000	6.57E-02	1.28E-02	
X	Bi-211	0.873			
	Pb-212	1.000	2.60E-01	4.36E-02	
	Bi-214	0.999	2.04E-01	3.32E-02	
	Pb-214	0.998	2.62E-01	3.08E-02	
	Ac-228	1.000	2.07E-01	6.89E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 14-Aug-19-10020

L1-10208C-FIGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 11:36:00AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
7	1052.00	8.58796E-03	55.66		

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	4.15E-02	4.99E-02	4.99E-02
	BE-7	477.60		10.44	2.47E-01	4.62E-01	4.62E-01
+	K-40	1460.82	*	10.66	7.03E+00	4.44E-01	4.44E-01
	Mn-54	834.85		99.98	3.34E-03	4.87E-02	4.87E-02
	Co-60	1173.23		99.85	-2.63E-02	5.72E-02	6.14E-02
		1332.49		99.98	-1.58E-02		5.72E-02
	Nb-94	702.65		99.81	1.51E-02	3.80E-02	3.80E-02
		871.09		99.89	1.00E-02		4.56E-02
	Ag-108m	79.13		6.60	2.00E-01	4.12E-02	1.58E+00
		433.94		90.50	-3.81E-02		4.12E-02
		614.28		89.80	-1.91E-02		7.34E-02
		722.94		90.80	5.53E-02		5.43E-02
	Sb-125	176.31		6.84	-1.71E-01	1.27E-01	5.09E-01
		380.45		1.52	-1.66E+00		2.46E+00
		427.87		29.60	8.74E-02		1.27E-01
		463.36		10.49	3.20E-01		3.81E-01
		600.60		17.65	1.90E-01		2.55E-01
		606.71		4.98	2.10E+00		1.38E+00

Analysis Report for 14-Aug-19-10020

L1-10208C-FIGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	635.95	11.22	-1.04E-01	1.27E-01	3.85E-01
	671.44	1.79	-1.98E+00		2.33E+00
Ba-133	79.61	2.65	-3.27E-02	8.17E-02	3.83E+00
	81.00	32.90	-1.01E-01		2.82E-01
	276.40	7.16	-8.62E-02		4.62E-01
	302.85	18.34	1.24E-01		2.03E-01
	356.01	62.05	-7.18E-02		8.17E-02
	383.85	8.94	-4.09E-02		4.34E-01
Cs-134	475.36	1.48	3.29E+00	5.59E-02	3.13E+00
	563.25	8.34	2.05E-01		4.68E-01
	569.33	15.37	6.04E-02		2.50E-01
	604.72	97.62	-3.58E-03		6.49E-02
	795.86	85.46	4.50E-02		5.59E-02
	801.95	8.69	3.26E-01		5.26E-01
	1038.61	0.99	-2.83E-01		5.09E+00
	1167.97	1.79	-2.09E+00		3.29E+00
	1365.19	3.02	1.54E-01		1.18E+00
Cs-137	661.66	85.10	6.18E-02	5.68E-02	5.68E-02
Eu-152	121.78	28.67	-1.48E-02	1.21E-01	1.52E-01
	244.70	7.61	-1.34E-01		5.29E-01
	295.94	0.45	7.45E+00		1.04E+01
	344.28	26.60	-3.79E-02		1.21E-01
	367.79	0.86	-1.32E+00		3.63E+00
	411.12	2.24	9.49E-01		1.94E+00
	443.96	2.83	-3.74E-01		1.38E+00
	488.68	0.42	1.01E+00		8.83E+00
	563.99	0.49	1.07E+00		7.86E+00
	586.26	0.46	1.19E+01		1.19E+01
	678.62	0.47	-4.86E-01		8.34E+00
	688.67	0.86	2.46E+00		4.62E+00
	719.35	0.28	-7.85E+00		1.53E+01
	778.90	12.96	-1.44E-01		3.07E-01
	810.45	0.32	-4.58E+00		1.47E+01
	867.37	4.26	8.19E-04		1.10E+00
	919.33	0.43	-1.58E+01		1.02E+01
	964.08	14.65	5.07E-01		4.14E-01
	1085.87	10.24	2.11E-01		6.45E-01
	1089.74	1.73	1.91E+00		3.72E+00
	1112.07	13.69	-3.08E-01		4.17E-01
	1212.95	1.43	-1.87E+00		4.49E+00
	1249.94	0.19	1.54E+00		2.95E+01
	1299.14	1.63	1.98E+00		3.29E+00
	1408.01	21.07	1.58E-01		2.59E-01
	1457.64	0.50	1.57E+02		4.06E+01
	1528.10	0.28	4.77E+00		1.16E+01
Eu-154	123.07	40.40	-2.54E-02	1.05E-01	1.05E-01
	247.93	6.89	-1.06E-02		5.40E-01
	591.76	4.95	-1.60E-01		8.14E-01
	692.42	1.78	3.73E-01		2.27E+00
	723.30	20.06	2.10E-01		2.46E-01
	756.80	4.52	2.07E-01		1.01E+00

Analysis Report for 14-Aug-19-10020

L1-10208C-FIGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	-6.52E-01	1.05E-01	3.43E-01
	996.29	10.48	2.61E-01		4.61E-01
	1004.76	18.01	1.11E-01		2.78E-01
	1274.43	34.80	-2.47E-01		1.52E-01
	1596.48	1.80	-2.99E+00		2.22E+00
Eu-155	45.30	1.31	-9.72E-01	2.40E-01	2.08E+01
	60.01	1.22	1.05E+01		2.31E+01
	86.55	30.70	-1.43E-02		2.40E-01
	105.31	21.10	-1.69E-01		2.40E-01
Ra-226	186.21	3.64	-1.50E-01	1.03E+00	1.03E+00
Pa-231	27.36	10.30	2.67E+00	1.58E+00	2.49E+00
	283.69	1.70	-5.74E-01		2.02E+00
	300.07	2.47	2.53E-01		1.58E+00
	302.65	2.20	1.03E+00		1.71E+00
	330.06	1.40	1.03E+00		2.66E+00
U-235	143.76	10.96	2.46E-01	6.49E-02	3.59E-01
	163.33	5.08	-1.60E-01		7.20E-01
	185.71	57.20	-6.74E-02		6.49E-02
	202.11	1.08	5.17E-01		3.51E+00
	205.31	5.01	-5.92E-01		7.45E-01
Am-241	59.54	35.90	7.59E-02	7.84E-01	7.84E-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 16-Aug-19-10021
L1-10208C-FIGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 16-Aug-19-10021
Sample Description	: L1-10208C-FIGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.721E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 1:12:00PM
Acquisition Started	: 8/16/2019 12:34:11PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1800.7 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	: 8/16/2019
Efficiency Calibration Description	:
Sample Number	: 78892
Fill Height	: 1721.46 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/16/2019 1:04:14PM

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

Data Validated
1430 8-16-19

Analysis Report for 16-Aug-19-10021

L1-10208C-FIGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.20	152 -	158	155.00	8.21E+01	25.44	2.91E+02	0.73
2	238.64	473 -	481	477.47	2.92E+02	29.62	2.71E+02	1.16
3	295.22	587 -	595	590.50	1.08E+02	19.56	1.27E+02	1.17
4	338.28	671 -	681	676.54	9.96E+01	17.88	9.14E+01	1.37
5	351.91	698 -	708	703.76	2.69E+02	21.88	8.79E+01	1.20
6	463.03	920 -	931	925.82	3.35E+01	14.96	7.45E+01	0.55
7	583.10	1160 -	1171	1165.80	1.11E+02	17.63	7.80E+01	1.16
8	609.17	1214 -	1223	1217.92	1.87E+02	16.97	4.29E+01	1.78
9	911.09	1815 -	1828	1821.64	8.72E+01	13.50	3.38E+01	1.48
10	968.86	1932 -	1941	1937.18	3.85E+01	11.34	3.95E+01	1.55
11	1120.50	2233 -	2246	2240.55	5.42E+01	11.45	2.78E+01	1.12
12	1460.63	2915 -	2928	2921.32	8.46E+02	29.62	1.09E+01	1.98

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.72E+00	4.30E-01
Tl-208	0.99	583.19	*	85.00	6.99E-02	1.19E-02
Bi-211	0.89	351.07	*	13.02	7.90E-01	9.04E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.01E-01	2.61E-02

Analysis Report for 16-Aug-19-10021

L1-10208C-FIGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	1.00	300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.65E-01	8.66E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.82	609.32	*	45.49	2.26E-01	2.46E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.96E-01	6.37E-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	1.00	241.99		7.25		
		295.22	*	18.42	1.97E-01	3.92E-02
		351.93	*	35.60	2.89E-01	3.29E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	4.67E-01	1.54E-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	3.28E-01	6.48E-02
		409.46		1.92		
		463.00	*	4.40	3.50E-01	1.59E-01
		794.95		4.25		
		911.20	*	25.80	2.42E-01	3.88E-02
		964.77		4.99		
		968.97	*	15.80	1.81E-01	5.40E-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 16-Aug-19-10021

L1-10208C-FIGS-002SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.994	7.72E+00	4.30E-01	
X	Sb-125	0.419			
	Tl-208	0.999	6.99E-02	1.19E-02	
	Bi-211	0.894	2.50E-01	1.40E-01	
	Pb-212	1.000	2.01E-01	2.61E-02	
?	Pb212-XR	0.999	2.65E-01	8.66E-02	
	Bi-214	0.821	2.35E-01	2.30E-02	
	Pb-214	1.000	1.97E-01	3.92E-02	
?	Pb214-XR	0.999	4.67E-01	1.54E-01	
	Ac-228	0.999	2.45E-01	2.79E-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 16-Aug-19-10021

L1-10208C-FIGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/16/2019 1:04:14PM
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	6.57E-02	3.75E-02	3.75E-02
	BE-7	477.60		10.44	3.64E-01	2.78E-01	2.78E-01
+	K-40	1460.82	*	10.66	7.72E+00	1.98E-01	1.98E-01
	Mn-54	834.85		99.98	2.52E-03	2.86E-02	2.86E-02
	Co-60	1173.23		99.85	8.20E-03	3.53E-02	4.00E-02
		1332.49		99.98	7.91E-03		3.53E-02
	Nb-94	702.65		99.81	4.96E-03	2.80E-02	2.80E-02
		871.09		99.89	2.46E-02		2.86E-02
	Ag-108m	79.13		6.60	-1.99E-01	2.77E-02	8.14E-01
		433.94		90.50	1.85E-02		2.77E-02
		614.28		89.80	-1.91E-02		3.81E-02
		722.94		90.80	3.23E-03		3.28E-02
	Sb-125	176.31		6.84	8.31E-02	7.55E-02	3.71E-01
		380.45		1.52	1.17E-01		1.48E+00
		427.87		29.60	-1.57E-02		7.55E-02
		463.36	*	10.49	1.47E-01		2.19E-01
		600.60		17.65	6.08E-02		1.51E-01
		606.71		4.98	-1.26E+00		8.99E-01
		635.95		11.22	-6.87E-02		2.13E-01

Analysis Report for 16-Aug-19-10021

L1-10208C-FIGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.24E-01	7.55E-02	1.37E+00
Ba-133	79.61	2.65	-7.45E-01	5.05E-02	1.91E+00
	81.00	32.90	-1.91E-01		1.24E-01
	276.40	7.16	3.63E-02		3.24E-01
	302.85	18.34	5.38E-02		1.30E-01
	356.01	62.05	-4.51E-02		5.05E-02
	383.85	8.94	1.13E-01		2.57E-01
Cs-134	475.36	1.48	2.29E+00	3.32E-02	1.88E+00
	563.25	8.34	-7.61E-02		2.86E-01
	569.33	15.37	4.63E-02		1.63E-01
	604.72	97.62	-7.54E-02		4.09E-02
	795.86	85.46	1.30E-02		3.32E-02
	801.95	8.69	-2.69E-01		2.82E-01
	1038.61	0.99	-3.54E-01		3.52E+00
	1167.97	1.79	5.31E-01		2.25E+00
	1365.19	3.02	1.39E-01		8.41E-01
Cs-137	661.66	85.10	5.03E-02	3.87E-02	3.87E-02
Eu-152	121.78	28.67	1.63E-02	8.42E-02	8.42E-02
	244.70	7.61	-1.57E-01		3.18E-01
	295.94	0.45	5.30E+00		6.34E+00
	344.28	26.60	-1.19E-02		8.58E-02
	367.79	0.86	1.85E+00		2.71E+00
	411.12	2.24	-1.76E-01		1.05E+00
	443.96	2.83	-2.26E-01		7.58E-01
	488.68	0.42	8.79E-01		5.61E+00
	563.99	0.49	-2.89E-01		5.00E+00
	586.26	0.46	-1.17E-01		8.43E+00
	678.62	0.47	2.59E+00		5.42E+00
	688.67	0.86	-5.71E-01		2.82E+00
	719.35	0.28	2.80E+00		9.39E+00
	778.90	12.96	-1.28E-01		2.04E-01
	810.45	0.32	2.01E+00		8.81E+00
	867.37	4.26	-4.05E-01		6.29E-01
	919.33	0.43	-2.31E+00		6.78E+00
	964.08	14.65	4.95E-02		2.63E-01
	1085.87	10.24	-3.24E-01		3.17E-01
	1089.74	1.73	-1.36E+00		1.97E+00
	1112.07	13.69	-3.80E-02		2.34E-01
	1212.95	1.43	-1.49E+00		2.63E+00
	1249.94	0.19	4.48E-01		1.95E+01
	1299.14	1.63	-1.22E+00		2.13E+00
	1408.01	21.07	7.53E-02		1.31E-01
	1457.64	0.50	-1.61E+01		2.78E+01
	1528.10	0.28	-3.02E+00		7.19E+00
Eu-154	123.07	40.40	3.09E-03	5.99E-02	5.99E-02
	247.93	6.89	-1.03E-01		3.03E-01
	591.76	4.95	-2.73E-01		4.91E-01
	692.42	1.78	6.74E-01		1.42E+00
	723.30	20.06	1.04E-02		1.51E-01
	756.80	4.52	-1.17E-01		5.74E-01
	873.18	12.08	-1.22E-01		2.23E-01

Analysis Report for 16-Aug-19-10021

L1-10208C-FIGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-6.32E-04	5.99E-02	2.89E-01
	1004.76	18.01	-1.76E-02		1.74E-01
	1274.43	34.80	-1.23E-02		1.04E-01
	1596.48	1.80	-3.14E-01		1.31E+00
Eu-155	45.30	1.31	-1.50E+00	1.28E-01	8.00E+00
	60.01	1.22	-3.68E+00		8.80E+00
	86.55	30.70	5.42E-02		1.28E-01
	105.31	21.10	8.80E-03		1.32E-01
Ra-226	186.21	3.64	8.80E-01	7.47E-01	7.47E-01
Pa-231	27.36	10.30	5.82E-01	7.80E-01	7.80E-01
	283.69	1.70	-2.78E-01		1.24E+00
	300.07	2.47	-2.56E-01		9.08E-01
	302.65	2.20	4.48E-01		1.08E+00
	330.06	1.40	9.18E-01		1.71E+00
U-235	143.76	10.96	-8.20E-02	4.76E-02	1.99E-01
	163.33	5.08	2.32E-01		5.01E-01
	185.71	57.20	5.77E-02		4.76E-02
	202.11	1.08	7.76E-01		2.32E+00
	205.31	5.01	-5.27E-01		4.76E-01
Am-241	59.54	35.90	3.25E-02	3.14E-01	3.14E-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-Aug-19-10021

L1-10208C-FIGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 14-Aug-19-10021
Sample Description	: L1-10208C-FIGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.547E+03 grams
Facility	: Default
Sample Taken On	: 8/13/2019 1:14:00PM
Acquisition Started	: 8/14/2019 11:40:09AM
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	: 8/14/2019
Efficiency Calibration Description	:
Sample Number	: 78769
Fill Height	: 1547.21 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 8/14/2019 11:55:12AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 8/14/19 - 1700

J Graham

Analysis Report for 14-Aug-19-10021

L1-10208C-FIGS-003SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	238.74	949 -	973	955.42	1.55E+02	13.31	5.15E+01	1.10
m	2	241.86	949 -	973	967.89	4.28E+01	7.80	4.00E+01	1.10
	3	295.21	1175 -	1188	1181.06	6.75E+01	13.19	3.65E+01	1.27
	4	351.98	1402 -	1413	1407.90	8.09E+01	12.20	2.71E+01	0.78
	5	583.18	2324 -	2339	2332.06	4.50E+01	9.65	1.60E+01	0.54
	6	609.38	2428 -	2446	2436.79	1.08E+02	11.77	9.19E+00	1.22
	7	911.29	3639 -	3650	3644.20	2.62E+01	6.79	7.79E+00	0.65
	8	1460.75	5831 -	5855	5843.39	3.72E+02	20.57	1.25E+01	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	7.75E+00	5.45E-01
Tl-208	1.00	583.19	*	85.00	6.43E-02	1.43E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.43E-01	2.86E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.96E-01	3.69E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 14-Aug-19-10021

L1-10208C-FIGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	4.05E-01	8.06E-02
		295.22	*	18.42	2.80E-01	5.92E-02
		351.93	*	35.60	1.97E-01	3.35E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.65E-01	4.34E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 14-Aug-19-10021

L1-10208C-FIGS-003SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	7.75E+00	5.45E-01	
	Tl-208	1.000	6.43E-02	1.43E-02	
X	Bi-211	0.877			
	Pb-212	0.998	2.43E-01	2.86E-02	
	Bi-214	1.000	2.96E-01	3.69E-02	
	Pb-214	0.999	2.39E-01	2.74E-02	
	Ac-228	1.000	1.65E-01	4.34E-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 14-Aug-19-10021

L1-10208C-FIGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 8/14/2019 11:55:12AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.51E-02	5.18E-02	5.18E-02
	BE-7	477.60		10.44	4.17E-01	4.16E-01	4.16E-01
+	K-40	1460.82	*	10.66	7.75E+00	5.68E-01	5.68E-01
	Mn-54	834.85		99.98	5.42E-02	5.49E-02	5.49E-02
	Co-60	1173.23		99.85	4.65E-02	6.15E-02	6.29E-02
		1332.49		99.98	4.88E-02		6.15E-02
	Nb-94	702.65		99.81	-8.24E-03	4.16E-02	4.51E-02
		871.09		99.89	1.75E-02		4.16E-02
	Ag-108m	79.13		6.60	-1.31E-01	3.98E-02	1.65E+00
		433.94		90.50	-2.23E-02		3.98E-02
		614.28		89.80	-1.77E-02		8.01E-02
		722.94		90.80	2.62E-02		4.81E-02
	Sb-125	176.31		6.84	5.67E-01	1.45E-01	5.31E-01
		380.45		1.52	5.07E-01		2.48E+00
		427.87		29.60	7.86E-02		1.45E-01
		463.36		10.49	-7.72E-02		4.13E-01
		600.60		17.65	1.82E-01		2.48E-01
		606.71		4.98	2.84E+00		1.49E+00
		635.95		11.22	-2.86E-01		3.53E-01

Analysis Report for 14-Aug-19-10021

L1-10208C-FIGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.91E-01	1.45E-01	2.17E+00
Ba-133	79.61	2.65	2.08E+00	8.12E-02	4.07E+00
	81.00	32.90	-4.11E-01		2.67E-01
	276.40	7.16	2.49E-01		5.31E-01
	302.85	18.34	-5.28E-02		1.97E-01
	356.01	62.05	-8.04E-02		8.12E-02
	383.85	8.94	-1.88E-01		4.14E-01
Cs-134	475.36	1.48	1.58E+00	5.51E-02	2.76E+00
	563.25	8.34	3.56E-03		4.21E-01
	569.33	15.37	-1.12E-01		2.61E-01
	604.72	97.62	3.13E-03		7.03E-02
	795.86	85.46	5.16E-02		5.51E-02
	801.95	8.69	-4.01E-01		5.16E-01
	1038.61	0.99	1.78E+00		5.88E+00
	1167.97	1.79	7.76E-01		3.29E+00
	1365.19	3.02	6.98E-01		1.63E+00
Cs-137	661.66	85.10	6.58E-03	5.03E-02	5.03E-02
Eu-152	121.78	28.67	5.03E-02	1.38E-01	1.50E-01
	244.70	7.61	-1.98E-01		5.22E-01
	295.94	0.45	1.45E+01		1.07E+01
	344.28	26.60	4.23E-02		1.38E-01
	367.79	0.86	1.00E+00		4.45E+00
	411.12	2.24	-1.36E+00		1.54E+00
	443.96	2.83	-3.39E-01		1.34E+00
	488.68	0.42	2.90E+00		8.72E+00
	563.99	0.49	1.25E+00		7.15E+00
	586.26	0.46	-5.15E+00		1.20E+01
	678.62	0.47	3.90E+00		8.40E+00
	688.67	0.86	3.11E+00		4.66E+00
	719.35	0.28	2.81E+00		1.27E+01
	778.90	12.96	2.28E-01		3.67E-01
	810.45	0.32	-5.93E+00		1.26E+01
	867.37	4.26	-9.06E-01		9.36E-01
	919.33	0.43	-8.89E+00		1.08E+01
	964.08	14.65	4.32E-01		4.89E-01
	1085.87	10.24	3.25E-01		4.78E-01
	1089.74	1.73	-1.79E-01		2.93E+00
	1112.07	13.69	-3.51E-02		4.64E-01
	1212.95	1.43	2.82E+00		4.95E+00
	1249.94	0.19	1.58E+00		3.03E+01
	1299.14	1.63	-2.11E+00		3.44E+00
	1408.01	21.07	-9.42E-03		2.00E-01
	1457.64	0.50	1.72E+02		4.35E+01
	1528.10	0.28	5.10E-01		1.47E+01
Eu-154	123.07	40.40	7.02E-03	1.06E-01	1.06E-01
	247.93	6.89	2.51E-01		4.91E-01
	591.76	4.95	-2.12E-01		7.43E-01
	692.42	1.78	1.54E-01		2.45E+00
	723.30	20.06	1.18E-01		2.23E-01
	756.80	4.52	8.23E-01		9.55E-01
	873.18	12.08	-1.93E-01		3.32E-01

Analysis Report for 14-Aug-19-10021

L1-10208C-FIGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.93E-01	1.06E-01	4.94E-01
	1004.76	18.01	9.14E-02		3.01E-01
	1274.43	34.80	-6.00E-02		1.56E-01
	1596.48	1.80	1.19E+00		2.29E+00
Eu-155	45.30	1.31	1.25E+01	2.24E-01	2.07E+01
	60.01	1.22	-2.66E+01		2.00E+01
	86.55	30.70	2.24E-02		2.38E-01
	105.31	21.10	1.24E-02		2.24E-01
Ra-226	186.21	3.64	6.98E-01	1.11E+00	1.11E+00
Pa-231	27.36	10.30	2.02E+00	1.62E+00	2.38E+00
	283.69	1.70	-5.14E-01		2.02E+00
	300.07	2.47	-4.07E-01		1.62E+00
	302.65	2.20	-8.24E-01		1.62E+00
	330.06	1.40	6.96E-01		2.80E+00
U-235	143.76	10.96	2.29E-01	7.12E-02	3.69E-01
	163.33	5.08	-4.03E-02		7.62E-01
	185.71	57.20	6.56E-02		7.12E-02
	202.11	1.08	1.06E-01		3.55E+00
	205.31	5.01	7.48E-02		7.56E-01
Am-241	59.54	35.90	-1.18E-01	7.54E-01	7.54E-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 05-Sep-19-10028
L1-10208C-FIGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 05-Sep-19-10028
Sample Description	: L1-10208C-FIGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.428E+03 grams
Facility	: Default
Sample Taken On	: 9/4/2019 1:30:00PM
Acquisition Started	: 9/5/2019 10:59:41AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 9/5/2019
Efficiency Calibration Description	:
Sample Number	: 79264
Fill Height	: 1428.30 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/5/2019 11:14:44AM

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

Data Validated
1000 9-6-19

Analysis Report for 05-Sep-19-10028

L1-10208C-FIGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.80	948 -	961	954.80	1.20E+02	17.87	7.21E+01	1.26
2	295.19	1174 -	1186	1180.03	4.18E+01	12.19	4.02E+01	0.64
3	338.37	1347 -	1357	1352.54	2.92E+01	8.91	2.08E+01	1.15
4	352.20	1398 -	1416	1407.79	8.98E+01	14.21	3.33E+01	1.62
5	583.21	2323 -	2337	2330.95	4.45E+01	10.17	2.05E+01	0.86
6	609.16	2429 -	2441	2434.70	5.44E+01	9.35	1.26E+01	0.46
7	910.88	3635 -	3648	3640.97	3.55E+01	7.29	6.50E+00	0.61
8	968.79	3867 -	3879	3872.58	2.61E+01	6.84	7.87E+00	0.88
9	1119.56	4470 -	4482	4475.66	2.35E+01	6.38	6.50E+00	0.82
10	1459.96	5828 -	5851	5837.78	3.49E+02	19.43	7.78E+00	1.44

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	8.00E+00	5.65E-01
Tl-208	1.00	583.19	*	85.00	6.81E-02	1.61E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.93E-01	3.27E-02
		300.09		3.30		
Bi-214	0.98	609.32	*	45.49	1.60E-01	2.92E-02
		768.36		4.89		

Analysis Report for 05-Sep-19-10028

L1-10208C-FIGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.98	806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	3.20E-01	8.79E-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	1.81E-01	5.48E-02
		351.93	*	35.60	2.30E-01	4.07E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.29E-01	7.24E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.43E-01	5.11E-02
		964.77		4.99		
		968.97	*	15.80	3.05E-01	8.10E-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 05-Sep-19-10028

L1-10208C-FIGS-004SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.888	8.00E+00	5.65E-01	
Tl-208	1.000	6.81E-02	1.61E-02	
Pb-212	0.996	1.93E-01	3.27E-02	
Bi-214	0.987	1.76E-01	2.77E-02	
Pb-214	0.994	2.12E-01	3.27E-02	
Ac-228	0.994	2.52E-01	3.71E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 05-Sep-19-10028

L1-10208C-FIGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/5/2019 11:14:44AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	9.43E-02	5.99E-02	5.99E-02
	BE-7	477.60		10.44	3.25E-01	4.69E-01	4.69E-01
+	K-40	1460.82	*	10.66	8.00E+00	4.79E-01	4.79E-01
	Mn-54	834.85		99.98	-2.73E-02	4.23E-02	4.23E-02
	Co-60	1173.23		99.85	-5.67E-02	5.54E-02	6.20E-02
		1332.49		99.98	3.01E-02		5.54E-02
	Nb-94	702.65		99.81	5.87E-03	4.07E-02	4.26E-02
		871.09		99.89	-1.00E-02		4.07E-02
	Ag-108m	79.13		6.60	8.53E-01	4.30E-02	1.27E+00
		433.94		90.50	-1.93E-02		4.30E-02
		614.28		89.80	1.55E-03		5.43E-02
		722.94		90.80	-7.96E-03		5.39E-02
	Sb-125	176.31		6.84	-1.41E-01	1.23E-01	4.36E-01
		380.45		1.52	1.02E+00		2.23E+00
		427.87		29.60	2.21E-03		1.23E-01
		463.36		10.49	7.93E-02		4.23E-01
		600.60		17.65	-9.98E-02		2.29E-01
		606.71		4.98	1.46E+00		1.32E+00
		635.95		11.22	4.85E-02		4.00E-01

Analysis Report for 05-Sep-19-10028

L1-10208C-FIGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-9.00E-01	1.23E-01	2.07E+00
Ba-133	79.61	2.65	2.17E+00	7.45E-02	3.09E+00
	81.00	32.90	-2.88E-01		2.08E-01
	276.40	7.16	2.68E-01		4.67E-01
	302.85	18.34	1.30E-01		1.79E-01
	356.01	62.05	-5.18E-03		7.45E-02
	383.85	8.94	-3.60E-02		3.56E-01
Cs-134	475.36	1.48	2.64E+00	5.41E-02	3.33E+00
	563.25	8.34	-2.90E-01		5.01E-01
	569.33	15.37	-1.43E-01		2.28E-01
	604.72	97.62	-1.85E-02		6.15E-02
	795.86	85.46	3.53E-02		5.41E-02
	801.95	8.69	-9.20E-02		4.82E-01
	1038.61	0.99	1.98E+00		5.43E+00
	1167.97	1.79	6.48E-01		3.65E+00
	1365.19	3.02	-6.29E-01		1.55E+00
Cs-137	661.66	85.10	5.38E-02	5.67E-02	5.67E-02
Eu-152	121.78	28.67	-2.10E-02	1.16E-01	1.18E-01
	244.70	7.61	6.18E-01		5.39E-01
	295.94	0.45	5.65E+00		9.70E+00
	344.28	26.60	-3.79E-02		1.16E-01
	367.79	0.86	7.72E-01		3.71E+00
	411.12	2.24	4.30E-01		1.56E+00
	443.96	2.83	-5.62E-01		1.17E+00
	488.68	0.42	8.85E+00		1.04E+01
	563.99	0.49	-1.05E+01		7.78E+00
	586.26	0.46	-6.25E+00		1.35E+01
	678.62	0.47	-1.83E+00		7.77E+00
	688.67	0.86	-1.80E+00		4.80E+00
	719.35	0.28	6.40E+00		1.73E+01
	778.90	12.96	-2.35E-01		3.04E-01
	810.45	0.32	-9.48E+00		1.18E+01
	867.37	4.26	-4.31E-01		8.84E-01
	919.33	0.43	8.18E+00		1.14E+01
	964.08	14.65	-1.09E-01		4.86E-01
	1085.87	10.24	1.98E-01		6.31E-01
	1089.74	1.73	-3.75E-01		3.46E+00
	1112.07	13.69	-3.79E-01		4.17E-01
	1212.95	1.43	-3.16E+00		4.87E+00
	1249.94	0.19	-5.87E+00		3.16E+01
	1299.14	1.63	1.69E+00		3.70E+00
	1408.01	21.07	1.97E-02		1.95E-01
	1457.64	0.50	1.72E+02		4.58E+01
	1528.10	0.28	1.92E-01		1.40E+01
Eu-154	123.07	40.40	-3.30E-02	8.31E-02	8.31E-02
	247.93	6.89	1.94E-01		4.99E-01
	591.76	4.95	2.72E-01		8.62E-01
	692.42	1.78	9.48E-01		2.44E+00
	723.30	20.06	-3.66E-02		2.44E-01
	756.80	4.52	-6.06E-01		9.73E-01
	873.18	12.08	2.13E-01		4.14E-01

Analysis Report for 05-Sep-19-10028

L1-10208C-FIGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.75E-02	8.31E-02	5.75E-01
	1004.76	18.01	5.14E-02		3.40E-01
	1274.43	34.80	-2.47E-01		1.51E-01
	1596.48	1.80	4.63E-01		2.27E+00
Eu-155	45.30	1.31	2.97E+00	1.96E-01	1.09E+01
	60.01	1.22	7.00E+00		1.27E+01
	86.55	30.70	1.11E-01		1.99E-01
	105.31	21.10	8.33E-02		1.96E-01
Ra-226	186.21	3.64	5.30E-01	9.63E-01	9.63E-01
Pa-231	27.36	10.30	8.01E-01	1.29E+00	1.29E+00
	283.69	1.70	-1.20E+00		2.00E+00
	300.07	2.47	-8.01E-01		1.33E+00
	302.65	2.20	9.56E-01		1.48E+00
	330.06	1.40	-1.09E+00		2.82E+00
U-235	143.76	10.96	3.63E-02	6.16E-02	2.96E-01
	163.33	5.08	2.17E-01		6.69E-01
	185.71	57.20	2.28E-02		6.16E-02
	202.11	1.08	-1.71E+00		2.88E+00
	205.31	5.01	-3.37E-01		6.26E-01
Am-241	59.54	35.90	1.74E-01	4.46E-01	4.46E-01

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

Apex-Gamma

Analysis Report for 05-Sep-19-10029
L1-10208C-QIGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 05-Sep-19-10029
Sample Description	: L1-10208C-QIGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.510E+03 grams
Facility	: Default
Sample Taken On	: 9/4/2019 1:30:00PM
Acquisition Started	: 9/5/2019 12:01:44PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 9/5/2019
Efficiency Calibration Description	:
Sample Number	: 79267
Fill Height	: 1509.79 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/5/2019 12:16:46PM

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

Data Validated
1000 9-6-19

Analysis Report for 05-Sep-19-10029

L1-10208C-QIGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.75	948 -	961	954.56	1.35E+02	18.80	7.91E+01	1.33
2	295.32	1173 -	1188	1180.58	5.34E+01	13.73	4.26E+01	1.08
3	351.99	1401 -	1414	1406.99	8.85E+01	11.79	1.85E+01	1.16
4	477.83	1902 -	1916	1909.79	4.13E+01	9.46	1.67E+01	0.45
5	511.04	2037 -	2047	2042.51	2.36E+01	9.35	2.64E+01	1.03
6	582.91	2322 -	2339	2329.76	6.60E+01	11.16	1.80E+01	0.48
7	609.25	2429 -	2442	2435.04	8.35E+01	11.17	1.45E+01	1.28
8	661.45	2639 -	2649	2643.70	2.31E+01	5.68	3.87E+00	0.47
9	910.98	3634 -	3648	3641.37	3.04E+01	9.21	1.86E+01	0.32
10	1460.19	5828 -	5850	5838.70	3.29E+02	18.42	2.67E+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
An Pk	1.00	511.00	*	100.00	2.80E-02	1.13E-02
BE-7	0.99	477.60	*	10.44	4.49E-01	1.08E-01
K-40	0.93	1460.82	*	10.66	7.42E+00	5.25E-01
Cs-137	0.99	661.66	*	85.10	3.80E-02	9.62E-03
Tl-208	0.98	583.19	*	85.00	9.96E-02	1.79E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.15E-01	3.46E-02

Analysis Report for 05-Sep-19-10029

L1-10208C-QIGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.43E-01	3.56E-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	2.29E-01	6.16E-02
		351.93	*	35.60	2.23E-01	3.47E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.05E-01	6.27E-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 05-Sep-19-10029

L1-10208C-QIGS-004SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	1.000	2.80E-02	1.13E-02	
	BE-7	0.992	4.49E-01	1.08E-01	
	K-40	0.938	7.42E+00	5.25E-01	
	Cs-137	0.993	3.80E-02	9.62E-03	
	Tl-208	0.988	9.96E-02	1.79E-02	
X	Bi-211	0.872			
	Pb-212	0.998	2.15E-01	3.46E-02	
	Bi-214	1.000	2.43E-01	3.56E-02	
	Pb-214	0.999	2.25E-01	3.03E-02	
	Ac-228	0.998	2.05E-01	6.27E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 05-Sep-19-10029

L1-10208C-QIGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/5/2019 12:16:46PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	2.80E-02	3.56E-02	3.56E-02
+	BE-7	477.60	*	10.44	4.49E-01	2.87E-01	2.87E-01
+	K-40	1460.82	*	10.66	7.42E+00	3.04E-01	3.04E-01
	Mn-54	834.85		99.98	-4.14E-02	4.48E-02	4.48E-02
	Co-60	1173.23		99.85	1.01E-02	5.20E-02	7.00E-02
		1332.49		99.98	-4.57E-03		5.20E-02
	Nb-94	702.65		99.81	1.76E-02	4.68E-02	4.68E-02
		871.09		99.89	-2.51E-02		4.76E-02
	Ag-108m	79.13		6.60	1.05E+00	3.84E-02	1.23E+00
		433.94		90.50	9.89E-04		3.84E-02
		614.28		89.80	-1.15E-02		6.45E-02
		722.94		90.80	-4.91E-03		5.62E-02
	Sb-125	176.31		6.84	-8.87E-02	1.05E-01	4.42E-01
		380.45		1.52	1.44E+00		2.35E+00
		427.87		29.60	2.05E-03		1.05E-01
		463.36		10.49	6.33E-02		3.63E-01
		600.60		17.65	-1.82E-01		2.23E-01
		606.71		4.98	1.99E+00		1.49E+00
		635.95		11.22	6.14E-02		3.49E-01

Analysis Report for 05-Sep-19-10029

L1-10208C-QIGS-004SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	1.29E-01	1.05E-01	2.59E+00
	Ba-133	79.61		2.65	1.54E+00	6.24E-02	2.96E+00
		81.00		32.90	-1.80E-01		1.96E-01
		276.40		7.16	1.48E-01		4.62E-01
		302.85		18.34	6.42E-02		2.02E-01
		356.01		62.05	-3.40E-02		6.24E-02
		383.85		8.94	-3.59E-01		3.91E-01
	Cs-134	475.36		1.48	2.60E-01	5.95E-02	3.48E+00
		563.25		8.34	-6.18E-02		4.88E-01
		569.33		15.37	9.15E-02		2.43E-01
		604.72		97.62	-4.52E-02		6.49E-02
		795.86		85.46	9.56E-03		5.95E-02
		801.95		8.69	-1.94E-01		4.84E-01
		1038.61		0.99	3.60E+00		5.60E+00
		1167.97		1.79	-7.65E-01		3.77E+00
		1365.19		3.02	2.21E-02		1.47E+00
+	Cs-137	661.66	*	85.10	3.80E-02	2.16E-02	2.16E-02
	Eu-152	121.78		28.67	-6.01E-02	1.11E-01	1.11E-01
		244.70		7.61	1.36E-01		4.92E-01
		295.94		0.45	9.38E+00		1.02E+01
		344.28		26.60	-9.22E-02		1.23E-01
		367.79		0.86	3.27E-02		4.18E+00
		411.12		2.24	-1.95E-01		1.58E+00
		443.96		2.83	2.72E-01		1.39E+00
		488.68		0.42	-1.73E+00		7.78E+00
		563.99		0.49	-5.59E+00		7.56E+00
		586.26		0.46	-2.49E+00		1.43E+01
		678.62		0.47	-1.53E+00		8.79E+00
		688.67		0.86	-4.31E+00		4.33E+00
		719.35		0.28	1.58E+01		1.76E+01
		778.90		12.96	-1.57E-01		3.41E-01
		810.45		0.32	1.25E+01		1.34E+01
		867.37		4.26	7.17E-01		1.20E+00
		919.33		0.43	-3.58E+00		9.73E+00
		964.08		14.65	-6.50E-02		4.05E-01
		1085.87		10.24	1.87E-01		5.31E-01
		1089.74		1.73	6.48E-01		3.20E+00
		1112.07		13.69	6.00E-02		4.42E-01
		1212.95		1.43	4.13E+00		5.27E+00
		1249.94		0.19	2.68E+01		3.73E+01
		1299.14		1.63	-8.45E-01		3.37E+00
		1408.01		21.07	-1.94E-02		2.08E-01
		1457.64		0.50	1.60E+02		4.35E+01
		1528.10		0.28	-1.09E+01		1.29E+01
	Eu-154	123.07		40.40	2.11E-03	8.34E-02	8.34E-02
		247.93		6.89	-2.82E-01		4.58E-01
		591.76		4.95	3.43E-01		8.70E-01
		692.42		1.78	7.28E-01		2.33E+00
		723.30		20.06	6.21E-02		2.57E-01
		756.80		4.52	2.90E-01		1.00E+00
		873.18		12.08	6.94E-02		4.25E-01

Analysis Report for 05-Sep-19-10029

L1-10208C-QIGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.06E-01	8.34E-02	5.44E-01
	1004.76	18.01	1.84E-02		2.87E-01
	1274.43	34.80	2.11E-02		1.93E-01
	1596.48	1.80	-1.67E+00		2.58E+00
Eu-155	45.30	1.31	2.95E+00	1.83E-01	1.13E+01
	60.01	1.22	-2.79E+00		1.32E+01
	86.55	30.70	-1.32E-04		1.85E-01
	105.31	21.10	-1.12E-01		1.83E-01
Ra-226	186.21	3.64	6.81E-01	1.00E+00	1.00E+00
Pa-231	27.36	10.30	1.28E+00	1.34E+00	1.34E+00
	283.69	1.70	1.07E+00		1.97E+00
	300.07	2.47	1.05E+00		1.58E+00
	302.65	2.20	-6.45E-02		1.68E+00
	330.06	1.40	1.24E+00		2.43E+00
U-235	143.76	10.96	-2.62E-01	6.23E-02	3.15E-01
	163.33	5.08	-2.00E-01		6.20E-01
	185.71	57.20	9.66E-03		6.23E-02
	202.11	1.08	-1.33E+00		2.98E+00
	205.31	5.01	-2.23E-01		6.66E-01
Am-241	59.54	35.90	-1.08E-01	4.60E-01	4.60E-01

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

Apex-Gamma

Analysis Report for 06-Sep-19-10041

L1-10208C-FIGS-002SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 06-Sep-19-10041
Sample Description	: L1-10208C-FIGS-002SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.558E+03 grams
Facility	: Default
Sample Taken On	: 9/5/2019 8:30:00AM
Acquisition Started	: 9/6/2019 2:42:33PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 9/6/2019
Efficiency Calibration Description	:
Sample Number	: 79318
Fill Height	: 1558.46 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/6/2019 2:57:43PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

1330 9/6/19

Analysis Report for 06-Sep-19-10041

L1-10208C-FIGS-002SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.84	949 -	962	954.93	1.23E+02	18.56	7.49E+01	1.12
2	295.12	1176 -	1187	1179.78	6.63E+01	11.23	2.37E+01	0.96
3	338.55	1349 -	1357	1353.26	2.66E+01	9.24	2.74E+01	0.61
4	352.04	1398 -	1413	1407.18	1.04E+02	12.37	1.62E+01	1.45
5	583.21	2326 -	2338	2330.95	5.77E+01	10.44	1.93E+01	1.03
6	609.23	2429 -	2442	2434.97	7.95E+01	9.85	6.52E+00	0.66
7	910.78	3634 -	3648	3640.57	3.89E+01	7.92	8.06E+00	0.94
8	1460.17	5827 -	5851	5838.60	4.20E+02	21.37	9.09E+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	0.93	1460.82	*	10.66	9.37E+00	6.27E-01
Tl-208	1.00	583.19	*	85.00	8.64E-02	1.65E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.95E-01	3.33E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.29E-01	3.16E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 06-Sep-19-10041

L1-10208C-FIGS-002SB

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	2.82E-01	5.29E-02
		351.93	*	35.60	2.60E-01	3.74E-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	2.05E-01	7.31E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.60E-01	5.42E-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 06-Sep-19-10041

L1-10208C-FIGS-002SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.933	9.37E+00	6.27E-01	
	Tl-208	1.000	8.64E-02	1.65E-02	
X	Bi-211	0.859			
	Pb-212	0.994	1.95E-01	3.33E-02	
	Bi-214	0.999	2.29E-01	3.16E-02	
	Pb-214	0.998	2.68E-01	3.05E-02	
	Ac-228	0.990	2.41E-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 06-Sep-19-10041

L1-10208C-FIGS-002SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/6/2019 2:57:43PM
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	7.24E-02	5.53E-02	5.53E-02
	BE-7	477.60		10.44	-9.28E-02	3.19E-01	3.19E-01
+	K-40	1460.82	*	10.66	9.37E+00	5.24E-01	5.24E-01
	Mn-54	834.85		99.98	1.90E-02	5.22E-02	5.22E-02
	Co-60	1173.23		99.85	5.85E-02	6.07E-02	6.39E-02
		1332.49		99.98	1.46E-02		6.07E-02
	Nb-94	702.65		99.81	-4.07E-04	3.82E-02	3.82E-02
		871.09		99.89	2.09E-02		4.65E-02
	Ag-108m	79.13		6.60	8.98E-01	4.44E-02	1.30E+00
		433.94		90.50	-1.15E-02		4.44E-02
		614.28		89.80	6.36E-03		5.79E-02
		722.94		90.80	2.05E-02		5.75E-02
	Sb-125	176.31		6.84	-1.20E-01	1.33E-01	4.31E-01
		380.45		1.52	-5.21E-01		2.05E+00
		427.87		29.60	-1.01E-02		1.33E-01
		463.36		10.49	1.97E-01		4.05E-01
		600.60		17.65	-8.69E-02		2.18E-01
		606.71		4.98	2.24E+00		1.40E+00
		635.95		11.22	4.65E-02		3.86E-01

Analysis Report for 06-Sep-19-10041

L1-10208C-FIGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	3.23E-02	1.33E-01	2.42E+00
Ba-133	79.61	2.65	2.41E+00	6.61E-02	3.17E+00
	81.00	32.90	-2.37E-01		2.06E-01
	276.40	7.16	1.15E-01		5.40E-01
	302.85	18.34	7.27E-02		1.90E-01
	356.01	62.05	-7.35E-02		6.61E-02
	383.85	8.94	-2.59E-01		3.49E-01
Cs-134	475.36	1.48	-2.27E-01	5.61E-02	2.34E+00
	563.25	8.34	-3.11E-01		5.02E-01
	569.33	15.37	-1.06E-01		2.65E-01
	604.72	97.62	-4.43E-02		6.31E-02
	795.86	85.46	2.62E-02		5.61E-02
	801.95	8.69	-2.91E-01		4.89E-01
	1038.61	0.99	1.35E+00		5.02E+00
	1167.97	1.79	2.32E+00		3.69E+00
	1365.19	3.02	6.69E-01		1.65E+00
Cs-137	661.66	85.10	1.63E-03	5.42E-02	5.42E-02
Eu-152	121.78	28.67	5.27E-02	1.27E-01	1.27E-01
	244.70	7.61	3.01E-01		5.16E-01
	295.94	0.45	1.03E+01		1.02E+01
	344.28	26.60	2.21E-02		1.50E-01
	367.79	0.86	1.88E+00		4.28E+00
	411.12	2.24	-1.67E-01		1.70E+00
	443.96	2.83	9.64E-01		1.40E+00
	488.68	0.42	3.09E+00		8.91E+00
	563.99	0.49	-1.56E+01		7.28E+00
	586.26	0.46	1.28E+01		1.44E+01
	678.62	0.47	-4.81E+00		8.32E+00
	688.67	0.86	-1.28E+00		4.84E+00
	719.35	0.28	9.06E+00		1.60E+01
	778.90	12.96	-5.47E-01		3.27E-01
	810.45	0.32	-4.58E+00		1.36E+01
	867.37	4.26	7.82E-02		1.11E+00
	919.33	0.43	7.81E+00		1.09E+01
	964.08	14.65	-1.11E-01		4.82E-01
	1085.87	10.24	-1.70E-01		5.18E-01
	1089.74	1.73	7.30E-01		3.28E+00
	1112.07	13.69	-1.97E-01		4.38E-01
	1212.95	1.43	-3.41E+00		4.86E+00
	1249.94	0.19	8.32E+00		3.42E+01
	1299.14	1.63	-2.04E+00		3.61E+00
	1408.01	21.07	2.47E-02		2.36E-01
	1457.64	0.50	1.93E+02		4.86E+01
	1528.10	0.28	-3.57E+00		9.77E+00
Eu-154	123.07	40.40	-4.75E-02	8.74E-02	8.74E-02
	247.93	6.89	3.09E-01		5.01E-01
	591.76	4.95	-3.36E-01		7.80E-01
	692.42	1.78	7.11E-01		2.31E+00
	723.30	20.06	4.02E-02		2.58E-01
	756.80	4.52	3.03E-01		8.87E-01
	873.18	12.08	2.18E-01		3.85E-01

Analysis Report for 06-Sep-19-10041

L1-10208C-FIGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.38E-01	8.74E-02	5.02E-01
	1004.76	18.01	5.21E-02		2.75E-01
	1274.43	34.80	4.56E-02		1.72E-01
	1596.48	1.80	-9.54E-01		2.56E+00
Eu-155	45.30	1.31	-7.77E-01	1.83E-01	1.20E+01
	60.01	1.22	8.02E+00		1.34E+01
	86.55	30.70	5.74E-02		1.83E-01
	105.31	21.10	7.88E-03		2.13E-01
Ra-226	186.21	3.64	5.20E-01	9.51E-01	9.51E-01
Pa-231	27.36	10.30	6.88E-01	1.33E+00	1.33E+00
	283.69	1.70	-1.54E-01		1.95E+00
	300.07	2.47	-2.15E-01		1.40E+00
	302.65	2.20	8.02E-01		1.60E+00
	330.06	1.40	-1.16E+00		2.82E+00
U-235	143.76	10.96	-9.79E-02	6.04E-02	3.12E-01
	163.33	5.08	-7.57E-03		6.20E-01
	185.71	57.20	1.67E-02		6.04E-02
	202.11	1.08	8.66E-01		3.10E+00
	205.31	5.01	-1.16E-01		6.59E-01
Am-241	59.54	35.90	1.06E-01	4.60E-01	4.60E-01

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

Apex-Gamma

Analysis Report for 09-Sep-19-10002

L1-10208C-FIGS-002SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Sep-19-10002
Sample Description	: L1-10208C-FIGS-002SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.558E+03 grams
Facility	: Default
Sample Taken On	: 9/5/2019 8:30:00AM
Acquisition Started	: 9/9/2019 6:58:58AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1802.9 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 9/9/2019
Efficiency Calibration Description	:
Sample Number	: 79330
Fill Height	: 1558.46 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/9/2019 7:29:06AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 9-9-19 1530

Analysis Report for 09-Sep-19-10002

L1-10208C-FIGS-002SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.53	950 -	960	954.23	2.72E+02	24.11	1.26E+02	0.78
2	295.21	1175 -	1189	1180.74	1.24E+02	18.88	7.93E+01	1.11
3	351.80	1399 -	1415	1406.94	1.72E+02	19.91	7.18E+01	1.02
4	583.13	2324 -	2339	2331.73	1.03E+02	12.51	1.78E+01	1.19
5	609.11	2428 -	2446	2435.62	1.37E+02	17.18	4.72E+01	1.29
6	727.04	2903 -	2913	2907.19	2.52E+01	8.54	1.98E+01	0.56
7	911.10	3637 -	3649	3643.36	5.30E+01	11.41	2.90E+01	0.39
8	968.65	3866 -	3881	3873.59	2.93E+01	10.40	2.58E+01	1.55
9	1119.92	4473 -	4486	4478.78	5.15E+01	10.02	1.75E+01	1.03
10	1460.34	5827 -	5853	5841.18	7.16E+02	27.31	6.75E+00	1.75
11	1764.00	7051 -	7064	7057.01	1.08E+01	6.53	1.12E+01	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	0.96	1460.82	*	10.66	8.88E+00	5.13E-01
Tl-208	1.00	583.19	*	85.00	8.57E-02	1.16E-02
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	3.10E-01	1.07E-01
		785.37		1.10		
		1620.50		1.47		

Analysis Report for 09-Sep-19-10002

L1-10208C-FIGS-002SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.42E-01	2.90E-02
		300.09		3.30		
Bi-214	0.98	609.32	*	45.49	2.19E-01	3.05E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	3.79E-01	7.54E-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	1.08E-01	6.54E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.94E-01	5.06E-02
		351.93	*	35.60	2.40E-01	3.38E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.96E-01	4.31E-02
		964.77		4.99		
		968.97	*	15.80	1.85E-01	6.62E-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 09-Sep-19-10002

L1-10208C-FIGS-002SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.963	8.88E+00	5.13E-01	
	Tl-208	1.000	8.57E-02	1.16E-02	
X	Bi-211	0.918			
	Bi-212	0.991	3.10E-01	1.07E-01	
	Pb-212	0.999	2.42E-01	2.90E-02	
	Bi-214	0.989	2.20E-01	2.59E-02	
	Pb-214	0.998	2.57E-01	2.81E-02	
	Ac-228	0.996	1.93E-01	3.61E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Sep-19-10002

L1-10208C-FIGS-002SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/9/2019 7:29:06AM
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	6.17E-02	4.39E-02	4.39E-02
	BE-7	477.60		10.44	7.53E-02	3.09E-01	3.09E-01
+	K-40	1460.82	*	10.66	8.88E+00	2.64E-01	2.64E-01
	Mn-54	834.85		99.98	1.79E-02	3.80E-02	3.80E-02
	Co-60	1173.23		99.85	2.42E-02	3.95E-02	5.20E-02
		1332.49		99.98	3.84E-02		3.95E-02
	Nb-94	702.65		99.81	4.02E-04	3.27E-02	3.27E-02
		871.09		99.89	-1.58E-02		3.53E-02
	Ag-108m	79.13		6.60	8.24E-01	3.43E-02	1.46E+00
		433.94		90.50	4.94E-03		3.43E-02
		614.28		89.80	-1.34E-02		4.62E-02
		722.94		90.80	-4.07E-02		4.53E-02
	Sb-125	176.31		6.84	1.13E-01	1.00E-01	4.33E-01
		380.45		1.52	-7.98E-01		1.84E+00
		427.87		29.60	2.38E-02		1.00E-01
		463.36		10.49	1.99E-02		2.98E-01
		600.60		17.65	8.61E-02		1.93E-01
		606.71		4.98	-5.04E-01		1.10E+00
		635.95		11.22	4.09E-02		2.72E-01

Analysis Report for 09-Sep-19-10002

L1-10208C-FIGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-9.99E-01	1.00E-01	1.83E+00
Ba-133	79.61	2.65	5.81E-01	5.51E-02	3.47E+00
	81.00	32.90	-2.57E-01		2.40E-01
	276.40	7.16	2.20E-01		4.02E-01
	302.85	18.34	-2.57E-03		1.58E-01
	356.01	62.05	1.42E-02		5.51E-02
	383.85	8.94	9.96E-02		3.29E-01
Cs-134	475.36	1.48	-1.11E+00	4.19E-02	2.08E+00
	563.25	8.34	4.62E-01		3.84E-01
	569.33	15.37	-5.00E-02		2.03E-01
	604.72	97.62	-7.03E-03		5.30E-02
	795.86	85.46	8.03E-03		4.19E-02
	801.95	8.69	6.81E-02		3.83E-01
	1038.61	0.99	-5.77E-01		4.00E+00
	1167.97	1.79	-2.04E+00		2.78E+00
	1365.19	3.02	-5.09E-01		1.25E+00
Cs-137	661.66	85.10	-3.56E-03	3.73E-02	3.73E-02
Eu-152	121.78	28.67	8.29E-03	1.03E-01	1.19E-01
	244.70	7.61	2.22E-01		4.33E-01
	295.94	0.45	5.73E+00		8.15E+00
	344.28	26.60	-5.06E-02		1.03E-01
	367.79	0.86	9.14E-01		3.02E+00
	411.12	2.24	3.03E-01		1.35E+00
	443.96	2.83	-9.30E-01		1.04E+00
	488.68	0.42	-5.49E+00		6.97E+00
	563.99	0.49	2.62E+00		6.40E+00
	586.26	0.46	2.42E+00		9.94E+00
	678.62	0.47	-1.15E+00		6.75E+00
	688.67	0.86	-1.38E+00		3.77E+00
	719.35	0.28	6.06E+00		1.27E+01
	778.90	12.96	1.10E-01		2.61E-01
	810.45	0.32	-6.65E+00		1.04E+01
	867.37	4.26	-9.62E-01		8.75E-01
	919.33	0.43	-4.06E+00		9.08E+00
	964.08	14.65	1.65E-01		3.72E-01
	1085.87	10.24	-3.85E-01		4.31E-01
	1089.74	1.73	1.02E+00		2.79E+00
	1112.07	13.69	-1.69E-01		3.20E-01
	1212.95	1.43	-1.50E+00		3.80E+00
	1249.94	0.19	1.14E+01		2.79E+01
	1299.14	1.63	1.09E+00		2.61E+00
	1408.01	21.07	-4.18E-02		1.72E-01
	1457.64	0.50	1.88E+02		3.49E+01
	1528.10	0.28	-6.31E+00		7.99E+00
Eu-154	123.07	40.40	-1.25E-02	8.35E-02	8.35E-02
	247.93	6.89	1.25E-01		4.23E-01
	591.76	4.95	3.14E-01		6.76E-01
	692.42	1.78	6.03E-01		1.90E+00
	723.30	20.06	-1.57E-01		2.05E-01
	756.80	4.52	-1.08E-01		7.53E-01
	873.18	12.08	-9.90E-02		2.88E-01

Analysis Report for 09-Sep-19-10002

L1-10208C-FIGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.58E-01	8.35E-02	3.57E-01
	1004.76	18.01	-2.62E-02		2.26E-01
	1274.43	34.80	-9.51E-02		1.23E-01
	1596.48	1.80	-2.37E-01		1.83E+00
Eu-155	45.30	1.31	3.12E+00	2.06E-01	2.26E+01
	60.01	1.22	-2.41E+00		2.33E+01
	86.55	30.70	8.65E-02		2.06E-01
	105.31	21.10	1.31E-01		2.16E-01
Ra-226	186.21	3.64	4.32E-01	8.59E-01	8.59E-01
Pa-231	27.36	10.30	3.02E+00	1.23E+00	2.64E+00
	283.69	1.70	-3.57E-01		1.55E+00
	300.07	2.47	5.53E-01		1.23E+00
	302.65	2.20	9.17E-02		1.32E+00
	330.06	1.40	4.53E-01		2.20E+00
U-235	143.76	10.96	1.53E-01	5.47E-02	3.08E-01
	163.33	5.08	-1.66E-01		5.96E-01
	185.71	57.20	2.78E-02		5.47E-02
	202.11	1.08	-1.05E+00		2.61E+00
	205.31	5.01	1.89E-01		5.78E-01
Am-241	59.54	35.90	2.08E-01	8.24E-01	8.24E-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

ATTACHMENT 8
EBERLINE ANALYTICAL REPORTS

EBERLINE ANALYTICAL

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

EBS-OR-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:	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
19-11030-01	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

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
19-11030-03	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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Eberline Analytical
Final Report of Analysis

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

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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
19-11030-05	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

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
19-11030-06	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

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
19-11030-08	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

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
19-11030-09	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

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Eberline Analytical
Final Report of Analysis

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Zion Solutions
2701 Deborah Ave
Zion, IL 60099

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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
19-11030-10	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

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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
19-11030-11	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

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
19-11030-12	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

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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

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
19-11030-14	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 (O) 1015

[293]

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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

[294]