ZION SOLUTIONS LLC
An EnergySolutions Company

ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

NORTH HALF OF UNIT 1 CONTAINMENT

SURVEY UNIT 12108

REVISION 1

PREPARED BY / DATE: Robert Yetter III — Robert F. Yetter III, Apr 29 2020 9:58 AM, cosign

Final Status Survey Specialist

REVIEWED BY / DATE: Robert Yetter — Robert F. Yetter, Apr 29 2020 2:06 PM, cosign

Director, Radiological Site Closure

APPROVED BY / DATE: Sarah Roberts — Sarah Roberts, Apr 29 2020 6:49 PM, cosign

Vice President, Radiological Programs

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LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
AMCG	Average Member of the Critical Group
BcDCGL	Base Case DCGL
CCDD	Clean Concrete Demolition Debris
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	Zion Station Historical Site Assessment
IC	Insignificant Contributor
IDNS	Illinois Department of Nuclear Safety
ISOCS	In Situ Object Counting System
LBGR	Lower Bound of the Gray Region
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Count Rate
NAD	North American Datum
NaI	Sodium Iodide
OpDCGL	Operational Derived Concentration Guideline Level
OpSOF	Operational Sum of Fractions
ORISE	Oak Ridge Institute for Science and Education
QAPP	Quality Assurance Project Plan
QC	Quality Control

RA	Radiological Assessment
RE	Radiological Engineer
ROC	Radionuclides of Concern
SOF	Sum of Fractions
TEDE	Total Effective Dose Equivalent
TSD	Technical Support Documents
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 12108, "North Half of Unit 1 Containment," 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 (L1-12108A-F) was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, *"Final Status Survey Package Development"* (Reference 3), the ZSRP LTP, and guidance from NUREG-1575, "*Multi-Agency Radiation Survey and Site Investigation Manual"* (MARSSIM) (Reference 4).

This open land survey unit has a MARSSIM classification of one. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I (α) and Type II (β) decision error rates were set at 0.05. Seventeen (17) systematic surface soil samples were acquired from the survey unit. In addition, surface scanning was performed on 100% of the total surface area in the survey unit. No areas of elevated activity were detected during the scans. The analytical results for all soil samples taken in survey unit 12108 indicated that the Sum of Fractions (SOF) for each sample, when compared to the Operational Derived Concentration Guideline Levels (OpDCGL), was less than 1.0. The maximum Operational SOF (OpSOF) was 0.046. The mean OpSOF for the systematic samples was 0.027. The mean Base Case SOF (BcSOF), when the analytical results were compared to the Base Case DCGLs (BcDCGL), was 0.007, which results in a dose assigned to the survey unit of 0.170 mrem/year Total Effective Dose Equivalent (TEDE). Therefore, the null hypothesis is rejected and survey unit 12108 is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 12108, "North Half of Unit 1 Containment," is a Class 1 open land survey unit and is 1,933 m^2 in size. It is bounded on the west by survey unit 12202B, the east by survey units 12205C and 12205D; the north by survey unit 12107 and the south by survey unit 12109.

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

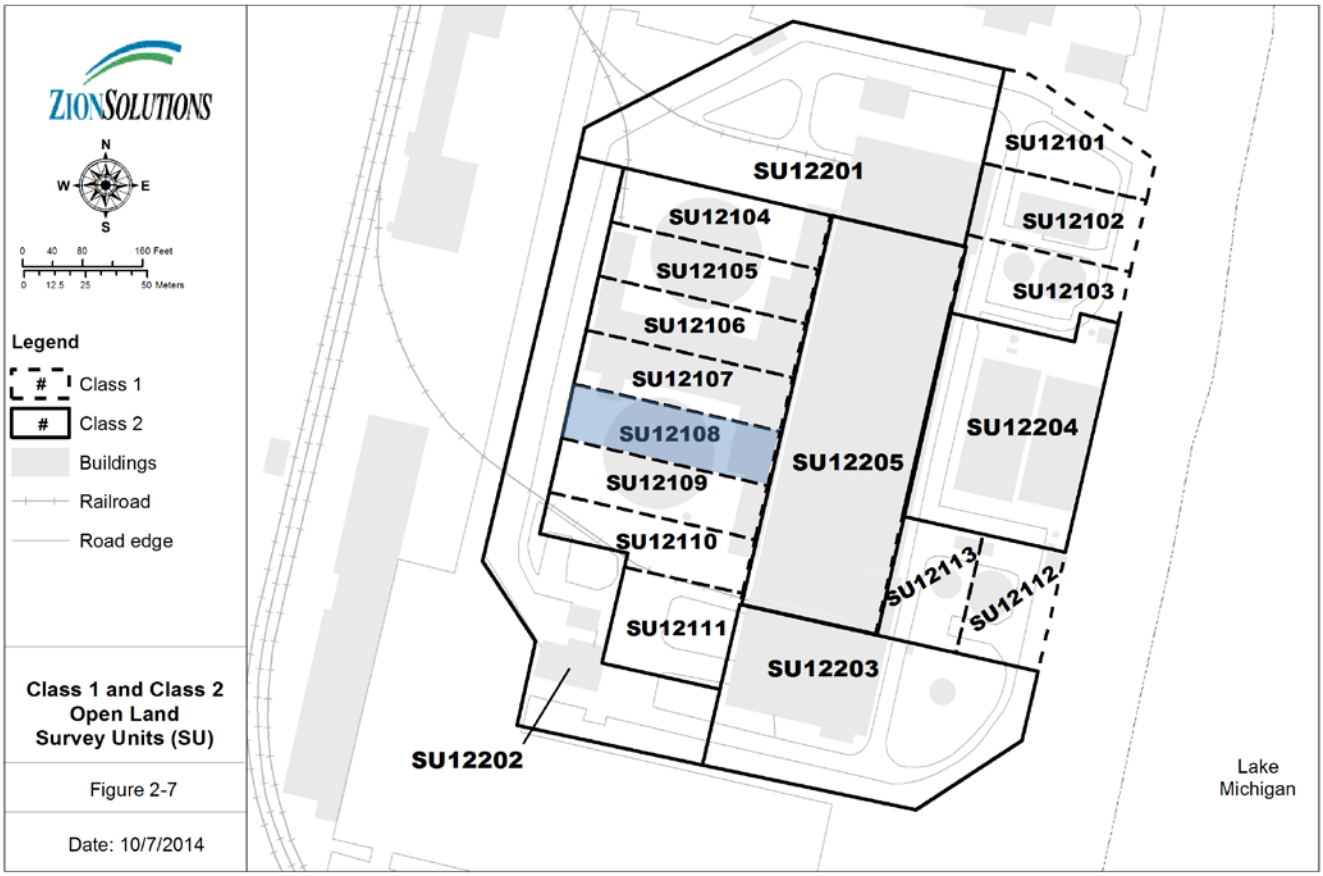
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 12108 was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 5).

The area encompassing this survey unit is made up of part of the north half of survey unit 10107 and most of the southern half of survey unit 10105 as identified in Figure 3 of the *"Zion Station Historical Site Assessment"* (HSA) (Reference 6). The HSA classified these survey units as Class 1 and Class 3 respectively. The LTP subsequently designated this area as survey unit 12108, a Class 1 open land survey unit, and described it in Table 2-4 as the "Area Around the North Half of Unit 1 Containment" and represented in Figure 2-7 of the LTP, which is replicated as Figure 1 below.

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



This area contained the footprint of the north half of Unit 1 Containment, the Unit 1 Auxiliary Transformer, the Diesel Oil Tank – Tanker Connection Point and the Illinois Department of Nuclear Safety (IDNS) Building. The HSA notes that there were eleven separate substantial spills of mixtures of spent resins and water in this area with contamination levels up to 675,000 dpm/100cm^2 and dose rates as high as 310 mR/hr. The HSA estimated that over 100 gallons of spent resin may have leaked into the concrete/adjacent soil and states that it is likely that the contamination may extend beyond 12 inches into the soil, covering an affected area of up to approximately 15,000 ft^2.

In August of 2018, ZSRP completed the demolition and backfill of the Auxiliary Building basement and Spent Fuel Pool. The next buildings that were slated for demolition were the Unit 1 and Unit 2 Containment domes. It was the intention of ZSRP to use the exterior concrete of the Unit 1 and Unit 2 Containment domes as Clean Concrete Demolition Debris (CCDD). However, for the concrete to be considered for use as CCDD, it was important to maintain the unrestricted release pedigree of the concrete. The 588-foot grade surface soils surrounding the two containments were identified as contaminated. While it was necessary to remediate the soils surrounding the Containments, the timeframe required was prohibitive at the time. Therefore, in lieu of remediating the exposed soil, a sacrificial layer of clean soil from off-site was placed over the contaminated indigenous surface soil with up to 1-½ feet of clean fill. Once the sacrificial layer was in place, the Containment dome structures were demolished without having to wait for the remediation to be completed. From August, 2018 through December, 2018, both Unit 1 and Unit 2 Containments were demolished and the resultant CCDD was removed from the area. After removal of the CCDD, the sacrificial soil was removed and the exposed 588-foot grade indigenous soils were scanned. The survey was performed under a Radiological Assessment (RA), which required "100% scan of the soils exposed by the removal of the sacrificial layer" with an alarm set-point set at the Minimum Detectable Count Rate (MDCR) of the instrument plus background. Any indication of elevated activity greater than the MDCR would then prompt investigation and remediation, as necessary.

From February 26, 2019, through June 18, 2019, scanning and remediation commenced south of Unit 1 and progressed to the north and west of the Containment footprints. Large areas of elevated activity were identified by scan and verified by soil sample analysis. The areas of elevated activity were marked. All soil identified as exceeding the OpDCGLs for subsurface soil was excavated and removed from the site as radioactive waste. Following excavation, post-remediation surveys were performed by scan and media sampling. The analysis of all post-remediation soil samples showed an OpSOF less than 1.0 when sample results were directly compared against the OpDCGLs for subsurface soils. However, all excavations remained open to allow the Oak Ridge Institute for Science and Education (ORISE) to perform confirmatory surveys of the exposed remediated soil.

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

A Radiological Engineer (RE) and a Characterization/License Termination (C/LT) Supervisor performed a visual inspection and walk-down of the survey unit on September 4, 2019, prior to performing FSS. The purpose of the walk-down was to assess the physical condition of the

survey unit, evaluate access points and travel paths and identify potentially hazardous conditions. A final classification assessment was performed in accordance with procedure ZS-LT-300-001-002, "*Survey Unit Classification*" as part of the survey design for FSS. The assessment confirmed that survey unit 12108 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 12108 does not exceed the release criteria specified in the LTP and that the potential dose from residual radioactivity is As Low As Reasonably Achievable (ALARA).

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

Zion*Solutions* TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* (Reference 8), was written to refine the initial selection of ROC for decommissioning at the ZSRP. The list of ROC was evaluated using Containment Building(s) and Auxiliary Building concrete core analysis data to evaluate the dose significance of each radionuclide in the end state model. Section 4.4 of TSD 14-019 evaluated the results of the characterization data of surveys taken of soils. The following conclusion was reached: *"The results of surface and subsurface soil characterization in the impacted area surrounding Zion indicate that there is minimal residual radioactivity in soil. Essentially all of the soil results were reported as non-detectable. Other than Cs-137 at very low levels, and Co-60 at a concentration of 0.24 pCi/g in one sample, the results for all radionuclides were less than MDC. Therefore, the direct determination of*

radionuclide mixture fractions for initial suite radionuclides in soil is not technically feasible due to the MDC biasing issues discussed above. Based on a generalized assumption that the contaminated water that caused concrete contamination would be similar to the source of soil contamination, the ROC and radionuclide mixture derived for the Auxiliary Building concrete was considered to be reasonably representative of soils for FSS planning and implementation."

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

Table 1 - Dose Significant Radionuclides and Mixture

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

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

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

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

At ZNPS, compliance is demonstrated through the summation of dose from four distinct source terms (basements, soils, buried pipe and groundwater) for the end-state. Basements are comprised

of the summation of four structural source terms (surfaces, embedded pipe, penetrations and fill). When applied to soil, the DCGLs are expressed in units of activity per unit of mass (pCi/g). The "unity rule" is applied when there is more than one ROC. The measurement results for each singular ROC present in the mixture are compared against their respective DCGL to derive a dose fraction.

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

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

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

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

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

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

unit (calculation of surrogate DCGLs, investigations levels, etc.). Details of the OpDCGLs derived for each dose component and the basis for the applied *a priori* dose fractions are provided in Zion*Solutions* TSD 17-004, *"Operational Derived Concentration Guideline Levels for Final Status Survey"* (Reference 10).

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

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

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

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

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

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

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

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

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

5. SURVEY DESIGN

The level of effort associated with planning a survey is based on the complexity of the survey and nature of the hazards. Guidance for preparing FSS plans is provided in procedure 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 12108. 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 Zion*Solutions* 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 12108, the surrogate OpDCGLs for Co-60 and Cs-137 were computed based on the maximum ratios from Table 6.

The equation for calculating a surrogate DCGL is as follows:

Equation 1

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

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

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

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

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

Equation 2

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

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

Equation 3

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

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

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

Equation 4

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

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

Equation 5

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

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

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

Table 7 - Investigation Levels

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

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

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

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

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

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

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

The computer program Visual Sample Plan (VSP) was used to generate the sample map, in accordance with ZS-LT-300-001-001. The map used was provided by the Survey Mapping/Computer Assisted Design Specialist, with coordinates based on the Illinois State Plane NAD 1983 standard topographical grid coordinate system. The number of samples generated by VSP for a systematic triangular grid was seventeen (17). The Prospective Power Curve generated by VSP showed adequate power for the survey design.

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

- To calculate the area bounded by the systematic samples: $A = \frac{A_{SU}}{N} = \frac{1933}{17} = 113.7\ m^2$
- 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 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 (L1-12108A-FQGS-001-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 L1-12108A-FSGS-002-SB and L1-12108A-FSGS-009-SB were selected for this survey unit.

Section 5.3.4.4 of LTP Chapter 5 states that attempts shall be made to acquire subsurface soil samples from beneath each Containment basement foundation and the Auxiliary Building basement floor slab. The objective is to assess the radiological contamination of subsurface soils adjacent to and below these basement foundations. The LTP states that attempts shall be made to acquire a minimum of 2 subsurface soil samples from beneath each Containment basement

foundation and the Auxiliary Building basement floor slab and, a minimum of 4 subsurface soil samples will be taken around each foundation from grade to the depth of approximately 55 feet or refusal, whichever is less. As part of this effort, five subsurface soil samples were taken in survey unit 12108 along the north side of Unit 1 Containment and the southwest portion of the Auxiliary Building to a depth of 32 feet below grade (samples L1-12108L-CJGS-001-SB, L1-12108L-CJGS-002-SB, L1-12108L-CJGS-003-SB and L1-12108L-CJGS-004-SB) to 55 feet below grade (sample L1-12108L-CJGS-005-SB), where refusal was met. Several attempts were made to acquire samples at a deeper depth and below the basement foundation in survey unit 12108 however, with the exception of sample L1-12108L-CJGS-005-SB, the "mud-mat" placed around the Containment basement exterior during construction obstructed the Geoprobe® from acquiring samples at a deeper depth. For sample L1-12108L-CJGS-005-SB, the probe was able to punch through the mud-mat and acquire a sample at a sub-basement slab depth.

The locations of the seventeen (17) systematic samples are listed in Table 8. Also included are the locations of the two (2) subsurface samples taken at random to a depth of 1 meter and the five (5) subsurface samples acquired at deeper depths. A map of the systematic sample locations is included in Attachment 1.

Table 8 - Systematic Sample Measurement Locations

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L1-12108A-FSGS-001-SS	641741.48	343643.56
L1-12108A-FSGS-002-SS	641741.48	343655.02
L1-12108A-FSGS-003-SS	641741.48	343666.48
L1-12108A-FSGS-004-SS	641751.41	343603.46
L1-12108A-FSGS-005-SS	641751.41	343614.92
L1-12108A-FSGS-006-SS	641751.41	343626.38
L1-12108A-FSGS-007-SS	641751.41	343637.83
L1-12108A-FSGS-008-SS	641751.41	343649.29
L1-12108A-FSGS-009-SS	641751.41	343660.75
L1-12108A-FSGS-010-SS	641761.33	343586.28
L1-12108A-FSGS-011-SS	641761.33	343597.73
L1-12108A-FSGS-012-SS	641761.33	343609.19
L1-12108A-FSGS-013-SS	641761.33	343620.65
L1-12108A-FSGS-014-SS	641761.33	343632.11
L1-12108A-FSGS-015-SS	641761.33	343643.56
L1-12108A-FSGS-016-SS	641771.25	343592.01
L1-12108A-FSGS-017-SS	641771.25	343603.46
L1-12108A-FSGS-002-SB	641741.48	343655.02
L1-12108A-FSGS-009-SB	641751.41	343660.75
L1-12108L-CJGS-001-SB	641767.62	343608.40
L1-12108L-CJGS-002-SB	641760.89	343600.03
L1-12108L-CJGS-003-SB	641756.95	343598.21
L1-12108L-CJGS-004-SB	641759.52	343598.00
L1-12108L-CJGS-005-SB	641751.35	343649.29

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

In addition, LTP, Section 5.1 states that if levels of residual gamma radioactivity in an individual soil sample exceed an OpSOF of 0.1, then the sample(s) will be analyzed for HTD

ROC. For all subsurface soil samples taken at depth, no ROC were positively detected at concentrations greater than the instrument MDC. Higher MDC values resulted in an OpSOF greater than 0.1 when the MDC values were compared against the subsurface soil OpDCGLs. As no radioactive material was positively detected in the samples, no further actions were deemed necessary.

Two (2) soil samples, L1-12108A-FSGS-005-SS and L1-12108A-FSGS-015-SS, were selected to meet the requirement that 10% of the samples collected for the FSS of survey unit 12108 be analyzed for HTD ROC. These samples were selected based on exhibiting the highest OpSOF. Each sample was sent off-site (Eberline Analytical) for analysis of the HTD ROC as specified in LTP, Section 5.1. Eberline analytical reports are provided in Attachment 8.

Table 9 provides a synopsis of the survey design for survey unit 12108.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	1,933 m^2	GPS measurements of area
Number of Surface Soil Samples	17 (Systematic)	• σ = 0.30 • UBGR = SOF of 1 • LBGR = SOF of 0.5 • Type I error = 0.05 • Type II error = 0.05 • Δ/σ = 1.67 (MARSSIM Table 5.5)
Grid Spacing	11.5m	(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)
Quality Control (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 2 and 9	(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 L1-12108A-F, which was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, "*Final Status Survey Package Development*." 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 12108, compliance with the unrestricted release criteria was demonstrated through a combination of surface scanning with a Ludlum Model 44-10 gamma detector and the sampling of surface soil for isotopic analysis. In accordance with the LTP Chapter 5, two (2) subsurface samples were obtained and analyzed. Also, if during the performance of FSS, the analysis of a surface soil sample, or the results of a surface gamma scan indicated the potential presence of residual radioactivity at a concentration of 75% of the subsurface OpDCGL, then a biased subsurface soil sample(s) would have been taken to the appropriate depth within the area of concern as part of the investigation. This threshold was not encountered during the FSS of survey unit 12108.

FSS field activities were conducted under FSS sample plan L1-12108A-F. A "Field Log" (ZS-LT-300-001-001, Attachment 14) was used to document field activities and other information pertaining to the performance of the FSS.

FSS field activities were projected to take four (4) working days to complete. Daily briefings were conducted to discuss the expectations for job performance and to review safety aspects of the job. The survey required field activities were performed during normal working hours starting on September 16, 2019, and concluding on September 18, 2019. The acquisition of the deep subsurface soil samples occurred between August 15, 2019, and August 21, 2019.

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

Gamma scans were performed on 100% of the surface area of the survey unit using a Ludlum 2350-1 paired with a Model 44-10 (2-inch x 2-inch) sodium iodide (NaI) detector operated in the rate-meter mode and using audio response. The probe was positioned within 2 inches of the ground and was moved at a scan speed of approximately 0.5 meters per second. No areas of elevated activity were detected on the scans. Daily, prior to and following use, each detector was subjected to an Operational Response Check in accordance with procedure ZS-RP-108-004-011, *"Operation of the Ludlum Model 2350-1 Data Logger"* (Reference 14). The daily Operational Response Check compared the background response and the response to a check source to ranges established for normal background and detector source response to ensure that the detector was working properly.

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

Table 10 - Instruments and Detectors

Instrument/Detector Type	Serial #	Calibration Due Date
Ludlum 2350-1/Ludlum 44-10	216166/PR372106	11/29/2019
Ludlum 2350-1/Ludlum 44-10	304712/PR311750	9/9/2020
Ludlum 2350-1/Ludlum 44-10	266656/PR372143	7/24/20020
Ludlum 2350-1/Ludlum 44-10	304708/PR321892	9/4/202

In accordance with the survey design, seventeen (17) surface soil samples were collected at the designated systematic sample points. In addition, two (2) subsurface samples were collected at the randomly selected sample locations, four (4) subsurface samples were collected along the exterior foundation of the Unit 1 Containment and Auxiliary Building to a depth of 32 feet and one (1) sample was taken to a depth of 52 feet under the basement foundation mat for the Auxiliary Building.

Two (2) samples (L1-12108A-FSGS-005-SS, and L1-12108A-FSGS-015-SS) were selected for HTD radionuclide analysis.

7. SURVEY RESULTS

One hundred percent (100%) of the surface of the survey unit was scanned for elevated radiation levels. Eighty-six (86) 1-meter wide scan rows, as shown on the map in Attachment 1, were marked in the field and scanned with the 2350-1/44-10 using latching mode. Readings were recorded at approximately 10-meter intervals during the scans. No elevated measurement locations were identified by surface scan. Table 11 provides an overview of the scan results. Complete scan results are provided in Attachment 2.

Table 11 - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[(1)] (cpm)	# of Scan Alarms	Investigation Samples
Row 1	2373	2741	None	None
Row 2	2392	2741	None	None
Row 3	2387	2741	None	None
Row 4	2335	2741	None	None
Row 5	2325	2741	None	None
Row 6	2405	2741	None	None
Row 7	2352	2741	None	None
Row 8	2231	2741	None	None

Table 11 (continued) - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[1] (cpm)	# of Scan Alarms	Investigation Samples
Row 9	2359	2741	None	None
Row 10	2400	2741	None	None
Row 11	2370	2741	None	None
Row 12	2353	2741	None	None
Row 13	2501	2741	None	None
Row 14	2442	2741	None	None
Row 15	2497	2741	None	None
Row 16	2696	2741	None	None
Row 17	2348	2741	None	None
Row 18	2492	2741	None	None
Row 19	2480	2741	None	None
Row 20	2404	2741	None	None
Row 21	2391	2741	None	None
Row 22	2386	2741	None	None
Row 23	2321	2740	None	None
Row 24	2317	2740	None	None
Row 25	2391	2740	None	None
Row 26	2482	2740	None	None
Row 27	2283	2740	None	None
Row 28	2340	2740	None	None
Row 29	2301	2740	None	None
Row 30	2486	2740	None	None
Row 31	2357	2740	None	None
Row 32	2333	2740	None	None
Row 33	2349	2740	None	None
Row 34	2359	2740	None	None
Row 35	2428	2740	None	None
Row 36	2363	2740	None	None
Row 37	2257	2740	None	None
Row 38	2381	2740	None	None
Row 39	2258	2740	None	None
Row 40	2246	2740	None	None
Row 41	2267	2740	None	None
Row 42	2233	2740	None	None
Row 43	2318	2740	None	None
Row 44	2221	2740	None	None
Row 45	2253	2740	None	None
Row 46	2407	2747	None	None
Row 47	2381	2747	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 48	2385	2747	None	None
Row 49	2454	2747	None	None
Row 50	2280	2747	None	None
Row 51	2260	2747	None	None
Row 52	2412	2747	None	None
Row 53	2377	2747	None	None
Row 54	2378	2747	None	None
Row 55	2310	2747	None	None
Row 56	2307	2747	None	None
Row 57	2318	2747	None	None
Row 58	2334	2747	None	None
Row 59	2316	2747	None	None
Row 60	2482	2747	None	None
Row 61	2423	2747	None	None
Row 62	2306	2747	None	None
Row 63	2317	2747	None	None
Row 64	2278	2747	None	None
Row 65	2325	2747	None	None
Row 66	2333	2747	None	None
Row 67	2409	2747	None	None
Row 68	2325	2747	None	None
Row 69	2358	2792	None	None
Row 70	2348	2792	None	None
Row 71	2414	2792	None	None
Row 72	2332	2792	None	None
Row 73	2375	2792	None	None
Row 74	2452	2792	None	None
Row 75	2420	2792	None	None
Row 76	2399	2792	None	None
Row 77	2387	2792	None	None
Row 78	2623	2792	None	None
Row 79	2304	2792	None	None
Row 80	2390	2792	None	None
Row 81	2518	2792	None	None
Row 82	2348	2792	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 83	2339	2792	None	None
Row 84	2453	2792	None	None
Row 85	2328	2792	None	None
Row 86	2334	2792	None	None

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

The seventeen (17) soil samples taken for non-parametric statistical testing, the two (2) subsurface soil samples selected at random and the five (5) subsurface soil samples taken at depth were analyzed using the on-site gamma spectroscopy system. Summaries of the sample analysis results are provided in Tables 12 and 13, respectively. The basic statistics for the systematic sample population are summarized in Table 19. The gamma spectroscopy results revealed no samples with activity levels above the MDC for Co-60, Cs-134 or Cs-137. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6. The mean of the gamma spectroscopic analysis results for the 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)
L1-12108A-FSGS-001-SS	1.97E-02	1.56E-02	1.14E-02	3.55E+00	2.28E-05
L1-12108A-FSGS-002-SS	2.26E-02	2.56E-02	0.00E+00	4.08E+00	0.00E+00
L1-12108A-FSGS-003-SS	1.17E-02	0.00E+00	0.00E+00	2.11E+00	0.00E+00
L1-12108A-FSGS-004-SS	2.56E-02	1.16E-02	0.00E+00	4.62E+00	0.00E+00
L1-12108A-FSGS-005-SS	3.33E-02	3.71E-03	4.86E-03	6.01E+00	9.72E-06
L1-12108A-FSGS-006-SS	2.16E-02	2.27E-02	5.89E-03	3.90E+00	1.18E-05
L1-12108A-FSGS-007-SS	7.55E-03	5.30E-02	0.00E+00	1.36E+00	0.00E+00
L1-12108A-FSGS-008-SS	7.30E-03	2.80E-02	0.00E+00	1.32E+00	0.00E+00
L1-12108A-FSGS-009-SS	2.97E-02	0.00E+00	0.00E+00	5.36E+00	0.00E+00
L1-12108A-FSGS-010-SS	2.46E-02	0.00E+00	0.00E+00	4.44E+00	0.00E+00
L1-12108A-FSGS-011-SS	1.60E-02	0.00E+00	1.00E-02	2.89E+00	2.00E-05

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

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L1-12108A-FSGS-012-SS	0.00E+00	3.13E-02	0.00E+00	0.00E+00	0.00E+00
L1-12108A-FSGS-013-SS	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
L1-12108A-FSGS-014-SS	0.00E+00	0.00E+00	1.35E-02	0.00E+00	2.70E-05
L1-12108A-FSGS-015-SS	1.85E-02	4.11E-02	5.58E-03	3.34E+00	1.12E-05
L1-12108A-FSGS-016-SS	0.00E+00	0.00E+00	6.20E-03	0.00E+00	1.24E-05
L1-12108A-FSGS-017-SS	3.14E-02	0.00E+00	2.61E-03	5.67E+00	5.22E-06

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

Table 13 - Summary of Gamma Spectroscopy Results for Subsurface Soil Samples

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L1-12108A-FSGS-002-SB	4.45E-02	0.00E+00	0.00E+00	8.03E+00	0.00E+00
L1-12108A-FSGS-009-SB	0.00E+00	3.69E-03	0.00E+00	0.00E+00	0.00E+00
L1-12108L-CJGS-001-SB	8.30E-02	8.29E-02	7.47E-02	1.50E+01	1.49E-04
L1-12108L-CJGS-002-SB	7.22E-02	7.60E-02	6.58E-02	1.30E+01	1.32E-04
L1-12108L-CJGS-003-SB	6.40E-02	8.57E-02	7.45E-02	1.15E+01	1.49E-04
L1-12108L-CJGS-004-SB	6.80E-02	7.20E-02	5.87E-02	1.23E+01	1.17E-04
L1-12108L-CJGS-005-SB	7.71E-02	9.27E-02	7.46E-02	1.39E+01	1.49E-04

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

The off-site laboratory, Eberline Analytical, processed the two (2) samples selected for HTD ROC analysis. Samples L1-12108A-FSGS-005-SS-A and L1-12108A-FSGS-015-SS-A were selected. Only HTD radionuclides included as ROC (Ni-63 and Sr-90 for soils) were included in the analysis. All analyses met the required MDC. No activity was positively detected in either of the samples at a concentration greater than MDC. Consequently, comparison of existing ratios versus the maximum ratios from Table 6 was not required. The off-site analysis results are provided in Table 14.

Table 14 - Off-Site Analysis Results

Sample # L1-12108A-FSGS-005-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	-3.61E-02	7.71E-02	1.07E-01	No
Cs-134	-4.71E-03	3.62E-02	8.80E-02	No
Cs-137	5.78E-02	5.65E-02	9.21E-02	No
Ni-63	-4.11E-01	2.13E+00	3.69E+00	No
Sr-90	7.81E-03	2.71E-01	5.79E-01	No

Sample # L1-12108A -FSGS-015-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	2.97E-02	6.19E-02	9.33E-02	No
Cs-134	-1.17E-03	3.12E-02	7.81E-02	No
Cs-137	7.77E-03	4.20E-02	8.80E-02	No
Ni-63	5.29E-01	1.85E+00	3.17E+00	No
Sr-90	5.83E-02	3.72E-01	7.89E-01	No

The implementation of survey specific QC measures included the collection of one (1) systematic sample (L1-12108A-FQGS-001-SS) for "split sample" analysis. The on-site laboratory analyzed the designated QC sample using the on-site gamma spectroscopy system. Gamma spectroscopy results (summarized in Table 15) indicate that concentrations for Cs-137, Co-60 and Cs-134 were less than MDC in the sample. The concentration for Ni-63 and Sr-90 are inferred based on the maximum ratios as specified in Table 6.

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

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L1-12108A-FQGS-001-SS	1.51E-02	9.64E-04	1.61E-02	2.72E+00	3.22E-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 calculations for the ROC in the systematic sample population when compared against the OpDCGLs for surface soils for survey unit 12108 are presented in Table 16. The results of the unity rule calculations for the ROC for the subsurface samples are presented in Table 17, and the results for the QC samples are presented in Table 18.

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12108A-FSGS-001-SS	1.81E-02	9.00E-03	3.14E-03	3.89E-03	7.37E-06	0.034
L1-12108A-FSGS-002-SS	2.07E-02	1.48E-02	0.00E+00	4.46E-03	0.00E+00	0.040
L1-12108A-FSGS-003-SS	1.07E-02	0.00E+00	0.00E+00	2.31E-03	0.00E+00	0.013
L1-12108A-FSGS-004-SS	2.35E-02	6.69E-03	0.00E+00	5.05E-03	0.00E+00	0.035
L1-12108A-FSGS-005-SS	3.05E-02	2.14E-03	1.34E-03	6.57E-03	3.14E-06	0.041
L1-12108A-FSGS-006-SS	1.98E-02	1.31E-02	1.62E-03	4.26E-03	3.81E-06	0.039
L1-12108A-FSGS-007-SS	6.92E-03	3.06E-02	0.00E+00	1.49E-03	0.00E+00	0.039
L1-12108A-FSGS-008-SS	6.69E-03	1.62E-02	0.00E+00	1.44E-03	0.00E+00	0.024
L1-12108A-FSGS-009-SS	2.72E-02	0.00E+00	0.00E+00	5.86E-03	0.00E+00	0.033
L1-12108A-FSGS-010-SS	2.25E-02	0.00E+00	0.00E+00	4.85E-03	0.00E+00	0.027
L1-12108A-FSGS-011-SS	1.47E-02	0.00E+00	2.75E-03	3.16E-03	6.46E-06	0.021
L1-12108A-FSGS-012-SS	0.00E+00	1.81E-02	0.00E+00	0.00E+00	0.00E+00	0.018
L1-12108A-FSGS-013-SS	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000
L1-12108A-FSGS-014-SS	0.00E+00	0.00E+00	3.72E-03	0.00E+00	8.72E-06	0.004
L1-12108A-FSGS-015-SS	1.70E-02	2.37E-02	1.54E-03	3.65E-03	3.61E-06	0.046
L1-12108A-FSGS-016-SS	0.00E+00	0.00E+00	1.71E-03	0.00E+00	4.01E-06	0.002
L1-12108A-FSGS-017-SS	2.88E-02	0.00E+00	7.19E-04	6.20E-03	1.69E-06	0.036

Systematic Measurements

Number of Systematic Measurements =	17
# of Systematic Measurements with OpSOF $\geq$ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	0
Max Individual Systematic Measurement OpSOF =	0.046
Mean Systematic Measurement OpSOF =	0.027

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

MEASUREMENT ID	Fraction of the OpDCGLs for Subsurface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12108A-FSGS-002-SB	5.05E-02	0.00E+00	0.00E+00	4.11E-02	0.00E+00	0.092
L1-12108A-FSGS-009-SB	0.00E+00	3.25E-03	0.00E+00	0.00E+00	0.00E+00	0.003
L1-12108L-CJGS-001-SB	9.42E-02	7.29E-02	3.77E-02	7.67E-02	3.52E-04	0.282(1)
L1-12108L-CJGS-002-SB	8.20E-02	6.68E-02	3.32E-02	6.67E-02	3.10E-04	0.249(1)
L1-12108L-CJGS-003-SB	7.26E-02	7.54E-02	3.76E-02	5.91E-02	3.51E-04	0.245(1)
L1-12108L-CJGS-004-SB	7.72E-02	6.33E-02	2.96E-02	6.28E-02	2.76E-04	0.233(1)
L1-12108L-CJGS-005-SB	8.75E-02	8.15E-02	3.76E-02	7.12E-02	3.51E-04	0.278(1)

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12108A-FQGS-001-SS	1.38E-02	5.56E-04	4.44E-03	2.98E-03	1.04E-05	0.022

Table 19 - Basic Statistical Properties of Systematic Sample Population

ROC	Mean (pCi/g)	Median (pCi/g)	Max (pCi/g)	Min (pCi/g)	Std. Dev. (pCi/g)	BcDCGL (pCi/g)	Avg. SOF per ROC	Avg. Dose Per ROC
Co-60	1.59E-02	1.85E-02	3.33E-02	0.00E+00	0.012	4.26	3.72E-03	9.31E-02
Cs-134	1.37E-02	3.71E-03	5.30E-02	0.00E+00	0.017	6.77	2.02E-03	5.05E-02
Cs-137	3.53E-03	0.00E+00	1.35E-02	0.00E+00	0.005	14.18	2.49E-04	6.23E-03
Ni-63	2.86E+00	3.34E+00	6.01E+00	0.00E+00	2.104	3572.1	8.01E-04	2.00E-02
Sr-90	7.06E-06	0.00E+00	2.70E-05	0.00E+00	0.000	12.09	5.84E-07	1.46E-05

The mean BcSOF for survey unit 12108 is 0.007, which equates to a dose of 0.170 mrem/year TEDE.

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

8. QUALITY CONTROL

The on-site laboratory processed one (1) split sample, L1-12108A-FQGS-001-SS, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in Zion*Solutions* QAPP. There was not acceptable agreement between field split results when using Cs-137 due to the fact that it is present in the samples at relatively low concentrations. However, when using K-40 (which is present in the samples at higher concentrations), there was acceptable agreement. Refer to Attachment 5 for data and quality control analysis results.

9. INVESTIGATIONS AND RESULTS

No investigations were performed in survey unit 12108.

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 including a Posting Plot are provided in Attachment 6.

13. ANOMALIES

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

14. CONCLUSION

Survey unit 12108 has met the DQOs of the FSS plan. The ALARA criteria for soils as specified in Chapter 4 of the LTP were achieved. The EMC for soils was not needed for this survey unit.

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

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

The mean BcSOF, when the analytical results were compared to the BcDCGLs, was 0.007, which results in a dose contribution from soil in survey unit 12108 of 0.170 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 12108 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 Final Status Survey"

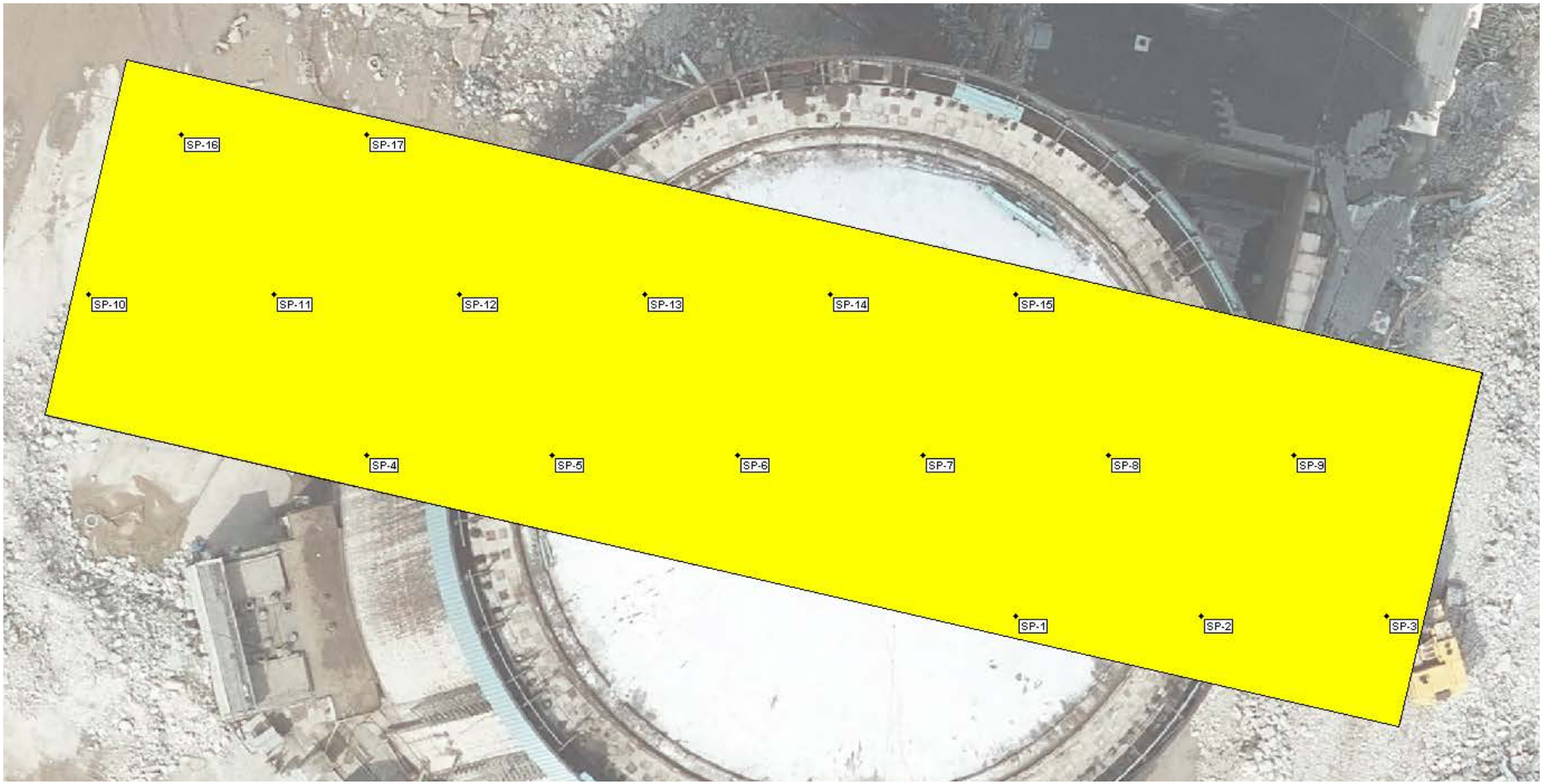
13. Zion*Solutions* procedure ZS-LT-300-001-003, "Isolation and Control for Final Status Survey"
14. Zion*Solutions* procedure ZS-RP-108-004-011, "Operation of the Ludlum Model 2350-1 Data Logger"
15. Zion*Solutions* TSD 13-004, "Examination of Cs-137 Global Fallout In Soils At Zion Station"
16. Zion*Solutions* procedure ZS-LT-300-001-004, "Final Status Survey Data Assessment"

16. ATTACHMENTS

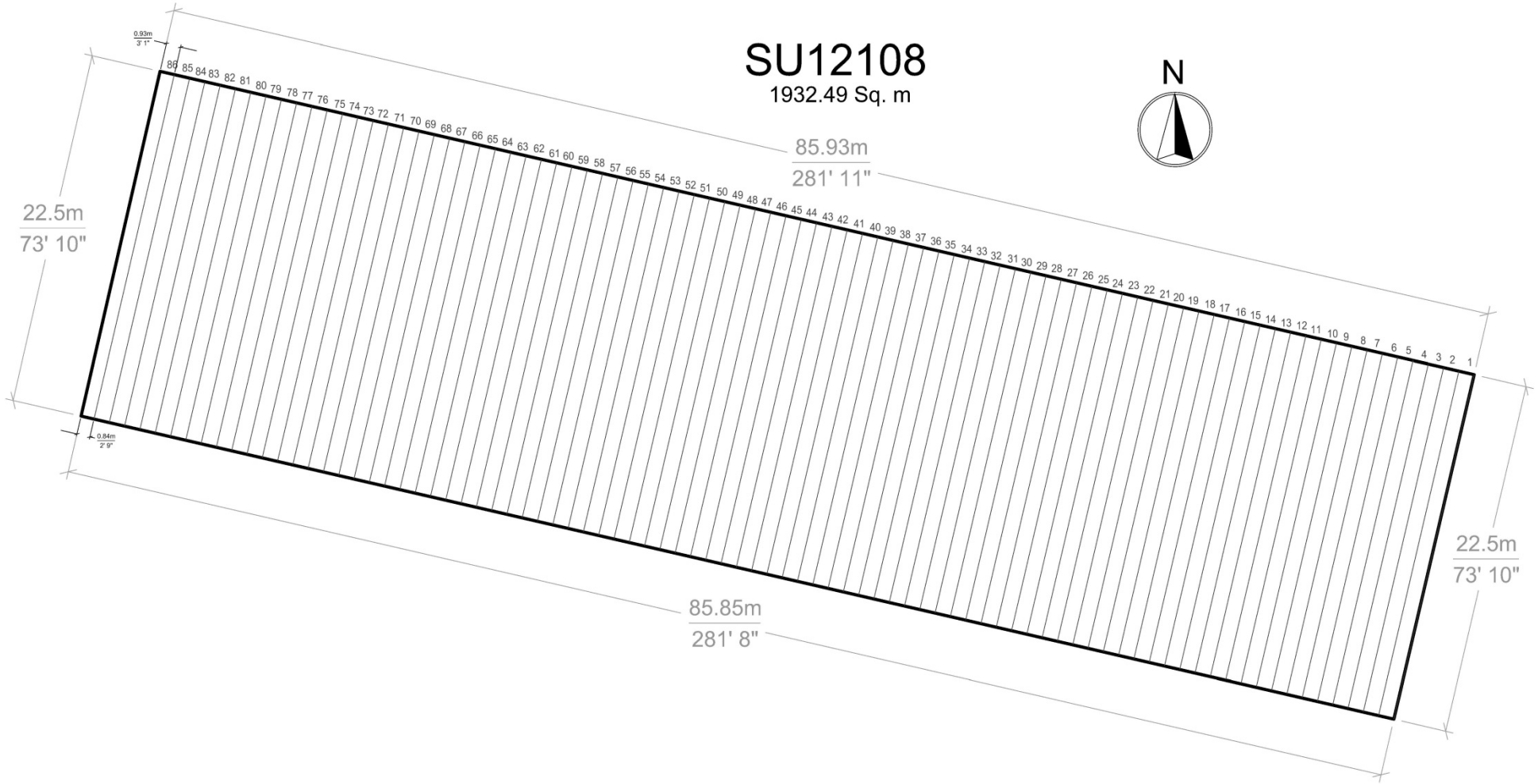
1. Attachment 1 - Figure and Map
2. Attachment 2 - Scan Data
3. Attachment 3 - Consultation Triggers for Residential and Commercial/Industrial Soil Contamination
4. Attachment 4 - Sign Test
5. Attachment 5 - QC Sample Assessment
6. Attachment 6 - Graphical Presentations
7. Attachment 7 - Sample Analytical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

ATTACHMENT 1
FIGURE AND MAP

Survey Unit 12108 Final Status Survey Boundaries and Systematic Sample Points



Survey Unit 12108 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	PR372106	216166	12108	GS001	9/16/2019 7:39	2291	2056	2741	No
44-10	PR372106	216166	12108	GS001	9/16/2019 7:41	2328	2056	2741	No
44-10	PR372106	216166	12108	GS001	9/16/2019 7:44	2373	2056	2741	No
44-10	PR372106	216166	12108	GS002	9/16/2019 7:46	2058	2056	2741	No
44-10	PR372106	216166	12108	GS002	9/16/2019 7:48	2392	2056	2741	No
44-10	PR372106	216166	12108	GS002	9/16/2019 7:50	2257	2056	2741	No
44-10	PR372106	216166	12108	GS003	9/16/2019 7:53	2387	2056	2741	No
44-10	PR372106	216166	12108	GS003	9/16/2019 7:55	2281	2056	2741	No
44-10	PR372106	216166	12108	GS003	9/16/2019 7:57	2385	2056	2741	No
44-10	PR372106	216166	12108	GS004	9/16/2019 7:59	2191	2056	2741	No
44-10	PR372106	216166	12108	GS004	9/16/2019 8:01	2335	2056	2741	No
44-10	PR372106	216166	12108	GS004	9/16/2019 8:03	2205	2056	2741	No
44-10	PR372106	216166	12108	GS005	9/16/2019 8:06	2325	2056	2741	No
44-10	PR372106	216166	12108	GS005	9/16/2019 8:08	2324	2056	2741	No
44-10	PR372106	216166	12108	GS005	9/16/2019 8:10	2293	2056	2741	No
44-10	PR372106	216166	12108	GS006	9/16/2019 8:12	2299	2056	2741	No
44-10	PR372106	216166	12108	GS006	9/16/2019 8:14	2405	2056	2741	No
44-10	PR372106	216166	12108	GS006	9/16/2019 8:16	2261	2056	2741	No
44-10	PR372106	216166	12108	GS007	9/16/2019 8:18	2314	2056	2741	No
44-10	PR372106	216166	12108	GS007	9/16/2019 8:20	2352	2056	2741	No
44-10	PR372106	216166	12108	GS007	9/16/2019 8:22	2242	2056	2741	No
44-10	PR372106	216166	12108	GS008	9/16/2019 8:24	2229	2056	2741	No
44-10	PR372106	216166	12108	GS008	9/16/2019 8:26	2231	2056	2741	No
44-10	PR372106	216166	12108	GS008	9/16/2019 8:28	2212	2056	2741	No
44-10	PR372106	216166	12108	GS009	9/16/2019 8:30	2241	2056	2741	No
44-10	PR372106	216166	12108	GS009	9/16/2019 8:32	2359	2056	2741	No
44-10	PR372106	216166	12108	GS009	9/16/2019 8:34	2342	2056	2741	No
44-10	PR372106	216166	12108	GS010	9/16/2019 8:36	2400	2056	2741	No
44-10	PR372106	216166	12108	GS010	9/16/2019 8:38	2320	2056	2741	No
44-10	PR372106	216166	12108	GS010	9/16/2019 8:40	2168	2056	2741	No
44-10	PR372106	216166	12108	GS011	9/16/2019 8:42	2370	2056	2741	No
44-10	PR372106	216166	12108	GS011	9/16/2019 8:44	2337	2056	2741	No
44-10	PR372106	216166	12108	GS011	9/16/2019 8:46	2318	2056	2741	No
44-10	PR372106	216166	12108	GS012	9/16/2019 8:48	2335	2056	2741	No
44-10	PR372106	216166	12108	GS012	9/16/2019 8:50	2353	2056	2741	No
44-10	PR372106	216166	12108	GS012	9/16/2019 8:53	2269	2056	2741	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	12108	GS013	9/16/2019 8:55	2333	2056	2741	No
44-10	PR372106	216166	12108	GS013	9/16/2019 8:57	2358	2056	2741	No
44-10	PR372106	216166	12108	GS013	9/16/2019 8:59	2501	2056	2741	No
44-10	PR372106	216166	12108	GS014	9/16/2019 9:01	2373	2056	2741	No
44-10	PR372106	216166	12108	GS014	9/16/2019 9:03	2442	2056	2741	No
44-10	PR372106	216166	12108	GS014	9/16/2019 9:05	2421	2056	2741	No
44-10	PR372106	216166	12108	GS015	9/16/2019 9:07	2402	2056	2741	No
44-10	PR372106	216166	12108	GS015	9/16/2019 9:09	2497	2056	2741	No
44-10	PR372106	216166	12108	GS015	9/16/2019 9:11	2352	2056	2741	No
44-10	PR372106	216166	12108	GS016	9/16/2019 9:13	2295	2056	2741	No
44-10	PR372106	216166	12108	GS016	9/16/2019 9:15	2696	2056	2741	No
44-10	PR372106	216166	12108	GS016	9/16/2019 9:17	2366	2056	2741	No
44-10	PR372106	216166	12108	GS017	9/16/2019 9:19	2305	2056	2741	No
44-10	PR372106	216166	12108	GS017	9/16/2019 9:21	2348	2056	2741	No
44-10	PR372106	216166	12108	GS017	9/16/2019 9:23	2323	2056	2741	No
44-10	PR372106	216166	12108	GS018	9/16/2019 9:25	2396	2056	2741	No
44-10	PR372106	216166	12108	GS018	9/16/2019 9:27	2492	2056	2741	No
44-10	PR372106	216166	12108	GS018	9/16/2019 9:29	2255	2056	2741	No
44-10	PR372106	216166	12108	GS019	9/16/2019 9:31	2397	2056	2741	No
44-10	PR372106	216166	12108	GS019	9/16/2019 9:33	2458	2056	2741	No
44-10	PR372106	216166	12108	GS019	9/16/2019 9:35	2480	2056	2741	No
44-10	PR372106	216166	12108	GS020	9/16/2019 9:37	2404	2056	2741	No
44-10	PR372106	216166	12108	GS020	9/16/2019 9:39	2276	2056	2741	No
44-10	PR372106	216166	12108	GS020	9/16/2019 9:41	2253	2056	2741	No
44-10	PR372106	216166	12108	GS021	9/16/2019 9:43	2391	2056	2741	No
44-10	PR372106	216166	12108	GS021	9/16/2019 9:45	2329	2056	2741	No
44-10	PR372106	216166	12108	GS021	9/16/2019 9:47	2329	2056	2741	No
44-10	PR372106	216166	12108	GS022	9/16/2019 9:49	2386	2056	2741	No
44-10	PR372106	216166	12108	GS022	9/16/2019 9:51	2266	2056	2741	No
44-10	PR372106	216166	12108	GS022	9/16/2019 9:53	2242	2056	2741	No
44-10	PR372143	304712	12108	GS023	9/16/2019 7:49	2321	2055	2740	No
44-10	PR372143	304712	12108	GS023	9/16/2019 7:52	2236	2055	2740	No
44-10	PR372143	304712	12108	GS023	9/16/2019 7:55	2308	2055	2740	No
44-10	PR372143	304712	12108	GS024	9/16/2019 7:59	2317	2055	2740	No
44-10	PR372143	304712	12108	GS024	9/16/2019 8:01	2296	2055	2740	No
44-10	PR372143	304712	12108	GS024	9/16/2019 8:04	2265	2055	2740	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR372143	304712	12108	GS025	9/16/2019 8:09	2329	2055	2740	No
44-10	PR372143	304712	12108	GS025	9/16/2019 8:11	2258	2055	2740	No
44-10	PR372143	304712	12108	GS025	9/16/2019 8:14	2391	2055	2740	No
44-10	PR372143	304712	12108	GS026	9/16/2019 8:18	2241	2055	2740	No
44-10	PR372143	304712	12108	GS026	9/16/2019 8:21	2375	2055	2740	No
44-10	PR372143	304712	12108	GS026	9/16/2019 8:24	2482	2055	2740	No
44-10	PR372143	304712	12108	GS027	9/16/2019 8:27	2282	2055	2740	No
44-10	PR372143	304712	12108	GS027	9/16/2019 8:31	2283	2055	2740	No
44-10	PR372143	304712	12108	GS027	9/16/2019 8:34	2261	2055	2740	No
44-10	PR372143	304712	12108	GS028	9/16/2019 8:38	2340	2055	2740	No
44-10	PR372143	304712	12108	GS028	9/16/2019 8:41	2259	2055	2740	No
44-10	PR372143	304712	12108	GS028	9/16/2019 8:43	2326	2055	2740	No
44-10	PR372143	304712	12108	GS029	9/16/2019 8:47	2301	2055	2740	No
44-10	PR372143	304712	12108	GS029	9/16/2019 8:49	2243	2055	2740	No
44-10	PR372143	304712	12108	GS029	9/16/2019 8:52	2263	2055	2740	No
44-10	PR372143	304712	12108	GS030	9/16/2019 8:55	2486	2055	2740	No
44-10	PR372143	304712	12108	GS030	9/16/2019 8:59	2278	2055	2740	No
44-10	PR372143	304712	12108	GS030	9/16/2019 9:02	2375	2055	2740	No
44-10	PR372143	304712	12108	GS031	9/16/2019 9:05	2349	2055	2740	No
44-10	PR372143	304712	12108	GS031	9/16/2019 9:08	2357	2055	2740	No
44-10	PR372143	304712	12108	GS031	9/16/2019 9:11	2307	2055	2740	No
44-10	PR372143	304712	12108	GS032	9/16/2019 9:14	2228	2055	2740	No
44-10	PR372143	304712	12108	GS032	9/16/2019 9:16	2333	2055	2740	No
44-10	PR372143	304712	12108	GS032	9/16/2019 9:18	2226	2055	2740	No
44-10	PR372143	304712	12108	GS033	9/16/2019 9:22	2349	2055	2740	No
44-10	PR372143	304712	12108	GS033	9/16/2019 9:24	2245	2055	2740	No
44-10	PR372143	304712	12108	GS033	9/16/2019 9:27	2292	2055	2740	No
44-10	PR372143	304712	12108	GS034	9/16/2019 9:30	2292	2055	2740	No
44-10	PR372143	304712	12108	GS034	9/16/2019 9:34	2344	2055	2740	No
44-10	PR372143	304712	12108	GS034	9/16/2019 9:37	2359	2055	2740	No
44-10	PR372143	304712	12108	GS035	9/16/2019 9:40	2296	2055	2740	No
44-10	PR372143	304712	12108	GS035	9/16/2019 9:43	2288	2055	2740	No
44-10	PR372143	304712	12108	GS035	9/16/2019 9:47	2428	2055	2740	No
44-10	PR372143	304712	12108	GS036	9/16/2019 10:05	2327	2055	2740	No
44-10	PR372143	304712	12108	GS036	9/16/2019 10:07	2363	2055	2740	No
44-10	PR372143	304712	12108	GS036	9/16/2019 10:09	2283	2055	2740	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR372143	304712	12108	GS037	9/16/2019 10:12	2257	2055	2740	No
44-10	PR372143	304712	12108	GS037	9/16/2019 10:14	2257	2055	2740	No
44-10	PR372143	304712	12108	GS037	9/16/2019 10:17	2206	2055	2740	No
44-10	PR372143	304712	12108	GS038	9/16/2019 10:20	2330	2055	2740	No
44-10	PR372143	304712	12108	GS038	9/16/2019 10:22	2315	2055	2740	No
44-10	PR372143	304712	12108	GS038	9/16/2019 10:25	2381	2055	2740	No
44-10	PR372143	304712	12108	GS039	9/16/2019 10:28	2258	2055	2740	No
44-10	PR372143	304712	12108	GS039	9/16/2019 10:30	2187	2055	2740	No
44-10	PR372143	304712	12108	GS039	9/16/2019 10:35	2224	2055	2740	No
44-10	PR372143	304712	12108	GS040	9/16/2019 12:26	2237	2055	2740	No
44-10	PR372143	304712	12108	GS040	9/16/2019 12:29	2164	2055	2740	No
44-10	PR372143	304712	12108	GS040	9/16/2019 12:31	2246	2055	2740	No
44-10	PR372143	304712	12108	GS041	9/16/2019 12:34	2135	2055	2740	No
44-10	PR372143	304712	12108	GS041	9/16/2019 12:36	2162	2055	2740	No
44-10	PR372143	304712	12108	GS041	9/16/2019 12:40	2267	2055	2740	No
44-10	PR372143	304712	12108	GS042	9/16/2019 12:43	2189	2055	2740	No
44-10	PR372143	304712	12108	GS042	9/16/2019 12:45	2233	2055	2740	No
44-10	PR372143	304712	12108	GS042	9/16/2019 12:47	2192	2055	2740	No
44-10	PR372143	304712	12108	GS043	9/16/2019 12:50	2248	2055	2740	No
44-10	PR372143	304712	12108	GS043	9/16/2019 12:52	2259	2055	2740	No
44-10	PR372143	304712	12108	GS043	9/16/2019 12:54	2318	2055	2740	No
44-10	PR372143	304712	12108	GS044	9/16/2019 12:58	2149	2055	2740	No
44-10	PR372143	304712	12108	GS044	9/16/2019 13:00	2221	2055	2740	No
44-10	PR372143	304712	12108	GS044	9/16/2019 13:02	2217	2055	2740	No
44-10	PR372143	304712	12108	GS045	9/16/2019 13:05	2253	2055	2740	No
44-10	PR372143	304712	12108	GS045	9/16/2019 13:07	2194	2055	2740	No
44-10	PR372143	304712	12108	GS045	9/16/2019 13:09	2221	2055	2740	No
44-10	PR311750	266656	12108	GS046	9/16/2019 7:42	2407	2060	2747	No
44-10	PR311750	266656	12108	GS046	9/16/2019 7:44	2230	2060	2747	No
44-10	PR311750	266656	12108	GS046	9/16/2019 7:46	2329	2060	2747	No
44-10	PR311750	266656	12108	GS047	9/16/2019 7:48	2381	2060	2747	No
44-10	PR311750	266656	12108	GS047	9/16/2019 7:50	2377	2060	2747	No
44-10	PR311750	266656	12108	GS047	9/16/2019 7:52	2336	2060	2747	No
44-10	PR311750	266656	12108	GS048	9/16/2019 7:54	2350	2060	2747	No
44-10	PR311750	266656	12108	GS048	9/16/2019 7:56	2274	2060	2747	No
44-10	PR311750	266656	12108	GS048	9/16/2019 7:58	2385	2060	2747	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR311750	266656	12108	GS049	9/16/2019 8:00	2152	2060	2747	No
44-10	PR311750	266656	12108	GS049	9/16/2019 8:02	2454	2060	2747	No
44-10	PR311750	266656	12108	GS049	9/16/2019 8:04	2256	2060	2747	No
44-10	PR311750	266656	12108	GS050	9/16/2019 8:06	2205	2060	2747	No
44-10	PR311750	266656	12108	GS050	9/16/2019 8:08	2280	2060	2747	No
44-10	PR311750	266656	12108	GS050	9/16/2019 8:10	2158	2060	2747	No
44-10	PR311750	266656	12108	GS051	9/16/2019 8:12	2219	2060	2747	No
44-10	PR311750	266656	12108	GS051	9/16/2019 8:14	2260	2060	2747	No
44-10	PR311750	266656	12108	GS051	9/16/2019 8:16	2185	2060	2747	No
44-10	PR311750	266656	12108	GS052	9/16/2019 8:18	2193	2060	2747	No
44-10	PR311750	266656	12108	GS052	9/16/2019 8:20	2412	2060	2747	No
44-10	PR311750	266656	12108	GS052	9/16/2019 8:22	2248	2060	2747	No
44-10	PR311750	266656	12108	GS053	9/16/2019 8:24	2302	2060	2747	No
44-10	PR311750	266656	12108	GS053	9/16/2019 8:26	2216	2060	2747	No
44-10	PR311750	266656	12108	GS053	9/16/2019 8:28	2377	2060	2747	No
44-10	PR311750	266656	12108	GS054	9/16/2019 8:30	2127	2060	2747	No
44-10	PR311750	266656	12108	GS054	9/16/2019 8:32	2292	2060	2747	No
44-10	PR311750	266656	12108	GS054	9/16/2019 8:34	2378	2060	2747	No
44-10	PR311750	266656	12108	GS055	9/16/2019 8:36	2230	2060	2747	No
44-10	PR311750	266656	12108	GS055	9/16/2019 8:38	2310	2060	2747	No
44-10	PR311750	266656	12108	GS055	9/16/2019 8:40	2185	2060	2747	No
44-10	PR311750	266656	12108	GS056	9/16/2019 8:42	2307	2060	2747	No
44-10	PR311750	266656	12108	GS056	9/16/2019 8:44	2244	2060	2747	No
44-10	PR311750	266656	12108	GS056	9/16/2019 8:46	2277	2060	2747	No
44-10	PR311750	266656	12108	GS057	9/16/2019 8:48	2220	2060	2747	No
44-10	PR311750	266656	12108	GS057	9/16/2019 8:50	2197	2060	2747	No
44-10	PR311750	266656	12108	GS057	9/16/2019 8:52	2318	2060	2747	No
44-10	PR311750	266656	12108	GS058	9/16/2019 8:54	2293	2060	2747	No
44-10	PR311750	266656	12108	GS058	9/16/2019 8:56	2334	2060	2747	No
44-10	PR311750	266656	12108	GS058	9/16/2019 8:58	2144	2060	2747	No
44-10	PR311750	266656	12108	GS059	9/16/2019 9:00	2296	2060	2747	No
44-10	PR311750	266656	12108	GS059	9/16/2019 9:02	2316	2060	2747	No
44-10	PR311750	266656	12108	GS059	9/16/2019 9:04	2254	2060	2747	No
44-10	PR311750	266656	12108	GS060	9/16/2019 9:06	2482	2060	2747	No
44-10	PR311750	266656	12108	GS060	9/16/2019 9:08	2281	2060	2747	No
44-10	PR311750	266656	12108	GS060	9/16/2019 9:10	2232	2060	2747	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR311750	266656	12108	GS061	9/16/2019 9:12	2243	2060	2747	No
44-10	PR311750	266656	12108	GS061	9/16/2019 9:14	2328	2060	2747	No
44-10	PR311750	266656	12108	GS061	9/16/2019 9:16	2423	2060	2747	No
44-10	PR311750	266656	12108	GS062	9/16/2019 9:18	2246	2060	2747	No
44-10	PR311750	266656	12108	GS062	9/16/2019 9:20	2306	2060	2747	No
44-10	PR311750	266656	12108	GS062	9/16/2019 9:22	2286	2060	2747	No
44-10	PR311750	266656	12108	GS063	9/16/2019 9:24	2317	2060	2747	No
44-10	PR311750	266656	12108	GS063	9/16/2019 9:26	2249	2060	2747	No
44-10	PR311750	266656	12108	GS063	9/16/2019 9:28	2295	2060	2747	No
44-10	PR311750	266656	12108	GS064	9/16/2019 9:30	2278	2060	2747	No
44-10	PR311750	266656	12108	GS064	9/16/2019 9:32	2244	2060	2747	No
44-10	PR311750	266656	12108	GS064	9/16/2019 9:34	2251	2060	2747	No
44-10	PR311750	266656	12108	GS065	9/16/2019 9:36	2325	2060	2747	No
44-10	PR311750	266656	12108	GS065	9/16/2019 9:38	2316	2060	2747	No
44-10	PR311750	266656	12108	GS065	9/16/2019 9:40	2192	2060	2747	No
44-10	PR311750	266656	12108	GS066	9/16/2019 9:42	2192	2060	2747	No
44-10	PR311750	266656	12108	GS066	9/16/2019 9:44	2333	2060	2747	No
44-10	PR311750	266656	12108	GS066	9/16/2019 9:46	2331	2060	2747	No
44-10	PR311750	266656	12108	GS067	9/16/2019 9:48	2409	2060	2747	No
44-10	PR311750	266656	12108	GS067	9/16/2019 9:50	2324	2060	2747	No
44-10	PR311750	266656	12108	GS067	9/16/2019 9:52	2274	2060	2747	No
44-10	PR311750	266656	12108	GS068	9/16/2019 9:54	2325	2060	2747	No
44-10	PR311750	266656	12108	GS068	9/16/2019 9:56	2197	2060	2747	No
44-10	PR311750	266656	12108	GS068	9/16/2019 9:58	2321	2060	2747	No
44-10	PR321892	304708	12108	GS069	9/16/2019 7:23	2358	2099	2792	No
44-10	PR321892	304708	12108	GS069	9/16/2019 7:25	2249	2099	2792	No
44-10	PR321892	304708	12108	GS069	9/16/2019 7:27	2112	2099	2792	No
44-10	PR321892	304708	12108	GS070	9/16/2019 7:31	2281	2099	2792	No
44-10	PR321892	304708	12108	GS070	9/16/2019 7:33	2348	2099	2792	No
44-10	PR321892	304708	12108	GS070	9/16/2019 7:34	2217	2099	2792	No
44-10	PR321892	304708	12108	GS071	9/16/2019 7:37	2414	2099	2792	No
44-10	PR321892	304708	12108	GS071	9/16/2019 7:39	2235	2099	2792	No
44-10	PR321892	304708	12108	GS071	9/16/2019 7:40	2267	2099	2792	No
44-10	PR321892	304708	12108	GS072	9/16/2019 7:42	2332	2099	2792	No
44-10	PR321892	304708	12108	GS072	9/16/2019 7:44	2168	2099	2792	No
44-10	PR321892	304708	12108	GS072	9/16/2019 7:45	2223	2099	2792	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR321892	304708	12108	GS073	9/16/2019 7:47	2375	2099	2792	No
44-10	PR321892	304708	12108	GS073	9/16/2019 7:49	2283	2099	2792	No
44-10	PR321892	304708	12108	GS073	9/16/2019 7:50	2228	2099	2792	No
44-10	PR321892	304708	12108	GS074	9/16/2019 7:52	2452	2099	2792	No
44-10	PR321892	304708	12108	GS074	9/16/2019 7:54	2408	2099	2792	No
44-10	PR321892	304708	12108	GS074	9/16/2019 7:55	2291	2099	2792	No
44-10	PR321892	304708	12108	GS075	9/16/2019 7:59	2420	2099	2792	No
44-10	PR321892	304708	12108	GS075	9/16/2019 8:02	2308	2099	2792	No
44-10	PR321892	304708	12108	GS075	9/16/2019 8:03	2267	2099	2792	No
44-10	PR321892	304708	12108	GS076	9/16/2019 8:05	2305	2099	2792	No
44-10	PR321892	304708	12108	GS076	9/16/2019 8:07	2399	2099	2792	No
44-10	PR321892	304708	12108	GS076	9/16/2019 8:08	2334	2099	2792	No
44-10	PR321892	304708	12108	GS077	9/16/2019 8:10	2387	2099	2792	No
44-10	PR321892	304708	12108	GS077	9/16/2019 8:12	2247	2099	2792	No
44-10	PR321892	304708	12108	GS077	9/16/2019 8:13	2275	2099	2792	No
44-10	PR321892	304708	12108	GS078	9/16/2019 8:15	2308	2099	2792	No
44-10	PR321892	304708	12108	GS078	9/16/2019 8:17	2623	2099	2792	No
44-10	PR321892	304708	12108	GS078	9/16/2019 8:18	2453	2099	2792	No
44-10	PR321892	304708	12108	GS079	9/16/2019 8:20	2277	2099	2792	No
44-10	PR321892	304708	12108	GS079	9/16/2019 8:22	2304	2099	2792	No
44-10	PR321892	304708	12108	GS079	9/16/2019 8:23	2235	2099	2792	No
44-10	PR321892	304708	12108	GS080	9/16/2019 8:59	2227	2099	2792	No
44-10	PR321892	304708	12108	GS080	9/16/2019 9:01	2390	2099	2792	No
44-10	PR321892	304708	12108	GS080	9/16/2019 9:02	2378	2099	2792	No
44-10	PR321892	304708	12108	GS081	9/16/2019 9:04	2518	2099	2792	No
44-10	PR321892	304708	12108	GS081	9/16/2019 9:06	2375	2099	2792	No
44-10	PR321892	304708	12108	GS081	9/16/2019 9:07	2177	2099	2792	No
44-10	PR321892	304708	12108	GS082	9/16/2019 9:09	2320	2099	2792	No
44-10	PR321892	304708	12108	GS082	9/16/2019 9:11	2287	2099	2792	No
44-10	PR321892	304708	12108	GS082	9/16/2019 9:12	2348	2099	2792	No
44-10	PR321892	304708	12108	GS083	9/16/2019 9:14	2339	2099	2792	No
44-10	PR321892	304708	12108	GS083	9/16/2019 9:16	2302	2099	2792	No
44-10	PR321892	304708	12108	GS083	9/16/2019 9:17	2288	2099	2792	No
44-10	PR321892	304708	12108	GS084	9/16/2019 9:19	2311	2099	2792	No
44-10	PR321892	304708	12108	GS084	9/16/2019 9:21	2453	2099	2792	No
44-10	PR321892	304708	12108	GS084	9/16/2019 9:22	2317	2099	2792	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR321892	304708	12108	GS085	9/16/2019 9:24	2328	2099	2792	No
44-10	PR321892	304708	12108	GS085	9/16/2019 9:26	2267	2099	2792	No
44-10	PR321892	304708	12108	GS085	9/16/2019 9:27	2179	2099	2792	No
44-10	PR321892	304708	12108	GS086	9/16/2019 9:29	2334	2099	2792	No
44-10	PR321892	304708	12108	GS086	9/16/2019 9:31	2313	2099	2792	No
44-10	PR321892	304708	12108	GS086	9/16/2019 9:32	2308	2099	2792	No

ATTACHMENT 3

CONSULTATION TRIGGERS FOR RESIDENTIAL AND COMMERCIAL/INDUSTRIAL SOIL CONTAMINATION

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

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

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

ATTACHMENT 4
SIGN TEST

Attachment 12
Sign Statistical Test

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

Survey Area: No. 12000 **Description:** Security Restricted Area Grounds
Survey Unit: No. 12108 **Description:** North Half of Unit 1 Containment
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	1.81E-02	9.00E-03	3.14E-03	3.89E-03	7.37E-06	SOF	0.034	0.966	+
2	2.07E-02	1.48E-02	0.00E+00	4.46E-03	0.00E+00	SOF	0.040	0.960	+
3	1.07E-02	0.00E+00	0.00E+00	2.31E-03	0.00E+00	SOF	0.013	0.987	+
4	2.35E-02	6.69E-03	0.00E+00	5.05E-03	0.00E+00	SOF	0.035	0.965	+
5	3.05E-02	2.14E-03	1.34E-03	6.57E-03	3.14E-06	SOF	0.041	0.959	+
6	1.98E-02	1.31E-02	1.62E-03	4.26E-03	3.81E-06	SOF	0.039	0.961	+
7	6.92E-03	3.06E-02	0.00E+00	1.49E-03	0.00E+00	SOF	0.039	0.961	+
8	6.69E-03	1.62E-02	0.00E+00	1.44E-03	0.00E+00	SOF	0.024	0.976	+
9	2.72E-02	0.00E+00	0.00E+00	5.86E-03	0.00E+00	SOF	0.033	0.967	+
10	2.25E-02	0.00E+00	0.00E+00	4.85E-03	0.00E+00	SOF	0.027	0.973	+
11	1.47E-02	0.00E+00	2.75E-03	3.16E-03	6.46E-06	SOF	0.021	0.979	+
12	0.00E+00	1.81E-02	0.00E+00	0.00E+00	0.00E+00	SOF	0.018	0.982	+
13	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	SOF	0.000	1.000	+
14	0.00E+00	0.00E+00	3.72E-03	0.00E+00	8.72E-06	SOF	0.004	0.996	+
15	1.70E-02	2.37E-02	1.54E-03	3.65E-03	3.61E-06	SOF	0.046	0.954	+
16	0.00E+00	0.00E+00	1.71E-03	0.00E+00	4.01E-06	SOF	0.002	0.998	+
17	2.88E-02	0.00E+00	7.19E-04	6.20E-03	1.69E-06	SOF	0.036	0.964	+

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

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

Prepared By (RE): J Graham / [signature] 10/17/19
(Print Name) (Signature) (Date)

Peer Reviewed By (RE): R.S. Mundis / [signature] 10-17-19
(Print Name) (Signature) (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #: 12000	Survey Unit # 12108	Survey Unit Name: North Half of Unit 1 Containment
Sample Plan#: L1-12108A-F		

Sample Description: Comparison of split samples collected from systematic surface soil sample #1. The samples were analyzed using gamma spectroscopy by on-site HPGe system. The standard/comparison samples were L1-12108A-FSGS-001SS/L1-12108A-FQGS-001SS.

STANDARD					COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
K-40	8.83E+00	5.65E-01	15.60	0.6 - 1.66	8.42E+00	5.40E-01	1.05	Y

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

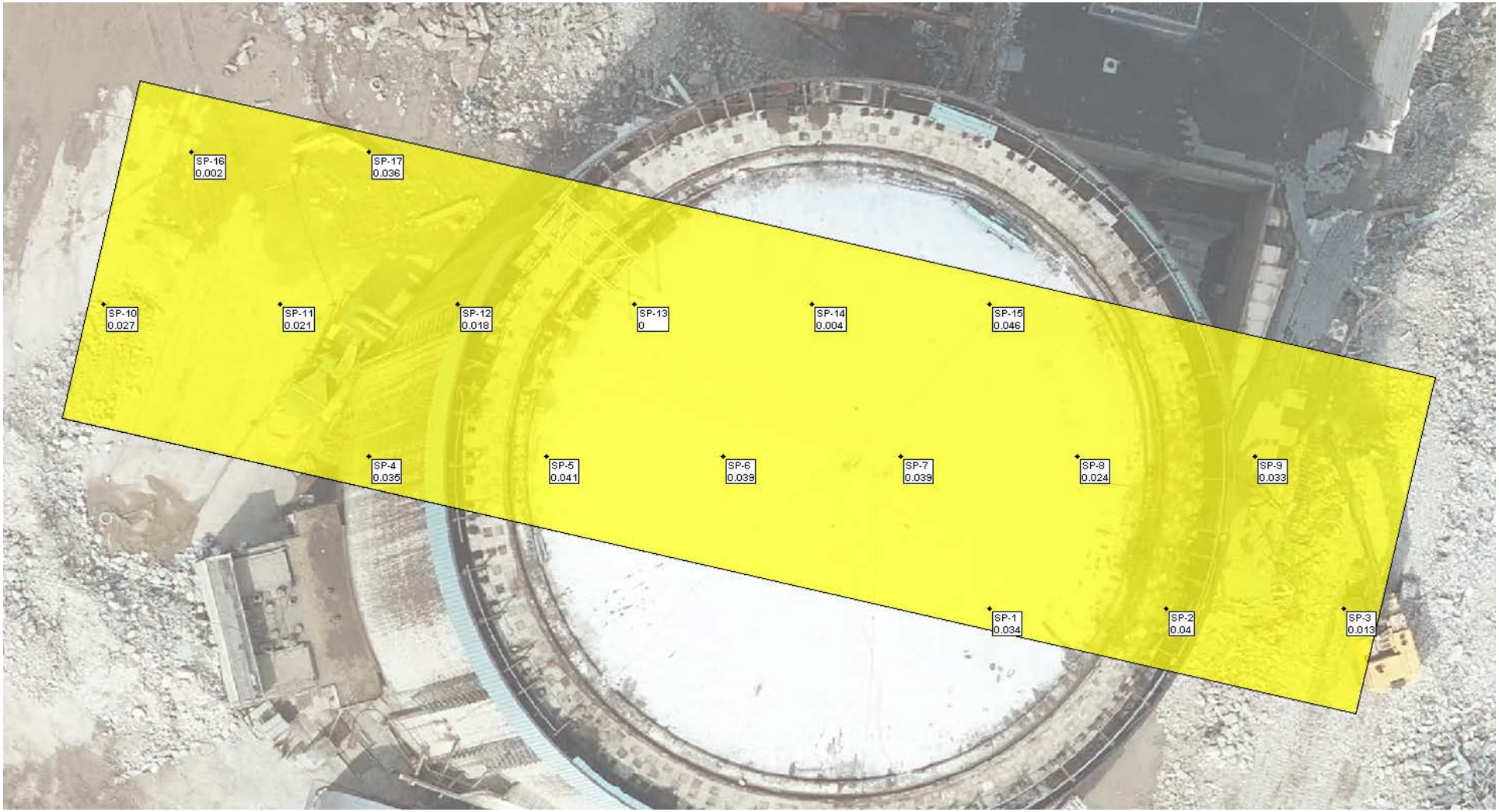
Table 4-1 from the QAPP is reproduced below to show acceptance criteria used to assess split samples.

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

Performed by: T Graham	Date: 10/17/19	Reviewed by: R.J. Mandia	Date: 10-17-19

ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot

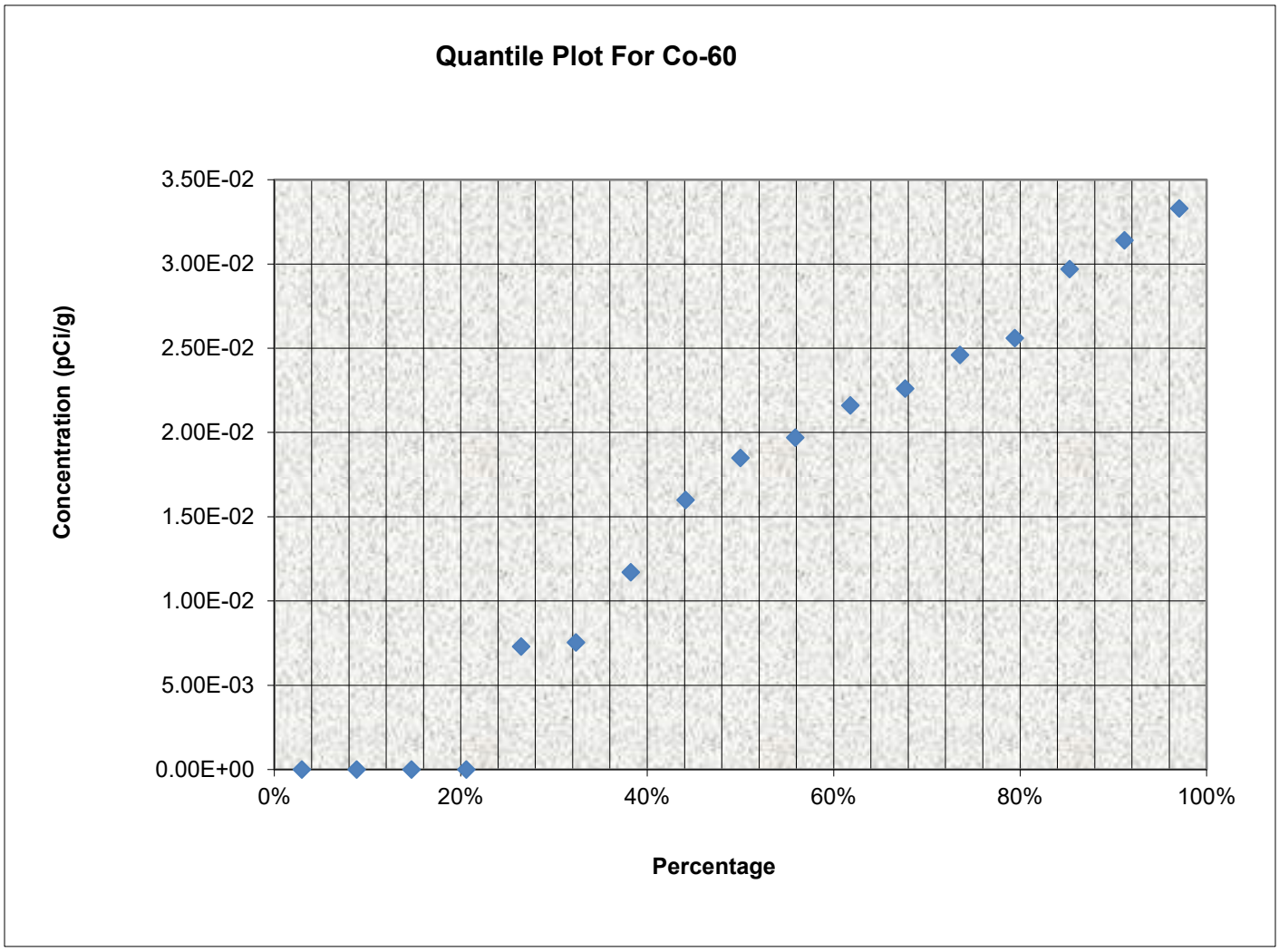


QUANTILE PLOT FOR Co-60

Survey Unit: 12108

Survey Unit Name: North Half of Unit 1 Containment

Mean: 1.59E-02 pCi/g

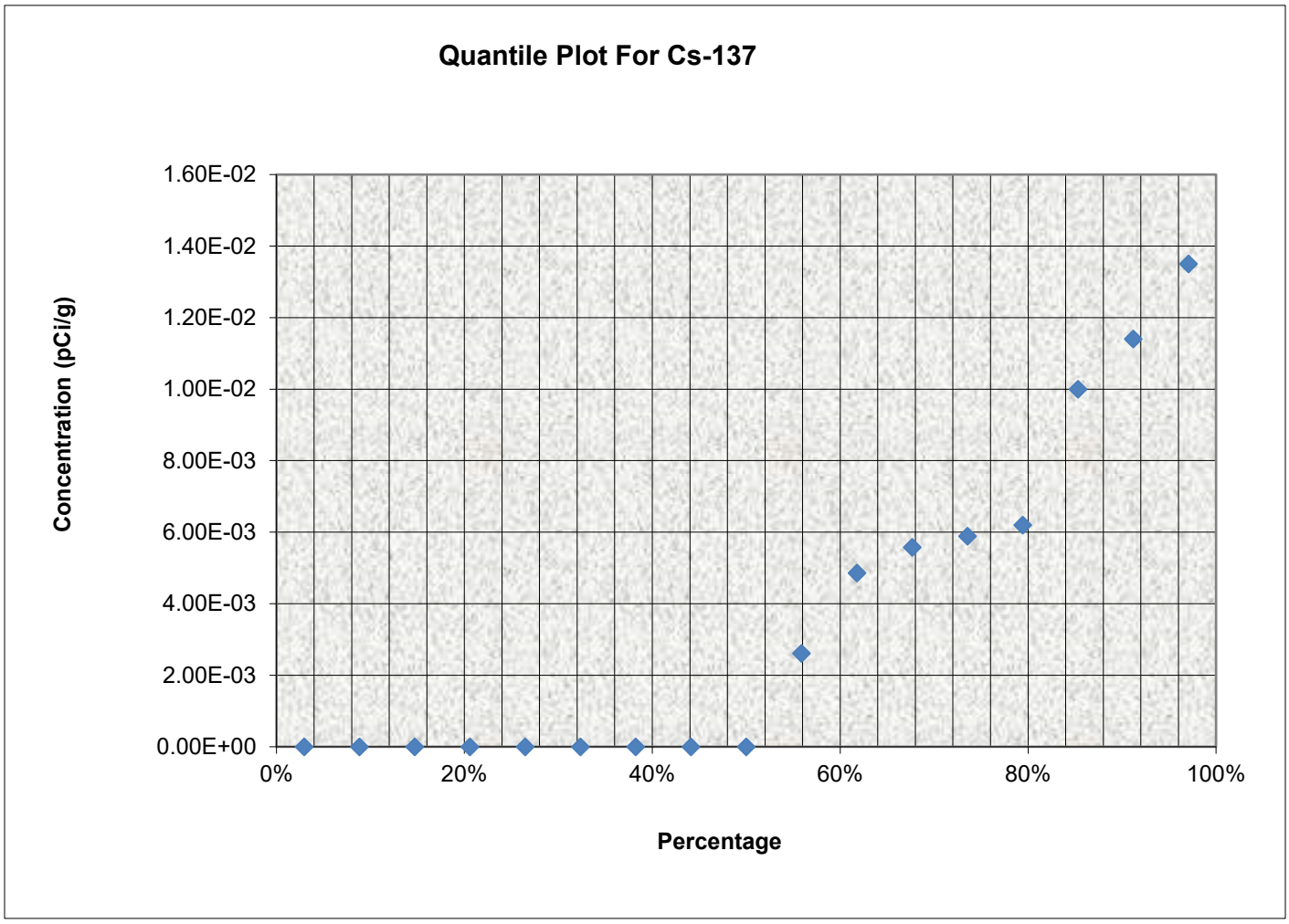


QUANTILE PLOT FOR Cs-137

Survey Unit: 12108

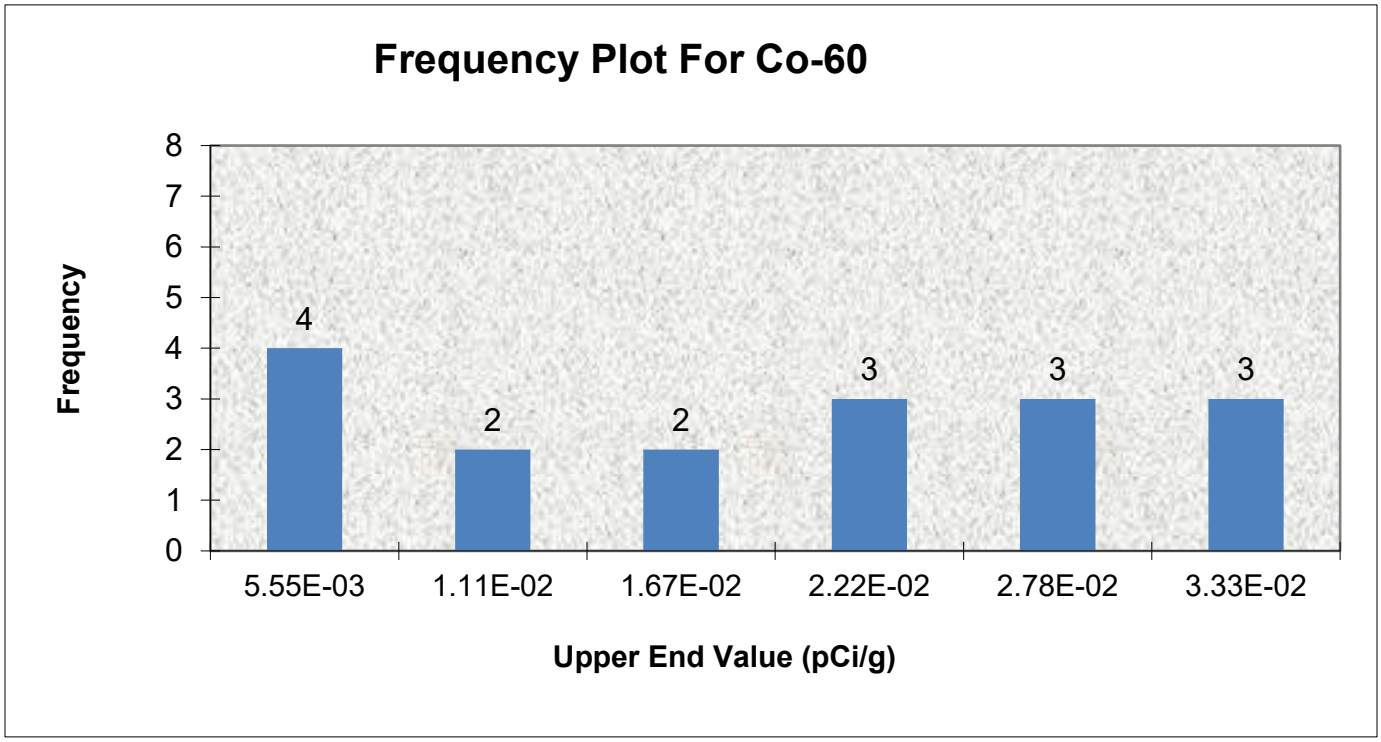
Survey Unit Name: North Half of Unit 1 Containment

Mean: 3.53E-03 pCi/g



HISTOGRAM FOR Co-60

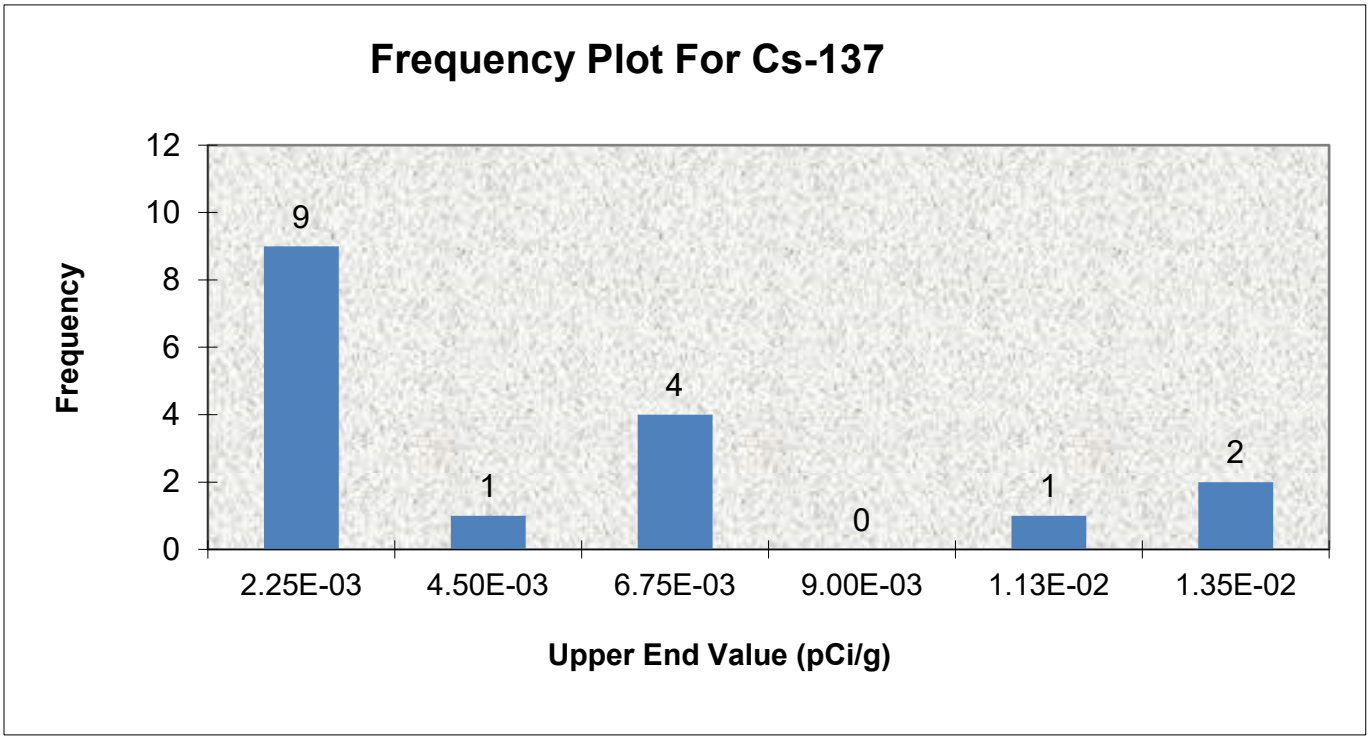
Survey Unit:	12108	
Survey Unit Name:	North Half of Unit 1 Containment	
Mean:	1.59E-02	pCi/g
Median:	1.85E-02	pCi/g
ST DEV:	0.012	
Skew:	-0.149	



Upper Value	Observation Frequency	Observation %
5.55E-03	4	24%
1.11E-02	2	12%
1.67E-02	2	12%
2.22E-02	3	18%
2.78E-02	3	18%
3.33E-02	3	18%
TOTAL	17	100%

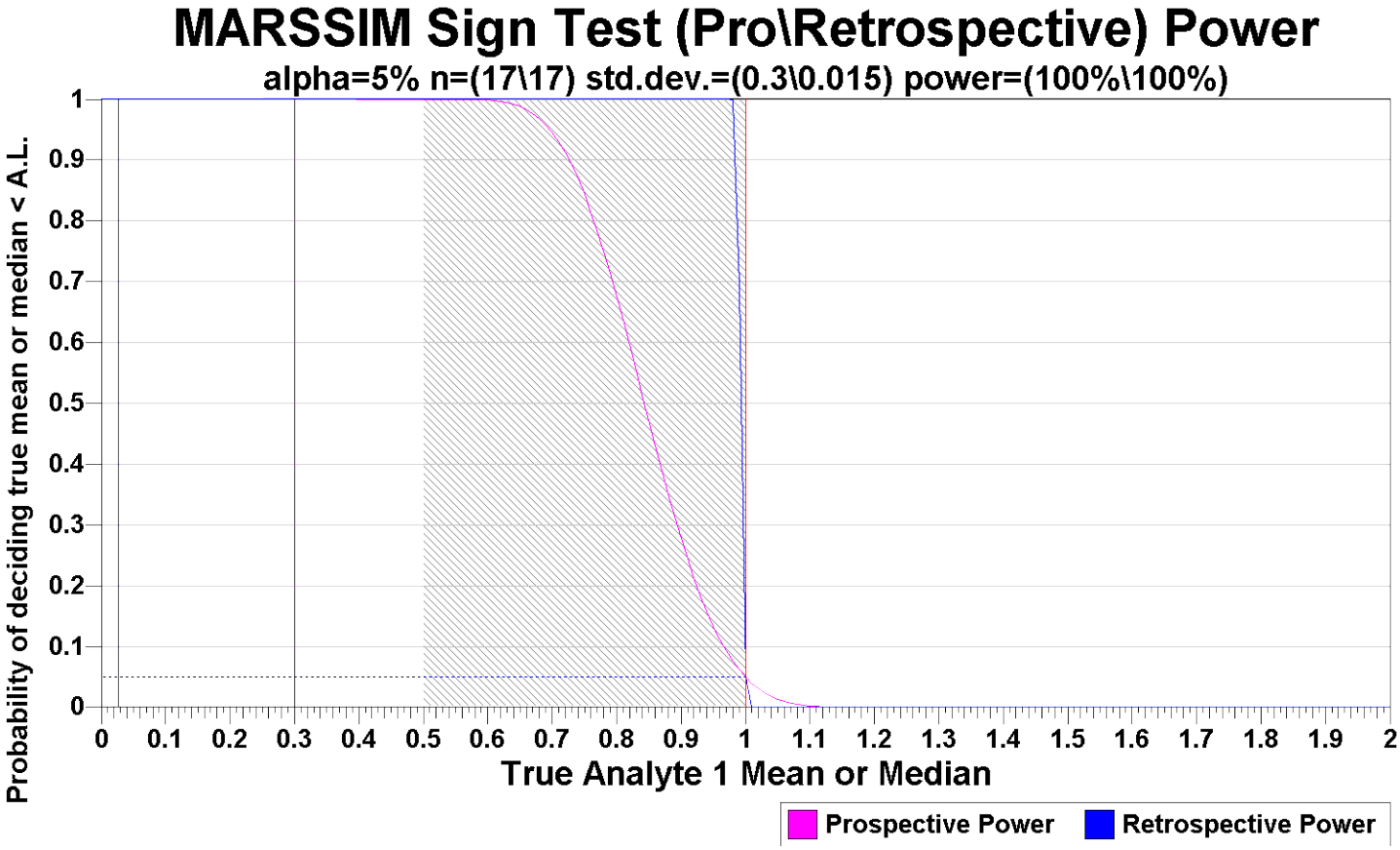
HISTOGRAM FOR Cs-137

Survey Unit:	12108	
Survey Unit Name:	North Half of Unit 1 Containment	
Mean:	3.53E-03	pCi/g
Median:	0.00E+00	pCi/g
ST DEV:	0.005	
Skew:	1.031	



Upper Value	Observation Frequency	Observation %
2.25E-03	9	53%
4.50E-03	1	6%
6.75E-03	4	24%
9.00E-03	0	0%
1.13E-02	1	6%
1.35E-02	2	12%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Unit 12108



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 24-Sep-19-10006

L1-12108A-FSGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10006
Sample Description	: L1-12108A-FSGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.643E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:00:00PM
Acquisition Started	: 9/24/2019 8:44:54AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79789
Fill Height	: 1642.54 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:00:03AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 9/24/19 -1600

J Graham

Analysis Report for 24-Sep-19-10006

L1-12108A-FSGS-001SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	238.62	473 -	487	477.43	1.65E+02	38.25	6.80E+01	1.03
m	2	241.60	473 -	487	483.37	3.16E+01	10.01	5.75E+01	1.04
	3	295.19	586 -	595	590.43	4.65E+01	13.21	5.65E+01	0.92
	4	351.99	699 -	708	703.93	8.37E+01	13.30	4.13E+01	1.16
	5	583.26	1161 -	1171	1166.12	6.80E+01	11.50	2.70E+01	1.20
	6	609.38	1212 -	1224	1218.33	7.50E+01	11.99	2.60E+01	1.09
	7	911.22	1818 -	1827	1821.89	3.55E+01	8.33	1.45E+01	1.08
	8	1460.79	2914 -	2928	2921.64	4.79E+02	22.49	9.39E+00	1.86

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	8.83E+00	5.65E-01
Tl-208	0.99	583.19	*	85.00	8.64E-02	1.55E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.28E-01	5.61E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.83E-01	3.13E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 24-Sep-19-10006

L1-12108A-FSGS-001SS

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	2.65E-01	8.66E-02
		295.22	*	18.42	1.72E-01	5.07E-02
		351.93	*	35.60	1.81E-01	3.22E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.99E-01	4.74E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 24-Sep-19-10006

L1-12108A-FSGS-001SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	8.83E+00	5.65E-01	
	Tl-208	0.999	8.64E-02	1.55E-02	
X	Bi-211	0.873			
	Pb-212	1.000	2.28E-01	5.61E-02	
	Bi-214	1.000	1.83E-01	3.13E-02	
	Pb-214	0.997	1.86E-01	2.59E-02	
	Ac-228	1.000	1.99E-01	4.74E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 24-Sep-19-10006

L1-12108A-FSGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:00:03AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	1.12E-01	6.05E-02	6.05E-02
	BE-7	477.60		10.44	1.69E-01	3.53E-01	3.53E-01
+	K-40	1460.82	*	10.66	8.83E+00	3.78E-01	3.78E-01
	Mn-54	834.85		99.98	-1.99E-03	4.37E-02	4.37E-02
	Co-60	1173.23		99.85	-9.87E-03	4.48E-02	5.17E-02
		1332.49		99.98	1.97E-02		4.48E-02
	Nb-94	702.65		99.81	1.45E-03	3.48E-02	3.96E-02
		871.09		99.89	5.94E-03		3.48E-02
	Ag-108m	79.13		6.60	1.84E-01	3.33E-02	1.11E+00
		433.94		90.50	-1.77E-02		3.33E-02
		614.28		89.80	-1.90E-02		5.24E-02
		722.94		90.80	-4.87E-03		4.54E-02
	Sb-125	176.31		6.84	-4.64E-02	1.14E-01	5.06E-01
		380.45		1.52	5.66E-01		2.22E+00
		427.87		29.60	4.92E-02		1.14E-01
		463.36		10.49	1.87E-01		3.63E-01
		600.60		17.65	4.26E-02		2.17E-01
		606.71		4.98	-1.86E-03		1.19E+00
		635.95		11.22	-2.33E-01		3.07E-01

Analysis Report for 24-Sep-19-10006

L1-12108A-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.56E+00	1.14E-01	1.84E+00
Ba-133	79.61	2.65	6.98E-01	6.91E-02	2.70E+00
	81.00	32.90	-1.36E-01		1.85E-01
	276.40	7.16	-2.12E-01		4.46E-01
	302.85	18.34	1.17E-01		1.89E-01
	356.01	62.05	-2.95E-02		6.91E-02
	383.85	8.94	-1.97E-04		3.61E-01
Cs-134	475.36	1.48	8.98E-02	4.46E-02	2.29E+00
	563.25	8.34	4.65E-02		4.13E-01
	569.33	15.37	5.72E-02		2.20E-01
	604.72	97.62	-2.62E-03		5.12E-02
	795.86	85.46	1.56E-02		4.46E-02
	801.95	8.69	-1.81E-01		3.90E-01
	1038.61	0.99	8.38E-01		4.98E+00
	1167.97	1.79	1.21E+00		3.42E+00
	1365.19	3.02	-3.38E-01		1.26E+00
Cs-137	661.66	85.10	1.14E-02	4.78E-02	4.78E-02
Eu-152	121.78	28.67	-2.25E-02	1.08E-01	1.08E-01
	244.70	7.61	-4.06E-02		4.60E-01
	295.94	0.45	4.24E+00		8.38E+00
	344.28	26.60	-7.95E-02		1.16E-01
	367.79	0.86	6.57E-01		3.69E+00
	411.12	2.24	6.87E-01		1.46E+00
	443.96	2.83	-1.22E-01		1.07E+00
	488.68	0.42	-4.51E+00		8.34E+00
	563.99	0.49	1.95E+00		7.15E+00
	586.26	0.46	-1.10E+00		1.26E+01
	678.62	0.47	-2.05E+00		7.90E+00
	688.67	0.86	5.00E-01		4.60E+00
	719.35	0.28	-6.55E+00		1.25E+01
	778.90	12.96	-4.29E-02		3.10E-01
	810.45	0.32	3.33E+00		1.16E+01
	867.37	4.26	-6.41E-01		7.62E-01
	919.33	0.43	1.14E+00		1.03E+01
	964.08	14.65	-5.28E-02		3.97E-01
	1085.87	10.24	2.08E-01		4.80E-01
	1089.74	1.73	-1.50E+00		2.73E+00
	1112.07	13.69	7.32E-03		4.56E-01
	1212.95	1.43	2.43E+00		4.55E+00
	1249.94	0.19	7.97E+00		3.34E+01
	1299.14	1.63	-2.29E-02		3.15E+00
	1408.01	21.07	1.30E-01		2.21E-01
	1457.64	0.50	-2.69E-01		4.27E+01
	1528.10	0.28	3.61E+00		9.82E+00
Eu-154	123.07	40.40	-1.84E-02	7.76E-02	7.76E-02
	247.93	6.89	7.86E-02		4.51E-01
	591.76	4.95	-5.24E-01		7.15E-01
	692.42	1.78	-1.33E-01		2.23E+00
	723.30	20.06	1.14E-01		2.15E-01
	756.80	4.52	5.66E-01		9.51E-01
	873.18	12.08	-6.75E-02		2.89E-01

Analysis Report for 24-Sep-19-10006

L1-12108A-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.05E-01	7.76E-02	4.13E-01
	1004.76	18.01	-6.63E-02		2.34E-01
	1274.43	34.80	-2.83E-02		1.54E-01
	1596.48	1.80	7.02E-01		1.71E+00
Eu-155	45.30	1.31	2.80E+00	1.75E-01	1.13E+01
	60.01	1.22	1.23E+00		1.26E+01
	86.55	30.70	1.60E-02		1.75E-01
	105.31	21.10	8.62E-02		1.84E-01
Ra-226	186.21	3.64	3.48E-01	9.94E-01	9.94E-01
Pa-231	27.36	10.30	1.09E+00	1.20E+00	1.20E+00
	283.69	1.70	1.20E-01		1.87E+00
	300.07	2.47	3.09E-01		1.42E+00
	302.65	2.20	9.76E-01		1.57E+00
	330.06	1.40	5.38E-01		2.41E+00
U-235	143.76	10.96	-5.62E-02	6.48E-02	2.72E-01
	163.33	5.08	-2.41E-02		6.56E-01
	185.71	57.20	5.24E-02		6.48E-02
	202.11	1.08	2.60E+00		3.24E+00
	205.31	5.01	-5.91E-01		6.46E-01
Am-241	59.54	35.90	-1.20E-02	4.30E-01	4.30E-01

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

Apex-Gamma

Analysis Report for 24-Sep-19-10007

L1-12108A-FQGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10007
Sample Description	: L1-12108A-FQGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.699E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:00:00PM
Acquisition Started	: 9/24/2019 9:08:48AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79793
Fill Height	: 1699.10 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:23:51AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 9/24/19 -1600

J Groban

Analysis Report for 24-Sep-19-10007

L1-12108A-FQGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.66	473 -	481	477.50	1.45E+02	19.43	1.04E+02	1.14
2	295.14	586 -	593	590.34	3.58E+01	11.08	4.32E+01	0.82
3	351.99	699 -	708	703.93	1.13E+02	15.30	5.35E+01	1.63
4	583.15	1162 -	1171	1165.91	5.67E+01	10.01	1.93E+01	1.51
5	609.26	1212 -	1223	1218.11	6.98E+01	12.40	3.32E+01	1.73
6	911.37	1816 -	1826	1822.19	4.15E+01	8.61	1.35E+01	1.07
7	968.83	1933 -	1941	1937.12	1.52E+01	7.77	2.08E+01	0.65
8	1460.80	2915 -	2929	2921.65	4.60E+02	21.75	4.93E+00	1.84

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	8.42E+00	5.40E-01
Tl-208	1.00	583.19	*	85.00	7.15E-02	1.33E-02
Bi-211	0.87	351.07	*	13.02	6.67E-01	1.05E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.00E-01	3.13E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.69E-01	3.17E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 24-Sep-19-10007

L1-12108A-FQGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.32E-01	4.21E-02
		351.93	*	35.60	2.44E-01	3.83E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.30E-01	4.88E-02
		964.77		4.99		
		968.97	*	15.80	1.43E-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

INTERFERENCE CORRECTED REPORT

Analysis Report for 24-Sep-19-10007

L1-12108A-FQGS-001SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	1.000	8.42E+00	5.40E-01	
Tl-208	1.000	7.15E-02	1.33E-02	
Bi-211	0.872	3.07E-01	1.56E-01	
Pb-212	1.000	2.00E-01	3.13E-02	
Bi-214	1.000	1.69E-01	3.17E-02	
Pb-214	0.999	1.32E-01	4.21E-02	
Ac-228	0.998	2.04E-01	4.07E-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 24-Sep-19-10007

L1-12108A-FQGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:23:51AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.66E-02	5.47E-02	5.47E-02
	BE-7	477.60		10.44	7.69E-02	3.54E-01	3.54E-01
+	K-40	1460.82	*	10.66	8.42E+00	2.77E-01	2.77E-01
	Mn-54	834.85		99.98	6.17E-03	4.17E-02	4.17E-02
	Co-60	1173.23		99.85	1.51E-02	3.81E-02	5.27E-02
		1332.49		99.98	-2.01E-02		3.81E-02
	Nb-94	702.65		99.81	-8.65E-03	3.37E-02	3.37E-02
		871.09		99.89	-1.90E-02		3.60E-02
	Ag-108m	79.13		6.60	4.49E-01	3.38E-02	1.17E+00
		433.94		90.50	-1.13E-02		3.38E-02
		614.28		89.80	-5.36E-03		5.24E-02
		722.94		90.80	9.51E-04		4.76E-02
	Sb-125	176.31		6.84	2.74E-02	1.12E-01	5.04E-01
		380.45		1.52	4.65E-01		2.06E+00
		427.87		29.60	6.28E-02		1.12E-01
		463.36		10.49	6.39E-03		2.93E-01
		600.60		17.65	6.67E-03		2.09E-01
		606.71		4.98	-2.13E-01		1.23E+00
		635.95		11.22	7.02E-02		3.09E-01

Analysis Report for 24-Sep-19-10007

L1-12108A-FQGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	3.80E-01	1.12E-01	2.01E+00
Ba-133	79.61	2.65	1.02E+00	7.25E-02	2.83E+00
	81.00	32.90	-2.05E-01		1.92E-01
	276.40	7.16	5.49E-02		4.53E-01
	302.85	18.34	5.07E-03		1.74E-01
	356.01	62.05	-4.46E-02		7.25E-02
	383.85	8.94	-1.97E-01		3.32E-01
Cs-134	475.36	1.48	-2.89E-01	4.63E-02	2.30E+00
	563.25	8.34	2.10E-01		4.52E-01
	569.33	15.37	-8.79E-02		2.19E-01
	604.72	97.62	-8.38E-03		5.58E-02
	795.86	85.46	9.64E-04		4.63E-02
	801.95	8.69	-9.23E-02		3.95E-01
	1038.61	0.99	-2.79E+00		4.32E+00
	1167.97	1.79	1.71E+00		3.13E+00
	1365.19	3.02	2.78E-01		1.40E+00
Cs-137	661.66	85.10	1.61E-02	4.44E-02	4.44E-02
Eu-152	121.78	28.67	3.96E-02	1.08E-01	1.18E-01
	244.70	7.61	-1.83E-01		4.58E-01
	295.94	0.45	1.62E+00		8.06E+00
	344.28	26.60	-1.27E-01		1.08E-01
	367.79	0.86	-1.88E+00		3.64E+00
	411.12	2.24	-4.33E-01		1.49E+00
	443.96	2.83	-5.87E-01		1.11E+00
	488.68	0.42	-4.04E+00		9.10E+00
	563.99	0.49	2.85E+00		7.72E+00
	586.26	0.46	-7.02E-01		1.19E+01
	678.62	0.47	-5.45E+00		8.43E+00
	688.67	0.86	-2.16E-01		4.88E+00
	719.35	0.28	3.21E+00		1.34E+01
	778.90	12.96	-5.52E-02		3.36E-01
	810.45	0.32	-1.68E+00		1.15E+01
	867.37	4.26	-1.04E-01		1.03E+00
	919.33	0.43	-2.75E+00		9.22E+00
	964.08	14.65	7.18E-02		4.03E-01
	1085.87	10.24	-4.71E-02		4.05E-01
	1089.74	1.73	-5.05E-01		2.40E+00
	1112.07	13.69	-3.50E-01		3.62E-01
	1212.95	1.43	1.61E+00		4.22E+00
	1249.94	0.19	-2.88E+00		2.86E+01
	1299.14	1.63	-2.42E-01		2.69E+00
	1408.01	21.07	2.05E-02		1.76E-01
	1457.64	0.50	-1.13E+01		4.15E+01
	1528.10	0.28	4.29E+00		1.05E+01
Eu-154	123.07	40.40	-1.29E-03	8.28E-02	8.28E-02
	247.93	6.89	-5.82E-02		4.50E-01
	591.76	4.95	-1.29E-01		6.93E-01
	692.42	1.78	-3.61E-02		2.17E+00
	723.30	20.06	5.51E-02		2.22E-01
	756.80	4.52	1.58E-01		9.02E-01
	873.18	12.08	-6.89E-02		2.99E-01

Analysis Report for 24-Sep-19-10007

L1-12108A-FQGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	4.69E-02	8.28E-02	4.23E-01
	1004.76	18.01	7.24E-02		2.55E-01
	1274.43	34.80	2.14E-02		1.39E-01
	1596.48	1.80	-1.74E-01		2.18E+00
Eu-155	45.30	1.31	-2.33E+00	1.84E-01	1.04E+01
	60.01	1.22	-5.54E+00		1.21E+01
	86.55	30.70	4.36E-02		1.84E-01
	105.31	21.10	4.44E-02		1.91E-01
Ra-226	186.21	3.64	4.50E-01	1.01E+00	1.01E+00
Pa-231	27.36	10.30	1.43E+00	1.33E+00	1.33E+00
	283.69	1.70	3.56E-01		1.83E+00
	300.07	2.47	-7.13E-01		1.33E+00
	302.65	2.20	4.22E-02		1.45E+00
	330.06	1.40	8.18E-01		2.25E+00
U-235	143.76	10.96	-1.11E-02	6.40E-02	2.88E-01
	163.33	5.08	9.82E-02		6.42E-01
	185.71	57.20	2.79E-02		6.40E-02
	202.11	1.08	2.10E+00		3.22E+00
	205.31	5.01	-2.65E-01		6.48E-01
Am-241	59.54	35.90	6.61E-03	4.36E-01	4.36E-01

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

Apex-Gamma

Analysis Report for 24-Sep-19-10008

L1-12108A-FSGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10008
Sample Description	: L1-12108A-FSGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.732E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:02:00PM
Acquisition Started	: 9/24/2019 8:45:02AM
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	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79790
Fill Height	: 1732.34 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:00:05AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/24/19 -1600

J Graham

Analysis Report for 24-Sep-19-10008

L1-12108A-FSGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.59	949 -	960	954.45	8.16E+01	15.54	6.24E+01	0.74
2	351.77	1401 -	1412	1406.82	5.51E+01	10.68	2.29E+01	0.43
3	582.84	2325 -	2338	2330.58	4.30E+01	8.06	8.04E+00	1.19
4	609.07	2428 -	2440	2435.45	3.95E+01	8.81	1.45E+01	1.27
5	911.04	3639 -	3650	3643.11	3.39E+01	6.64	4.11E+00	0.70
6	1460.39	5831 -	5852	5841.38	3.93E+02	20.80	1.07E+01	1.78

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.82	*	10.66	9.49E+00	6.49E-01
Tl-208	0.98	583.19	*	85.00	6.98E-02	1.37E-02
Bi-211	0.92	351.07	*	13.02	4.12E-01	8.65E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.43E-01	2.96E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.23E-01	2.85E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 24-Sep-19-10008

L1-12108A-FSGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.51E-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		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.45E-01	4.92E-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 24-Sep-19-10008

L1-12108A-FSGS-002SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.970	9.49E+00	6.49E-01	
	Tl-208	0.981	6.98E-02	1.37E-02	
?	Bi-211	0.924	4.12E-01	8.65E-02	
	Pb-212	1.000	1.43E-01	2.96E-02	
	Bi-214	0.996	1.23E-01	2.85E-02	
?	Pb-214	0.998	1.51E-01	3.16E-02	
	Ac-228	0.999	2.45E-01	4.92E-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 24-Sep-19-10008

L1-12108A-FSGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:00:05AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.61E-02	6.20E-02	6.20E-02
	BE-7	477.60		10.44	-1.50E-01	4.50E-01	4.50E-01
+	K-40	1460.82	*	10.66	9.49E+00	5.83E-01	5.83E-01
	Mn-54	834.85		99.98	-6.05E-04	4.78E-02	4.78E-02
	Co-60	1173.23		99.85	2.26E-02	5.72E-02	6.25E-02
		1332.49		99.98	1.50E-02		5.72E-02
	Nb-94	702.65		99.81	1.71E-03	4.29E-02	4.29E-02
		871.09		99.89	-5.62E-03		4.95E-02
	Ag-108m	79.13		6.60	1.65E+00	4.33E-02	1.91E+00
		433.94		90.50	-3.52E-02		4.33E-02
		614.28		89.80	-1.01E-01		5.35E-02
		722.94		90.80	9.55E-03		5.91E-02
	Sb-125	176.31		6.84	8.69E-04	1.52E-01	6.18E-01
		380.45		1.52	-4.37E-01		2.64E+00
		427.87		29.60	-1.05E-01		1.52E-01
		463.36		10.49	-5.60E-02		4.12E-01
		600.60		17.65	-2.23E-02		2.60E-01
		606.71		4.98	1.08E+00		1.28E+00
		635.95		11.22	1.03E-01		3.33E-01

Analysis Report for 24-Sep-19-10008

L1-12108A-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-5.06E-02	1.52E-01	2.83E+00
Ba-133	79.61	2.65	1.28E+00	7.34E-02	4.49E+00
	81.00	32.90	-1.74E-01		3.06E-01
	276.40	7.16	1.30E-01		5.39E-01
	302.85	18.34	5.10E-02		2.34E-01
	356.01	62.05	2.35E-03		7.34E-02
	383.85	8.94	3.52E-02		4.68E-01
Cs-134	475.36	1.48	2.43E+00	6.01E-02	3.17E+00
	563.25	8.34	2.96E-02		4.60E-01
	569.33	15.37	-8.08E-02		2.63E-01
	604.72	97.62	-1.62E-02		6.35E-02
	795.86	85.46	2.56E-02		6.01E-02
	801.95	8.69	1.48E-01		5.59E-01
	1038.61	0.99	3.67E+00		7.10E+00
	1167.97	1.79	1.27E+00		3.55E+00
	1365.19	3.02	-1.89E+00		1.75E+00
Cs-137	661.66	85.10	-3.45E-02	5.39E-02	5.39E-02
Eu-152	121.78	28.67	-5.66E-02	1.40E-01	1.61E-01
	244.70	7.61	-2.16E-01		5.81E-01
	295.94	0.45	-1.05E+00		1.01E+01
	344.28	26.60	-9.60E-03		1.40E-01
	367.79	0.86	1.57E+00		4.26E+00
	411.12	2.24	-1.04E+00		1.62E+00
	443.96	2.83	-1.09E+00		1.39E+00
	488.68	0.42	1.73E+00		9.12E+00
	563.99	0.49	-4.85E+00		7.39E+00
	586.26	0.46	-4.85E+00		1.28E+01
	678.62	0.47	-5.09E+00		9.32E+00
	688.67	0.86	2.11E+00		5.33E+00
	719.35	0.28	3.93E+00		1.74E+01
	778.90	12.96	-1.39E-01		3.29E-01
	810.45	0.32	-1.48E+00		1.52E+01
	867.37	4.26	-4.13E-01		1.12E+00
	919.33	0.43	6.22E+00		1.30E+01
	964.08	14.65	3.38E-01		4.78E-01
	1085.87	10.24	2.69E-01		5.97E-01
	1089.74	1.73	-1.61E+00		3.44E+00
	1112.07	13.69	5.04E-02		4.74E-01
	1212.95	1.43	-2.58E+00		5.43E+00
	1249.94	0.19	2.11E+00		3.70E+01
	1299.14	1.63	-4.99E-01		4.10E+00
	1408.01	21.07	9.44E-02		2.76E-01
	1457.64	0.50	2.10E+02		5.14E+01
	1528.10	0.28	3.78E+00		1.18E+01
Eu-154	123.07	40.40	-2.43E-02	1.15E-01	1.15E-01
	247.93	6.89	-3.82E-02		5.92E-01
	591.76	4.95	-1.92E-01		8.47E-01
	692.42	1.78	1.20E+00		2.31E+00
	723.30	20.06	9.83E-02		2.74E-01
	756.80	4.52	5.13E-01		1.05E+00
	873.18	12.08	1.06E-01		4.10E-01

Analysis Report for 24-Sep-19-10008

L1-12108A-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.42E-02	1.15E-01	4.71E-01
	1004.76	18.01	9.21E-02		3.18E-01
	1274.43	34.80	1.63E-01		1.98E-01
	1596.48	1.80	-5.48E-01		2.39E+00
Eu-155	45.30	1.31	-8.68E+00	2.74E-01	3.19E+01
	60.01	1.22	2.54E+00		3.17E+01
	86.55	30.70	1.53E-01		2.75E-01
	105.31	21.10	-9.48E-03		2.74E-01
Ra-226	186.21	3.64	8.17E-01	1.15E+00	1.15E+00
Pa-231	27.36	10.30	2.23E+00	1.70E+00	3.43E+00
	283.69	1.70	8.43E-01		2.15E+00
	300.07	2.47	-5.74E-01		1.70E+00
	302.65	2.20	6.30E-01		1.97E+00
	330.06	1.40	1.11E+00		3.06E+00
U-235	143.76	10.96	-4.89E-03	7.22E-02	4.11E-01
	163.33	5.08	-4.34E-01		7.43E-01
	185.71	57.20	3.73E-02		7.22E-02
	202.11	1.08	-9.05E-01		3.74E+00
	205.31	5.01	-5.67E-01		7.90E-01
Am-241	59.54	35.90	2.95E-01	1.11E+00	1.11E+00

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

Apex-Gamma

Analysis Report for 24-Sep-19-10009

L1-12108A-FSGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10009
Sample Description	: L1-12108A-FSGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.696E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:04:00PM
Acquisition Started	: 9/24/2019 8:45:09AM
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	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79791
Fill Height	: 1695.51 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:00:31AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/24/19 -1600

J Graham

Analysis Report for 24-Sep-19-10009

L1-12108A-FSGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.84	947 -	962	954.92	1.15E+02	19.96	9.29E+01	0.46
2	352.06	1402 -	1413	1407.24	7.14E+01	11.43	2.36E+01	1.09
3	582.98	2323 -	2337	2330.05	5.90E+01	9.82	1.30E+01	0.44
4	609.36	2428 -	2444	2435.50	7.87E+01	10.53	1.03E+01	1.06
5	1460.18	5827 -	5850	5838.65	3.92E+02	19.80	0.00E+00	1.52

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.93	1460.82	*	10.66	8.55E+00	5.70E-01
Tl-208	0.99	583.19	*	85.00	8.67E-02	1.54E-02
Bi-211	0.85	351.07	*	13.02	4.82E-01	8.64E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.80E-01	3.44E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.23E-01	3.27E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 24-Sep-19-10009

L1-12108A-FSGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.76E-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	0.936	8.55E+00	5.70E-01	
	Tl-208	0.993	8.67E-02	1.54E-02	
?	Bi-211	0.856	4.82E-01	8.64E-02	
	Pb-212	0.994	1.80E-01	3.44E-02	
	Bi-214	1.000	2.23E-01	3.27E-02	
?	Pb-214	0.999	1.76E-01	3.15E-02	

Analysis Report for 24-Sep-19-10009

L1-12108A-FSGS-003SS

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

Errors quoted at 1.000sigma

Analysis Report for 24-Sep-19-10009

L1-12108A-FSGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:00:31AM
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	4.66E-02	5.54E-02	5.54E-02
	BE-7	477.60		10.44	3.34E-02	4.40E-01	4.40E-01
+	K-40	1460.82	*	10.66	8.55E+00	6.27E-02	6.27E-02
	Mn-54	834.85		99.98	-9.27E-03	4.33E-02	4.33E-02
	Co-60	1173.23		99.85	-9.01E-03	5.05E-02	6.50E-02
		1332.49		99.98	1.17E-02		5.05E-02
	Nb-94	702.65		99.81	-2.99E-02	4.27E-02	4.27E-02
		871.09		99.89	1.28E-02		4.63E-02
	Ag-108m	79.13		6.60	3.65E-01	4.03E-02	1.24E+00
		433.94		90.50	5.49E-03		4.03E-02
		614.28		89.80	-5.45E-03		5.86E-02
		722.94		90.80	3.06E-02		5.64E-02
	Sb-125	176.31		6.84	3.77E-02	1.25E-01	4.38E-01
		380.45		1.52	2.68E-02		2.35E+00
		427.87		29.60	1.76E-02		1.25E-01
		463.36		10.49	4.85E-02		4.27E-01
		600.60		17.65	-5.79E-02		2.02E-01
		606.71		4.98	-2.88E-01		1.36E+00
		635.95		11.22	-1.19E-02		3.61E-01

Analysis Report for 24-Sep-19-10009

L1-12108A-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.05E-01	1.25E-01	2.35E+00
Ba-133	79.61	2.65	6.83E-01	6.66E-02	2.98E+00
	81.00	32.90	-1.97E-01		1.96E-01
	276.40	7.16	2.84E-01		5.02E-01
	302.85	18.34	5.66E-02		1.99E-01
	356.01	62.05	-2.28E-02		6.66E-02
	383.85	8.94	2.29E-01		4.26E-01
Cs-134	475.36	1.48	1.17E+00	5.56E-02	2.89E+00
	563.25	8.34	-2.77E-01		4.89E-01
	569.33	15.37	-1.35E-02		2.27E-01
	604.72	97.62	-3.86E-02		5.56E-02
	795.86	85.46	-9.07E-03		5.74E-02
	801.95	8.69	-3.12E-01		4.82E-01
	1038.61	0.99	-1.88E+00		5.70E+00
	1167.97	1.79	1.39E+00		3.80E+00
	1365.19	3.02	1.10E+00		1.58E+00
Cs-137	661.66	85.10	-9.42E-03	4.60E-02	4.60E-02
Eu-152	121.78	28.67	7.64E-02	1.15E-01	1.17E-01
	244.70	7.61	3.97E-01		5.27E-01
	295.94	0.45	5.30E+00		9.19E+00
	344.28	26.60	2.45E-02		1.15E-01
	367.79	0.86	-2.82E+00		3.69E+00
	411.12	2.24	-4.15E-01		1.52E+00
	443.96	2.83	-1.05E+00		1.04E+00
	488.68	0.42	1.23E+00		8.24E+00
	563.99	0.49	-3.60E+00		7.58E+00
	586.26	0.46	-3.84E+00		1.34E+01
	678.62	0.47	-4.87E+00		8.31E+00
	688.67	0.86	1.69E+00		5.03E+00
	719.35	0.28	-4.27E+00		1.51E+01
	778.90	12.96	1.88E-01		3.52E-01
	810.45	0.32	4.53E+00		1.13E+01
	867.37	4.26	6.07E-01		1.13E+00
	919.33	0.43	-8.96E+00		1.01E+01
	964.08	14.65	1.54E-01		4.12E-01
	1085.87	10.24	-5.42E-01		5.24E-01
	1089.74	1.73	-3.85E+00		3.16E+00
	1112.07	13.69	-2.32E-01		3.98E-01
	1212.95	1.43	1.84E+00		4.91E+00
	1249.94	0.19	-2.72E+01		3.21E+01
	1299.14	1.63	1.64E+00		3.83E+00
	1408.01	21.07	-2.21E-01		1.67E-01
	1457.64	0.50	1.79E+02		4.55E+01
	1528.10	0.28	4.27E+00		1.16E+01
Eu-154	123.07	40.40	1.47E-03	7.84E-02	7.84E-02
	247.93	6.89	-1.96E-01		4.64E-01
	591.76	4.95	1.50E-01		7.88E-01
	692.42	1.78	-9.68E-01		2.63E+00
	723.30	20.06	1.54E-01		2.56E-01
	756.80	4.52	5.20E-01		9.03E-01
	873.18	12.08	2.04E-03		3.65E-01

Analysis Report for 24-Sep-19-10009

L1-12108A-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.16E-01	7.84E-02	4.77E-01
	1004.76	18.01	1.10E-01		3.10E-01
	1274.43	34.80	-1.17E-01		1.44E-01
	1596.48	1.80	-2.78E-02		1.89E+00
Eu-155	45.30	1.31	1.86E+00	1.74E-01	1.19E+01
	60.01	1.22	2.32E+00		1.26E+01
	86.55	30.70	3.21E-03		1.74E-01
	105.31	21.10	-9.00E-02		1.91E-01
Ra-226	186.21	3.64	2.35E-01	9.39E-01	9.39E-01
Pa-231	27.36	10.30	9.98E-01	1.27E+00	1.27E+00
	283.69	1.70	-1.11E+00		1.92E+00
	300.07	2.47	-2.40E+00		1.50E+00
	302.65	2.20	3.35E-01		1.66E+00
	330.06	1.40	1.02E+00		2.39E+00
U-235	143.76	10.96	3.92E-02	5.95E-02	2.99E-01
	163.33	5.08	1.99E-01		6.71E-01
	185.71	57.20	1.42E-02		5.95E-02
	202.11	1.08	-1.26E+00		2.77E+00
	205.31	5.01	4.98E-02		6.29E-01
Am-241	59.54	35.90	3.69E-03	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 24-Sep-19-10010
L1-12108A-FSGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10010
Sample Description	: L1-12108A-FSGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.669E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:06:00PM
Acquisition Started	: 9/24/2019 8:45:17AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79792
Fill Height	: 1669.27 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:00:29AM

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

DATA VALIDATED 9/24/19 -1600
J Graham

Analysis Report for 24-Sep-19-10010

L1-12108A-FSGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	92.94	367 -	378	372.99	4.29E+01	13.87	5.81E+01	0.63
2	238.64	949 -	961	955.05	1.20E+02	16.75	6.10E+01	0.82
3	295.07	1175 -	1185	1180.50	1.86E+01	11.26	4.54E+01	0.74
4	338.31	1349 -	1358	1353.30	2.19E+01	8.34	2.11E+01	0.73
5	351.92	1401 -	1415	1407.66	8.93E+01	13.68	3.38E+01	1.15
6	583.17	2327 -	2339	2332.00	4.05E+01	8.56	1.25E+01	1.54
7	609.19	2427 -	2444	2436.01	6.70E+01	11.22	1.80E+01	1.06
8	969.08	3870 -	3881	3875.41	1.58E+01	6.47	1.02E+01	0.34
9	1460.72	5831 -	5854	5843.26	4.32E+02	22.18	1.50E+01	1.52

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.84E+00	5.94E-01
Tl-208	1.00	583.19	*	85.00	5.69E-02	1.25E-02
Bi-211	0.89	351.07	*	13.02	5.85E-01	1.01E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.85E-01	2.99E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.81E-01	3.22E-02
		768.36		4.89		

Analysis Report for 24-Sep-19-10010

L1-12108A-FSGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.61E-01	6.28E-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	1.67E-01	6.85E-02
		1588.20		3.22		
Ac228-XR	0.98	89.96		1.90		
		93.35	*	3.10	1.33E+00	4.82E-01
Th-234	0.99	92.38		2.13		
		92.80	*	2.10	2.32E+00	8.16E-01
		112.81		0.21		
U235-XR	0.98	89.96		3.47		
		93.35	*	5.60	7.36E-01	2.50E-01
		105.60		1.32		

* = 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 24-Sep-19-10010

L1-12108A-FSGS-004SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	8.84E+00	5.94E-01	
	Tl-208	1.000	5.69E-02	1.25E-02	
	Bi-211	0.891	5.85E-01	1.01E-01	
	Pb-212	1.000	1.85E-01	2.99E-02	
	Bi-214	0.999	1.81E-01	3.22E-02	
X	Pb-214	0.999			
	Ac-228	1.000	1.64E-01	4.63E-02	
?	Ac228-XR	0.984	1.33E+00	4.82E-01	
?	Th-234	0.998	2.32E+00	8.16E-01	
?	U235-XR	0.986	7.36E-01	2.50E-01	

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

Errors quoted at 1.000sigma

Analysis Report for 24-Sep-19-10010
L1-12108A-FSGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:00:29AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
3	295.07	2.06293E-02	60.63	Tol.	Eu-152 Pb-214

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.29E-02	5.37E-02	5.37E-02
	BE-7	477.60		10.44	-3.40E-02	4.43E-01	4.43E-01
+	K-40	1460.82	*	10.66	8.84E+00	5.97E-01	5.97E-01
	Mn-54	834.85		99.98	2.47E-02	4.71E-02	4.71E-02
	Co-60	1173.23		99.85	2.56E-02	4.63E-02	7.25E-02
		1332.49		99.98	5.62E-03		4.63E-02
	Nb-94	702.65		99.81	-1.12E-02	4.38E-02	4.38E-02
		871.09		99.89	-2.64E-02		4.85E-02
	Ag-108m	79.13		6.60	-1.02E+00	4.11E-02	1.47E+00
		433.94		90.50	9.47E-03		4.11E-02
		614.28		89.80	-2.04E-02		6.93E-02
		722.94		90.80	-8.67E-03		5.19E-02
	Sb-125	176.31		6.84	1.11E-01	1.17E-01	5.13E-01
		380.45		1.52	-5.61E-01		2.27E+00
		427.87		29.60	-4.13E-02		1.17E-01
		463.36		10.49	3.09E-01		3.65E-01
		600.60		17.65	6.13E-02		2.33E-01

Analysis Report for 24-Sep-19-10010

L1-12108A-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	606.71	4.98	1.68E+00	1.17E-01	1.33E+00
	635.95	11.22	-2.14E-01		3.39E-01
	671.44	1.79	-2.22E+00		2.17E+00
Ba-133	79.61	2.65	-1.46E+00	7.87E-02	3.55E+00
	81.00	32.90	-4.35E-01		2.50E-01
	276.40	7.16	5.45E-01		5.11E-01
	302.85	18.34	6.85E-02		1.84E-01
	356.01	62.05	-1.26E-02		7.87E-02
	383.85	8.94	4.03E-02		3.90E-01
Cs-134	475.36	1.48	1.14E+00	5.84E-02	2.95E+00
	563.25	8.34	1.66E-01		4.62E-01
	569.33	15.37	-3.65E-02		2.10E-01
	604.72	97.62	4.52E-03		6.28E-02
	795.86	85.46	1.16E-02		5.84E-02
	801.95	8.69	-9.92E-01		5.10E-01
	1038.61	0.99	1.23E+00		5.37E+00
	1167.97	1.79	6.05E-01		3.76E+00
	1365.19	3.02	-7.81E-01		1.25E+00
Cs-137	661.66	85.10	-3.02E-02	5.35E-02	5.35E-02
Eu-152	121.78	28.67	-7.98E-02	1.33E-01	1.33E-01
	244.70	7.61	2.79E-01		4.73E-01
	295.94	0.45	7.02E+00		9.73E+00
	344.28	26.60	-2.73E-03		1.40E-01
	367.79	0.86	-2.59E+00		3.83E+00
	411.12	2.24	7.25E-01		1.62E+00
	443.96	2.83	8.48E-02		1.20E+00
	488.68	0.42	2.21E+00		9.41E+00
	563.99	0.49	2.03E+00		7.63E+00
	586.26	0.46	1.36E+01		1.22E+01
	678.62	0.47	-1.14E+01		7.51E+00
	688.67	0.86	1.76E+00		5.32E+00
	719.35	0.28	4.57E+00		1.59E+01
	778.90	12.96	-2.35E-01		3.29E-01
	810.45	0.32	4.84E+00		1.42E+01
	867.37	4.26	-1.55E+00		1.07E+00
	919.33	0.43	-1.72E+01		1.10E+01
	964.08	14.65	7.82E-02		4.43E-01
	1085.87	10.24	8.08E-02		6.00E-01
	1089.74	1.73	1.55E+00		3.48E+00
	1112.07	13.69	-3.32E-01		4.09E-01
	1212.95	1.43	5.82E+00		5.26E+00
	1249.94	0.19	3.95E+00		3.36E+01
	1299.14	1.63	2.53E+00		3.76E+00
	1408.01	21.07	1.61E-01		2.23E-01
	1457.64	0.50	1.89E+02		4.57E+01
	1528.10	0.28	3.20E+00		9.98E+00
Eu-154	123.07	40.40	5.79E-03	9.65E-02	9.65E-02
	247.93	6.89	-3.02E-01		4.63E-01
	591.76	4.95	5.04E-01		8.55E-01
	692.42	1.78	-2.23E+00		2.26E+00
	723.30	20.06	-4.78E-02		2.35E-01

Analysis Report for 24-Sep-19-10010

L1-12108A-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	756.80	4.52	5.64E-01	9.65E-02	1.10E+00
	873.18	12.08	4.46E-01		4.51E-01
	996.29	10.48	3.44E-01		4.99E-01
	1004.76	18.01	-1.63E-01		2.68E-01
	1274.43	34.80	1.20E-01		1.61E-01
	1596.48	1.80	-4.84E-01		2.34E+00
Eu-155	45.30	1.31	-4.51E-01	2.17E-01	2.09E+01
	60.01	1.22	-1.26E+01		1.94E+01
	86.55	30.70	-6.81E-02		2.21E-01
	105.31	21.10	7.94E-02		2.17E-01
Ra-226	186.21	3.64	4.63E-01	1.05E+00	1.05E+00
Pa-231	27.36	10.30	2.37E+00	1.40E+00	2.32E+00
	283.69	1.70	-1.46E+00		1.88E+00
	300.07	2.47	-1.64E+00		1.40E+00
	302.65	2.20	-3.08E-01		1.52E+00
	330.06	1.40	2.51E+00		2.65E+00
U-235	143.76	10.96	1.32E-01	6.60E-02	3.39E-01
	163.33	5.08	2.59E-01		7.41E-01
	185.71	57.20	2.82E-02		6.60E-02
	202.11	1.08	-1.03E+00		3.20E+00
	205.31	5.01	-5.16E-01		6.92E-01
Am-241	59.54	35.90	-5.03E-01	7.04E-01	7.04E-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 24-Sep-19-10011
L1-12108A-FSGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10011
Sample Description	: L1-12108A-FSGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.750E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:08:00PM
Acquisition Started	: 9/24/2019 9:08:59AM
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	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79794
Fill Height	: 1750.16 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:24:04AM

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

DATA VALIDATED 9/24/19 -1600
J Graham

Analysis Report for 24-Sep-19-10011
L1-12108A-FSGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.62	947 -	962	954.58	1.18E+02	17.93	6.78E+01	0.96
2	351.83	1399 -	1413	1407.05	7.26E+01	11.48	2.04E+01	0.71
3	609.11	2428 -	2443	2435.59	7.08E+01	9.17	4.21E+00	0.65
4	1460.42	5830 -	5852	5841.52	3.96E+02	20.46	5.75E+00	1.83

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.82	*	10.66	9.53E+00	6.43E-01
Bi-211	0.91	351.07	*	13.02	5.42E-01	9.62E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.07E-01	3.56E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.21E-01	3.16E-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 24-Sep-19-10011

L1-12108A-FSGS-005SS

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	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.98E-01	3.51E-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	0.975	9.53E+00	6.43E-01	
?	Bi-211	0.912	5.42E-01	9.62E-02	
	Pb-212	1.000	2.07E-01	3.56E-02	
	Bi-214	0.997	2.21E-01	3.16E-02	
?	Pb-214	0.999	1.98E-01	3.51E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 24-Sep-19-10011

L1-12108A-FSGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:24:04AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.53E-02	6.19E-02	6.19E-02
	BE-7	477.60		10.44	2.32E-01	5.09E-01	5.09E-01
+	K-40	1460.82	*	10.66	9.53E+00	4.54E-01	4.54E-01
	Mn-54	834.85		99.98	2.36E-02	4.86E-02	4.86E-02
	Co-60	1173.23		99.85	-2.43E-02	6.44E-02	7.16E-02
		1332.49		99.98	3.33E-02		6.44E-02
	Nb-94	702.65		99.81	1.64E-02	4.63E-02	4.63E-02
		871.09		99.89	-4.54E-02		4.85E-02
	Ag-108m	79.13		6.60	-3.40E-01	4.27E-02	1.90E+00
		433.94		90.50	-2.27E-02		4.27E-02
		614.28		89.80	-4.61E-02		5.74E-02
		722.94		90.80	5.04E-02		6.03E-02
	Sb-125	176.31		6.84	-1.55E-01	1.30E-01	5.70E-01
		380.45		1.52	-1.04E+00		2.55E+00
		427.87		29.60	9.12E-02		1.30E-01
		463.36		10.49	1.41E-02		3.83E-01
		600.60		17.65	-3.36E-02		2.63E-01
		606.71		4.98	2.07E+00		1.40E+00
		635.95		11.22	-7.40E-03		4.25E-01

Analysis Report for 24-Sep-19-10011

L1-12108A-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.37E-01	1.30E-01	2.32E+00
Ba-133	79.61	2.65	-1.08E+00	7.41E-02	4.56E+00
	81.00	32.90	-2.38E-01		3.33E-01
	276.40	7.16	2.91E-01		5.54E-01
	302.85	18.34	5.57E-02		2.21E-01
	356.01	62.05	-2.46E-02		7.41E-02
	383.85	8.94	-2.53E-02		4.34E-01
Cs-134	475.36	1.48	2.19E+00	6.58E-02	3.42E+00
	563.25	8.34	-8.62E-02		4.80E-01
	569.33	15.37	2.43E-01		2.66E-01
	604.72	97.62	-1.65E-02		6.58E-02
	795.86	85.46	3.71E-03		6.64E-02
	801.95	8.69	-2.85E-01		5.93E-01
	1038.61	0.99	2.53E+00		5.44E+00
	1167.97	1.79	2.44E+00		4.27E+00
	1365.19	3.02	9.20E-02		1.74E+00
Cs-137	661.66	85.10	4.86E-03	5.30E-02	5.30E-02
Eu-152	121.78	28.67	8.08E-02	1.50E-01	1.72E-01
	244.70	7.61	1.06E-02		5.67E-01
	295.94	0.45	2.13E+00		1.01E+01
	344.28	26.60	1.60E-02		1.50E-01
	367.79	0.86	-3.89E-01		4.33E+00
	411.12	2.24	4.87E-01		1.87E+00
	443.96	2.83	1.23E+00		1.52E+00
	488.68	0.42	-7.63E-01		8.86E+00
	563.99	0.49	-4.72E-01		8.13E+00
	586.26	0.46	4.09E+00		1.30E+01
	678.62	0.47	-4.93E+00		9.16E+00
	688.67	0.86	-4.09E+00		4.91E+00
	719.35	0.28	-1.24E+01		1.39E+01
	778.90	12.96	2.34E-01		3.35E-01
	810.45	0.32	-1.13E+00		1.63E+01
	867.37	4.26	-3.72E-01		1.15E+00
	919.33	0.43	9.90E+00		1.26E+01
	964.08	14.65	-2.19E-01		5.04E-01
	1085.87	10.24	1.94E-01		6.22E-01
	1089.74	1.73	-2.88E-01		3.98E+00
	1112.07	13.69	-3.93E-01		4.85E-01
	1212.95	1.43	2.17E+00		5.53E+00
	1249.94	0.19	1.75E+01		3.75E+01
	1299.14	1.63	-1.88E+00		3.60E+00
	1408.01	21.07	1.35E-01		2.75E-01
	1457.64	0.50	2.03E+02		5.10E+01
	1528.10	0.28	7.54E+00		1.55E+01
Eu-154	123.07	40.40	2.90E-02	1.20E-01	1.20E-01
	247.93	6.89	-5.04E-02		5.61E-01
	591.76	4.95	-3.78E-01		9.03E-01
	692.42	1.78	1.95E+00		2.66E+00
	723.30	20.06	1.30E-01		2.73E-01
	756.80	4.52	2.84E-01		1.11E+00
	873.18	12.08	3.24E-01		4.56E-01

Analysis Report for 24-Sep-19-10011

L1-12108A-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.54E-01	1.20E-01	5.51E-01
	1004.76	18.01	1.31E-01		3.17E-01
	1274.43	34.80	3.34E-03		1.83E-01
	1596.48	1.80	-5.99E-01		1.71E+00
Eu-155	45.30	1.31	1.44E+00	2.94E-01	3.32E+01
	60.01	1.22	-9.04E+00		3.18E+01
	86.55	30.70	1.33E-01		2.96E-01
	105.31	21.10	1.70E-01		2.94E-01
Ra-226	186.21	3.64	-1.30E-01	1.12E+00	1.12E+00
Pa-231	27.36	10.30	1.90E+00	1.60E+00	3.60E+00
	283.69	1.70	1.18E+00		2.30E+00
	300.07	2.47	-1.41E+00		1.60E+00
	302.65	2.20	5.97E-01		1.85E+00
	330.06	1.40	8.68E-01		2.96E+00
U-235	143.76	10.96	-1.71E-01	7.21E-02	4.02E-01
	163.33	5.08	-7.28E-03		7.51E-01
	185.71	57.20	3.70E-02		7.21E-02
	202.11	1.08	1.36E-01		3.86E+00
	205.31	5.01	-7.54E-01		7.89E-01
Am-241	59.54	35.90	-3.05E-01	1.14E+00	1.14E+00

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

Apex-Gamma

Analysis Report for 24-Sep-19-10012

L1-12108A-FSGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10012
Sample Description	: L1-12108A-FSGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.744E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:10:00PM
Acquisition Started	: 9/24/2019 9:09:06AM
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	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79795
Fill Height	: 1744.34 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:24:26AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/24/19 -1600

J Graham

Analysis Report for 24-Sep-19-10012

L1-12108A-FSGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	92.89	369 -	377	372.00	3.25E+01	11.75	4.75E+01	0.75
2	238.79	946 -	960	954.72	1.37E+02	17.32	5.61E+01	0.93
3	295.14	1174 -	1186	1179.86	4.32E+01	11.14	3.08E+01	0.87
4	338.30	1349 -	1357	1352.29	2.85E+01	8.76	2.25E+01	0.57
5	352.03	1402 -	1414	1407.14	9.54E+01	12.75	2.56E+01	1.18
6	583.15	2323 -	2335	2330.71	3.89E+01	8.71	1.41E+01	1.07
7	609.14	2427 -	2440	2434.60	6.30E+01	10.08	1.40E+01	0.94
8	910.94	3635 -	3648	3641.21	4.10E+01	7.78	7.00E+00	0.40
9	1460.14	5826 -	5850	5838.52	4.03E+02	20.69	6.18E+00	1.95

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	8.73E+00	5.87E-01
Tl-208	1.00	583.19	*	85.00	5.69E-02	1.32E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.13E-01	3.20E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.77E-01	3.03E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 24-Sep-19-10012

L1-12108A-FSGS-006SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.80E-01	4.87E-02
		351.93	*	35.60	2.35E-01	3.65E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.15E-01	6.84E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.67E-01	5.20E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
Ac228-XR	0.97	89.96		1.90		
		93.35	*	3.10	8.51E-01	3.38E-01
Th-234	0.99	92.38		2.13		
		92.80	*	2.10	1.49E+00	5.75E-01
		112.81		0.21		
U235-XR	0.98	89.96		3.47		
		93.35	*	5.60	4.71E-01	1.77E-01
		105.60		1.32		

* = 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 24-Sep-19-10012

L1-12108A-FSGS-006SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.929	8.73E+00	5.87E-01	
	Tl-208	1.000	5.69E-02	1.32E-02	
X	Bi-211	0.862			
	Pb-212	0.997	2.13E-01	3.20E-02	
	Bi-214	0.998	1.77E-01	3.03E-02	
	Pb-214	0.999	2.15E-01	2.92E-02	
	Ac-228	0.997	2.48E-01	4.14E-02	
?	Ac228-XR	0.979	8.51E-01	3.38E-01	
?	Th-234	0.999	1.49E+00	5.75E-01	
?	U235-XR	0.982	4.71E-01	1.77E-01	

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

Errors quoted at 1.000sigma

Analysis Report for 24-Sep-19-10012

L1-12108A-FSGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:24:26AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	8.18E-02	6.02E-02	6.02E-02
	BE-7	477.60		10.44	2.80E-01	4.01E-01	4.01E-01
+	K-40	1460.82	*	10.66	8.73E+00	4.33E-01	4.33E-01
	Mn-54	834.85		99.98	2.50E-02	4.74E-02	4.74E-02
	Co-60	1173.23		99.85	1.14E-02	3.90E-02	6.69E-02
		1332.49		99.98	2.16E-02		3.90E-02
	Nb-94	702.65		99.81	1.56E-02	3.87E-02	3.87E-02
		871.09		99.89	1.20E-02		4.89E-02
	Ag-108m	79.13		6.60	1.14E-02	3.77E-02	1.24E+00
		433.94		90.50	-3.08E-03		3.77E-02
		614.28		89.80	-2.78E-02		5.66E-02
		722.94		90.80	6.58E-03		5.88E-02
	Sb-125	176.31		6.84	8.38E-02	1.15E-01	4.35E-01
		380.45		1.52	-6.76E-01		2.19E+00
		427.87		29.60	-3.92E-02		1.15E-01
		463.36		10.49	2.05E-01		3.60E-01
		600.60		17.65	3.30E-02		2.34E-01
		606.71		4.98	1.58E+00		1.35E+00
		635.95		11.22	-3.40E-01		2.87E-01

Analysis Report for 24-Sep-19-10012

L1-12108A-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.69E+00	1.15E-01	2.58E+00
Ba-133	79.61	2.65	1.25E-01	6.96E-02	3.03E+00
	81.00	32.90	-2.56E-01		2.13E-01
	276.40	7.16	1.63E-01		4.68E-01
	302.85	18.34	4.80E-02		1.78E-01
	356.01	62.05	-6.71E-03		6.96E-02
	383.85	8.94	1.26E-01		3.94E-01
Cs-134	475.36	1.48	1.14E+00	5.78E-02	2.50E+00
	563.25	8.34	-2.68E-01		4.98E-01
	569.33	15.37	1.46E-02		2.44E-01
	604.72	97.62	2.27E-02		6.32E-02
	795.86	85.46	1.13E-02		5.78E-02
	801.95	8.69	-1.04E-01		5.12E-01
	1038.61	0.99	4.61E+00		5.89E+00
	1167.97	1.79	-1.17E+00		3.29E+00
	1365.19	3.02	1.21E-01		1.61E+00
Cs-137	661.66	85.10	5.89E-03	4.43E-02	4.43E-02
Eu-152	121.78	28.67	5.97E-02	1.22E-01	1.23E-01
	244.70	7.61	1.17E-01		4.83E-01
	295.94	0.45	6.98E+00		9.28E+00
	344.28	26.60	-1.08E-01		1.22E-01
	367.79	0.86	1.26E+00		3.64E+00
	411.12	2.24	-6.99E-01		1.40E+00
	443.96	2.83	-4.85E-01		1.21E+00
	488.68	0.42	-6.63E+00		8.31E+00
	563.99	0.49	-4.98E+00		8.04E+00
	586.26	0.46	-1.24E+01		1.22E+01
	678.62	0.47	6.96E+00		9.37E+00
	688.67	0.86	1.05E+00		4.44E+00
	719.35	0.28	1.08E+01		1.63E+01
	778.90	12.96	-4.09E-01		2.90E-01
	810.45	0.32	-8.16E+00		1.28E+01
	867.37	4.26	-3.29E-01		1.21E+00
	919.33	0.43	8.21E+00		1.19E+01
	964.08	14.65	1.53E-01		4.39E-01
	1085.87	10.24	-9.68E-02		5.38E-01
	1089.74	1.73	-2.90E-01		2.99E+00
	1112.07	13.69	-3.33E-02		4.60E-01
	1212.95	1.43	1.22E+00		5.33E+00
	1249.94	0.19	6.24E-01		3.29E+01
	1299.14	1.63	-1.70E+00		3.11E+00
	1408.01	21.07	1.94E-02		2.22E-01
	1457.64	0.50	1.82E+02		4.61E+01
	1528.10	0.28	3.40E+00		1.06E+01
Eu-154	123.07	40.40	-2.80E-02	8.44E-02	8.44E-02
	247.93	6.89	2.59E-01		4.61E-01
	591.76	4.95	3.17E-01		8.05E-01
	692.42	1.78	-9.84E-02		2.23E+00
	723.30	20.06	4.52E-02		2.67E-01
	756.80	4.52	-1.11E-01		9.86E-01
	873.18	12.08	-1.70E-01		3.94E-01

Analysis Report for 24-Sep-19-10012

L1-12108A-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.49E-01	8.44E-02	4.58E-01
	1004.76	18.01	2.62E-01		3.20E-01
	1274.43	34.80	7.96E-03		1.70E-01
	1596.48	1.80	1.10E+00		2.27E+00
Eu-155	45.30	1.31	1.39E+00	2.00E-01	1.03E+01
	60.01	1.22	6.15E+00		1.19E+01
	86.55	30.70	1.70E-02		2.00E-01
	105.31	21.10	1.28E-02		2.06E-01
Ra-226	186.21	3.64	6.87E-01	9.54E-01	9.54E-01
Pa-231	27.36	10.30	1.09E+00	1.32E+00	1.37E+00
	283.69	1.70	-1.61E+00		1.98E+00
	300.07	2.47	-6.86E-01		1.32E+00
	302.65	2.20	4.14E-01		1.49E+00
	330.06	1.40	1.89E+00		2.76E+00
U-235	143.76	10.96	1.90E-01	6.06E-02	3.08E-01
	163.33	5.08	-2.20E-01		5.67E-01
	185.71	57.20	6.36E-02		6.06E-02
	202.11	1.08	5.76E-02		2.94E+00
	205.31	5.01	8.86E-02		6.18E-01
Am-241	59.54	35.90	1.71E-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 24-Sep-19-10013

L1-12108A-FSGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10013
Sample Description	: L1-12108A-FSGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.784E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:12:00PM
Acquisition Started	: 9/24/2019 9:09:15AM
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	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79796
Fill Height	: 1784.47 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:24:21AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/24/19 -1600

J Graham

Analysis Report for 24-Sep-19-10013

L1-12108A-FSGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.63	949 -	961	954.99	9.06E+01	16.45	6.74E+01	0.81
2	295.23	1176 -	1187	1181.14	3.65E+01	10.71	3.05E+01	0.80
3	351.70	1399 -	1415	1406.80	8.44E+01	12.85	2.56E+01	0.68
4	609.42	2429 -	2446	2436.95	6.33E+01	11.31	1.97E+01	1.63
5	911.53	3640 -	3651	3645.16	2.24E+01	6.94	9.58E+00	0.45
6	1460.83	5829 -	5855	5843.69	4.27E+02	21.73	1.03E+01	2.42

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	8.60E+00	5.76E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.39E-01	2.76E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.69E-01	3.19E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		

Analysis Report for 24-Sep-19-10013

L1-12108A-FSGS-007SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.48E-01	4.51E-02
		351.93	*	35.60	2.00E-01	3.44E-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	1.37E-01	4.29E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

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

Analysis Report for 24-Sep-19-10013

L1-12108A-FSGS-007SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	8.60E+00	5.76E-01	
X	Bi-211	0.938			
	Pb-212	1.000	1.39E-01	2.76E-02	
	Bi-214	0.999	1.69E-01	3.19E-02	
	Pb-214	0.995	1.81E-01	2.74E-02	
	Ac-228	0.995	1.37E-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 24-Sep-19-10013

L1-12108A-FSGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:24:21AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.06E-02	5.06E-02	5.06E-02
	BE-7	477.60		10.44	2.13E-01	4.57E-01	4.57E-01
+	K-40	1460.82	*	10.66	8.60E+00	5.19E-01	5.19E-01
	Mn-54	834.85		99.98	3.05E-02	4.89E-02	4.89E-02
	Co-60	1173.23		99.85	-2.78E-02	4.68E-02	5.65E-02
		1332.49		99.98	7.55E-03		4.68E-02
	Nb-94	702.65		99.81	-2.54E-03	4.53E-02	4.58E-02
		871.09		99.89	4.78E-03		4.53E-02
	Ag-108m	79.13		6.60	-3.88E-01	4.13E-02	1.30E+00
		433.94		90.50	3.98E-03		4.13E-02
		614.28		89.80	-2.30E-02		6.95E-02
		722.94		90.80	2.66E-02		5.24E-02
	Sb-125	176.31		6.84	1.06E-01	1.20E-01	4.96E-01
		380.45		1.52	7.12E-01		2.32E+00
		427.87		29.60	-4.11E-02		1.20E-01
		463.36		10.49	1.47E-01		3.86E-01
		600.60		17.65	-2.12E-02		2.52E-01
		606.71		4.98	2.15E+00		1.33E+00
		635.95		11.22	1.61E-01		3.31E-01

Analysis Report for 24-Sep-19-10013

L1-12108A-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.10E+00	1.20E-01	2.62E+00
Ba-133	79.61	2.65	2.48E+00	7.21E-02	3.27E+00
	81.00	32.90	-2.41E-01		2.27E-01
	276.40	7.16	-1.54E-01		4.40E-01
	302.85	18.34	7.52E-02		1.94E-01
	356.01	62.05	-2.31E-02		7.21E-02
	383.85	8.94	1.92E-01		4.20E-01
Cs-134	475.36	1.48	1.53E+00	5.83E-02	3.16E+00
	563.25	8.34	-5.63E-02		4.24E-01
	569.33	15.37	9.06E-02		2.47E-01
	604.72	97.62	8.83E-03		5.86E-02
	795.86	85.46	5.30E-02		5.83E-02
	801.95	8.69	-7.26E-01		5.11E-01
	1038.61	0.99	2.46E-01		4.92E+00
	1167.97	1.79	-1.09E+00		3.28E+00
	1365.19	3.02	2.56E-01		1.58E+00
Cs-137	661.66	85.10	-3.04E-02	5.00E-02	5.00E-02
Eu-152	121.78	28.67	-7.46E-02	1.18E-01	1.42E-01
	244.70	7.61	2.47E-01		5.20E-01
	295.94	0.45	7.49E+00		9.36E+00
	344.28	26.60	1.11E-03		1.18E-01
	367.79	0.86	-3.05E-03		3.98E+00
	411.12	2.24	1.67E-01		1.72E+00
	443.96	2.83	-1.67E+00		1.13E+00
	488.68	0.42	4.89E+00		8.32E+00
	563.99	0.49	-3.03E+00		7.17E+00
	586.26	0.46	8.49E+00		1.12E+01
	678.62	0.47	-1.84E+00		9.07E+00
	688.67	0.86	-3.70E+00		4.85E+00
	719.35	0.28	6.41E+00		1.52E+01
	778.90	12.96	5.95E-02		3.65E-01
	810.45	0.32	-4.17E+00		1.37E+01
	867.37	4.26	-6.77E-01		1.11E+00
	919.33	0.43	-5.41E+00		1.05E+01
	964.08	14.65	2.41E-01		4.19E-01
	1085.87	10.24	-1.55E-01		5.85E-01
	1089.74	1.73	-1.48E+00		3.44E+00
	1112.07	13.69	-6.47E-02		4.45E-01
	1212.95	1.43	-7.12E-02		4.79E+00
	1249.94	0.19	3.13E+00		3.58E+01
	1299.14	1.63	7.52E-01		3.09E+00
	1408.01	21.07	-2.54E-02		2.36E-01
	1457.64	0.50	1.82E+02		4.44E+01
	1528.10	0.28	-9.66E+00		8.82E+00
Eu-154	123.07	40.40	1.44E-02	1.04E-01	1.04E-01
	247.93	6.89	-9.17E-02		4.92E-01
	591.76	4.95	7.93E-01		8.71E-01
	692.42	1.78	1.72E-01		2.29E+00
	723.30	20.06	2.02E-01		2.42E-01
	756.80	4.52	2.09E-01		1.05E+00
	873.18	12.08	-2.79E-01		3.53E-01

Analysis Report for 24-Sep-19-10013

L1-12108A-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.78E-01	1.04E-01	4.13E-01
	1004.76	18.01	7.01E-02		2.84E-01
	1274.43	34.80	3.95E-02		1.64E-01
	1596.48	1.80	-5.44E-01		2.40E+00
Eu-155	45.30	1.31	-5.86E+00	1.98E-01	1.81E+01
	60.01	1.22	4.30E+00		2.10E+01
	86.55	30.70	-1.49E-01		2.09E-01
	105.31	21.10	-6.61E-02		1.98E-01
Ra-226	186.21	3.64	4.88E-01	1.00E+00	1.00E+00
Pa-231	27.36	10.30	2.43E+00	1.53E+00	2.33E+00
	283.69	1.70	-3.23E-01		2.02E+00
	300.07	2.47	1.73E-02		1.53E+00
	302.65	2.20	4.64E-01		1.61E+00
	330.06	1.40	2.90E+00		2.76E+00
U-235	143.76	10.96	7.53E-02	6.41E-02	3.62E-01
	163.33	5.08	1.39E-01		6.81E-01
	185.71	57.20	3.63E-02		6.41E-02
	202.11	1.08	1.89E+00		3.26E+00
	205.31	5.01	-3.75E-01		6.75E-01
Am-241	59.54	35.90	-8.98E-03	7.19E-01	7.19E-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 24-Sep-19-10014

L1-12108A-FSGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10014
Sample Description	: L1-12108A-FSGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.730E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:14:00PM
Acquisition Started	: 9/24/2019 9:30:58AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79797
Fill Height	: 1730.38 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:46:01AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 9/24/19 -1600

J Graham

Analysis Report for 24-Sep-19-10014

L1-12108A-FSGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.56	472 -	480	477.30	1.32E+02	18.97	1.06E+02	1.34
2	295.25	585 -	595	590.55	6.34E+01	13.16	4.56E+01	1.19
3	351.73	698 -	708	703.41	6.68E+01	13.83	5.23E+01	1.17
4	583.30	1161 -	1171	1166.21	5.61E+01	10.69	2.39E+01	1.56
5	609.40	1213 -	1222	1218.37	4.25E+01	10.22	2.75E+01	1.67
6	911.17	1818 -	1826	1821.78	3.15E+01	7.65	1.25E+01	1.23
7	1460.80	2914 -	2928	2921.66	5.19E+02	23.23	7.44E+00	1.87

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	9.45E+00	5.89E-01
Tl-208	0.99	583.19	*	85.00	7.06E-02	1.41E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.82E-01	2.99E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.03E-01	2.55E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 24-Sep-19-10014

L1-12108A-FSGS-008SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.32E-01	5.17E-02
		351.93	*	35.60	1.43E-01	3.18E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.74E-01	4.30E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 24-Sep-19-10014

L1-12108A-FSGS-008SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	9.45E+00	5.89E-01	
	Tl-208	0.998	7.06E-02	1.41E-02	
X	Bi-211	0.932			
	Pb-212	0.999	1.82E-01	2.99E-02	
	Bi-214	1.000	1.03E-01	2.55E-02	
	Pb-214	0.996	1.68E-01	2.71E-02	
	Ac-228	1.000	1.74E-01	4.30E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 24-Sep-19-10014

L1-12108A-FSGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:46:01AM
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	6.35E-02	5.60E-02	5.60E-02
	BE-7	477.60		10.44	2.64E-01	4.02E-01	4.02E-01
+	K-40	1460.82	*	10.66	9.45E+00	3.38E-01	3.38E-01
	Mn-54	834.85		99.98	7.28E-03	4.38E-02	4.38E-02
	Co-60	1173.23		99.85	-2.22E-02	4.97E-02	5.11E-02
		1332.49		99.98	7.30E-03		4.97E-02
	Nb-94	702.65		99.81	1.60E-02	3.87E-02	3.87E-02
		871.09		99.89	-2.23E-02		4.10E-02
	Ag-108m	79.13		6.60	8.37E-02	3.86E-02	1.09E+00
		433.94		90.50	1.79E-02		3.86E-02
		614.28		89.80	-3.64E-02		5.22E-02
		722.94		90.80	5.46E-03		4.84E-02
	Sb-125	176.31		6.84	-5.39E-02	1.03E-01	4.85E-01
		380.45		1.52	3.55E-01		2.07E+00
		427.87		29.60	-1.81E-02		1.03E-01
		463.36		10.49	5.12E-02		3.41E-01
		600.60		17.65	-2.51E-02		2.08E-01
		606.71		4.98	7.83E-02		1.09E+00
		635.95		11.22	4.63E-02		3.36E-01

Analysis Report for 24-Sep-19-10014

L1-12108A-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.72E-02	1.03E-01	2.23E+00
Ba-133	79.61	2.65	3.55E-01	6.16E-02	2.63E+00
	81.00	32.90	-1.72E-01		1.85E-01
	276.40	7.16	1.63E-01		4.38E-01
	302.85	18.34	6.24E-02		1.70E-01
	356.01	62.05	2.96E-03		6.16E-02
	383.85	8.94	4.68E-02		3.52E-01
Cs-134	475.36	1.48	1.83E+00	4.91E-02	2.55E+00
	563.25	8.34	1.17E-01		4.32E-01
	569.33	15.37	-1.33E-01		2.09E-01
	604.72	97.62	1.20E-02		4.91E-02
	795.86	85.46	2.80E-02		5.11E-02
	801.95	8.69	-4.03E-01		3.70E-01
	1038.61	0.99	2.90E+00		5.47E+00
	1167.97	1.79	1.01E-01		3.04E+00
	1365.19	3.02	-1.79E-01		1.24E+00
Cs-137	661.66	85.10	-3.54E-03	4.93E-02	4.93E-02
Eu-152	121.78	28.67	-1.90E-02	1.09E-01	1.09E-01
	244.70	7.61	6.83E-03		4.55E-01
	295.94	0.45	-7.56E-01		8.35E+00
	344.28	26.60	-9.90E-02		1.27E-01
	367.79	0.86	1.34E+00		3.80E+00
	411.12	2.24	-1.42E-01		1.33E+00
	443.96	2.83	2.47E-01		1.05E+00
	488.68	0.42	2.38E+00		7.27E+00
	563.99	0.49	1.52E+00		7.39E+00
	586.26	0.46	-1.17E+00		1.17E+01
	678.62	0.47	-1.48E+00		7.72E+00
	688.67	0.86	2.26E+00		4.28E+00
	719.35	0.28	1.26E+01		1.54E+01
	778.90	12.96	-7.52E-02		2.94E-01
	810.45	0.32	1.02E+01		1.35E+01
	867.37	4.26	2.44E-01		9.60E-01
	919.33	0.43	-2.30E+00		9.65E+00
	964.08	14.65	-2.37E-01		3.44E-01
	1085.87	10.24	3.13E-01		5.18E-01
	1089.74	1.73	-9.84E-01		2.93E+00
	1112.07	13.69	1.60E-01		3.89E-01
	1212.95	1.43	-2.39E+00		4.37E+00
	1249.94	0.19	9.56E+00		3.20E+01
	1299.14	1.63	1.37E+00		3.39E+00
	1408.01	21.07	3.14E-02		1.98E-01
	1457.64	0.50	-1.67E+00		4.37E+01
	1528.10	0.28	-3.56E-01		1.23E+01
Eu-154	123.07	40.40	-4.33E-03	7.78E-02	7.78E-02
	247.93	6.89	9.30E-02		4.59E-01
	591.76	4.95	3.19E-01		7.49E-01
	692.42	1.78	-2.73E-01		1.81E+00
	723.30	20.06	3.22E-02		2.22E-01
	756.80	4.52	-2.00E-01		9.09E-01
	873.18	12.08	3.08E-02		3.69E-01

Analysis Report for 24-Sep-19-10014

L1-12108A-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.02E-01	7.78E-02	3.59E-01
	1004.76	18.01	1.14E-01		2.23E-01
	1274.43	34.80	-2.53E-02		1.26E-01
	1596.48	1.80	-1.82E-01		1.80E+00
Eu-155	45.30	1.31	-1.50E+00	1.80E-01	1.06E+01
	60.01	1.22	-4.50E+00		1.23E+01
	86.55	30.70	5.35E-02		1.84E-01
	105.31	21.10	-2.42E-02		1.80E-01
Ra-226	186.21	3.64	2.99E-01	9.47E-01	9.47E-01
Pa-231	27.36	10.30	9.14E-01	1.20E+00	1.20E+00
	283.69	1.70	-1.12E+00		1.59E+00
	300.07	2.47	-1.63E-01		1.24E+00
	302.65	2.20	5.19E-01		1.41E+00
	330.06	1.40	6.14E-01		2.48E+00
U-235	143.76	10.96	1.43E-01	6.04E-02	3.00E-01
	163.33	5.08	-1.05E-01		6.93E-01
	185.71	57.20	2.37E-02		6.04E-02
	202.11	1.08	-1.84E+00		2.71E+00
	205.31	5.01	6.41E-02		6.53E-01
Am-241	59.54	35.90	-2.24E-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 24-Sep-19-10015

L1-12108A-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10015
Sample Description	: L1-12108A-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.779E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:16:00PM
Acquisition Started	: 9/24/2019 9:31:06AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79798
Fill Height	: 1778.97 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:46:11AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/24/19 -1600

J Graham

Analysis Report for 24-Sep-19-10015

L1-12108A-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	947 -	960	954.53	1.03E+02	16.68	6.31E+01	0.67
2	295.25	1176 -	1187	1180.90	4.48E+01	11.00	3.02E+01	0.73
3	351.77	1402 -	1414	1406.81	5.49E+01	10.80	2.31E+01	0.75
4	583.07	2326 -	2337	2331.49	3.57E+01	7.34	7.31E+00	0.43
5	609.14	2429 -	2442	2435.71	5.00E+01	9.74	1.60E+01	1.11
6	911.04	3638 -	3648	3643.12	2.51E+01	5.86	3.92E+00	1.44
7	1119.88	4473 -	4484	4478.62	1.66E+01	5.25	4.36E+00	0.39
8	1460.32	5830 -	5852	5841.13	4.22E+02	20.80	2.78E+00	1.63

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	1.01E+01	6.64E-01
Tl-208	0.99	583.19	*	85.00	5.77E-02	1.24E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.80E-01	3.25E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.56E-01	3.17E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 24-Sep-19-10015

L1-12108A-FSGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29	*	14.92	2.37E-01	7.55E-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	2.08E-01	5.38E-02
		351.93	*	35.60	1.49E-01	3.18E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.80E-01	4.29E-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 24-Sep-19-10015

L1-12108A-FSGS-009SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.961	1.01E+01	6.64E-01	
	Tl-208	0.998	5.77E-02	1.24E-02	
X	Bi-211	0.925			
	Pb-212	1.000	1.80E-01	3.25E-02	
	Bi-214	0.994	1.68E-01	2.92E-02	
	Pb-214	0.998	1.65E-01	2.73E-02	
	Ac-228	0.999	1.80E-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 24-Sep-19-10015

L1-12108A-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:46:11AM
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	7.77E-02	6.20E-02	6.20E-02
	BE-7	477.60		10.44	-1.77E-02	4.21E-01	4.21E-01
+	K-40	1460.82	*	10.66	1.01E+01	3.33E-01	3.33E-01
	Mn-54	834.85		99.98	-2.91E-02	4.01E-02	4.01E-02
	Co-60	1173.23		99.85	2.97E-02	5.68E-02	7.14E-02
		1332.49		99.98	1.55E-02		5.68E-02
	Nb-94	702.65		99.81	-6.87E-03	4.19E-02	4.19E-02
		871.09		99.89	2.52E-02		5.40E-02
	Ag-108m	79.13		6.60	2.31E-01	4.03E-02	1.88E+00
		433.94		90.50	-2.40E-02		4.03E-02
		614.28		89.80	-9.63E-03		6.73E-02
		722.94		90.80	-1.10E-02		5.54E-02
	Sb-125	176.31		6.84	6.04E-02	1.35E-01	5.43E-01
		380.45		1.52	7.79E-01		2.59E+00
		427.87		29.60	1.16E-02		1.35E-01
		463.36		10.49	-2.49E-01		4.54E-01
		600.60		17.65	-4.66E-02		2.36E-01
		606.71		4.98	1.43E+00		1.38E+00
		635.95		11.22	-9.78E-02		4.02E-01

Analysis Report for 24-Sep-19-10015

L1-12108A-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-6.86E-01	1.35E-01	2.65E+00
Ba-133	79.61	2.65	4.10E-01	6.65E-02	4.42E+00
	81.00	32.90	-1.91E-01		3.09E-01
	276.40	7.16	2.41E-01		5.25E-01
	302.85	18.34	1.09E-01		2.15E-01
	356.01	62.05	3.16E-03		6.65E-02
	383.85	8.94	1.25E-01		4.25E-01
Cs-134	475.36	1.48	2.57E-01	5.98E-02	2.79E+00
	563.25	8.34	-3.99E-01		4.79E-01
	569.33	15.37	-1.79E-01		2.42E-01
	604.72	97.62	-5.05E-03		6.44E-02
	795.86	85.46	-6.46E-03		5.98E-02
	801.95	8.69	-3.50E-01		5.74E-01
	1038.61	0.99	5.99E-01		5.81E+00
	1167.97	1.79	-6.45E-01		4.03E+00
	1365.19	3.02	1.01E-01		1.68E+00
Cs-137	661.66	85.10	-2.30E-02	5.36E-02	5.36E-02
Eu-152	121.78	28.67	-1.06E-01	1.33E-01	1.51E-01
	244.70	7.61	-1.43E-01		5.82E-01
	295.94	0.45	8.02E+00		1.03E+01
	344.28	26.60	-1.31E-01		1.33E-01
	367.79	0.86	7.06E-02		4.76E+00
	411.12	2.24	9.32E-01		2.16E+00
	443.96	2.83	1.27E-01		1.47E+00
	488.68	0.42	1.48E+00		1.01E+01
	563.99	0.49	1.37E+00		8.33E+00
	586.26	0.46	-4.07E-01		1.22E+01
	678.62	0.47	7.83E+00		1.06E+01
	688.67	0.86	3.30E+00		6.15E+00
	719.35	0.28	5.68E-01		1.93E+01
	778.90	12.96	-2.26E-02		3.70E-01
	810.45	0.32	9.48E+00		1.51E+01
	867.37	4.26	1.47E-02		1.23E+00
	919.33	0.43	7.93E+00		1.36E+01
	964.08	14.65	-7.45E-02		4.12E-01
	1085.87	10.24	7.81E-02		6.29E-01
	1089.74	1.73	8.35E-01		4.11E+00
	1112.07	13.69	2.21E-01		4.97E-01
	1212.95	1.43	-2.62E+00		5.51E+00
	1249.94	0.19	1.64E+01		3.93E+01
	1299.14	1.63	9.22E-01		3.88E+00
	1408.01	21.07	7.97E-02		2.74E-01
	1457.64	0.50	2.12E+02		5.19E+01
	1528.10	0.28	2.27E+00		1.62E+01
Eu-154	123.07	40.40	-1.69E-02	1.10E-01	1.10E-01
	247.93	6.89	-7.25E-02		6.14E-01
	591.76	4.95	-4.77E-01		7.81E-01
	692.42	1.78	-5.85E-01		2.75E+00
	723.30	20.06	1.11E-01		2.48E-01
	756.80	4.52	2.26E-01		1.01E+00
	873.18	12.08	5.07E-01		4.60E-01

Analysis Report for 24-Sep-19-10015

L1-12108A-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.62E-01	1.10E-01	5.96E-01
	1004.76	18.01	6.55E-02		3.40E-01
	1274.43	34.80	-1.74E-01		1.58E-01
	1596.48	1.80	-5.72E-01		3.17E+00
Eu-155	45.30	1.31	-3.47E+00	2.79E-01	3.10E+01
	60.01	1.22	-7.91E+00		3.17E+01
	86.55	30.70	4.15E-02		2.79E-01
	105.31	21.10	8.57E-02		2.82E-01
Ra-226	186.21	3.64	9.66E-01	1.14E+00	1.14E+00
Pa-231	27.36	10.30	2.75E+00	1.60E+00	3.58E+00
	283.69	1.70	-1.23E-02		2.05E+00
	300.07	2.47	-1.19E-01		1.60E+00
	302.65	2.20	4.63E-01		1.78E+00
	330.06	1.40	9.67E-02		2.75E+00
U-235	143.76	10.96	-2.45E-01	7.14E-02	3.79E-01
	163.33	5.08	1.21E-01		7.87E-01
	185.71	57.20	1.99E-02		7.14E-02
	202.11	1.08	4.96E-01		3.55E+00
	205.31	5.01	-2.72E-01		7.62E-01
Am-241	59.54	35.90	8.31E-02	1.14E+00	1.14E+00

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

Apex-Gamma

Analysis Report for 24-Sep-19-10016

L1-12108A-FSGS-010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10016
Sample Description	: L1-12108A-FSGS-010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.672E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:18:00PM
Acquisition Started	: 9/24/2019 9:31:13AM
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	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79799
Fill Height	: 1672.07 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:46:26AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/24/19 -1600

J Graham

Analysis Report for 24-Sep-19-10016

L1-12108A-FSGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.20	305 -	315	309.33	5.43E+01	15.75	7.87E+01	0.63
2	238.71	950 -	962	954.42	1.07E+02	17.24	6.72E+01	1.09
3	295.31	1175 -	1187	1180.53	4.17E+01	11.51	3.43E+01	1.00
4	338.44	1346 -	1358	1352.83	3.10E+01	9.97	2.60E+01	1.00
5	352.07	1401 -	1412	1407.29	6.10E+01	11.19	2.50E+01	1.04
6	583.05	2325 -	2338	2330.34	5.61E+01	10.13	1.69E+01	1.32
7	609.06	2429 -	2441	2434.30	4.58E+01	9.44	1.63E+01	0.82
8	1119.75	4471 -	4482	4476.42	2.15E+01	5.04	1.52E+00	0.49
9	1460.28	5825 -	5850	5839.07	4.12E+02	20.60	3.04E+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	0.95	1460.82	*	10.66	9.02E+00	5.97E-01
Tl-208	0.99	583.19	*	85.00	8.28E-02	1.58E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.67E-01	3.02E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.79E-01	1.17E-01
		87.35		3.97		

Analysis Report for 24-Sep-19-10016

L1-12108A-FSGS-010SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.30E-01	2.79E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.80E-01	6.67E-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	1.75E-01	5.04E-02
		351.93	*	35.60	1.51E-01	3.02E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	6.69E-01	2.08E-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	2.35E-01	7.82E-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 24-Sep-19-10016

L1-12108A-FSGS-010SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.955	9.02E+00	5.97E-01	
	Tl-208	0.997	8.28E-02	1.58E-02	
X	Bi-211	0.853			
	Pb-212	0.999	1.67E-01	3.02E-02	
?	Pb212-XR	0.999	3.79E-01	1.17E-01	
	Bi-214	0.990	1.52E-01	2.57E-02	
	Pb-214	0.998	1.57E-01	2.59E-02	
?	Pb214-XR	0.999	6.69E-01	2.08E-01	
	Ac-228	1.000	2.35E-01	7.82E-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 24-Sep-19-10016

L1-12108A-FSGS-010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:46:26AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	8.44E-02	5.65E-02	5.65E-02
	BE-7	477.60		10.44	1.02E-01	3.92E-01	3.92E-01
+	K-40	1460.82	*	10.66	9.02E+00	3.24E-01	3.24E-01
	Mn-54	834.85		99.98	8.75E-03	4.65E-02	4.65E-02
	Co-60	1173.23		99.85	1.31E-02	5.07E-02	5.86E-02
		1332.49		99.98	2.46E-02		5.07E-02
	Nb-94	702.65		99.81	2.64E-02	4.63E-02	4.63E-02
		871.09		99.89	1.54E-02		4.72E-02
	Ag-108m	79.13		6.60	-4.11E-01	3.75E-02	1.17E+00
		433.94		90.50	2.10E-02		3.75E-02
		614.28		89.80	-2.24E-02		5.42E-02
		722.94		90.80	-1.86E-02		4.73E-02
	Sb-125	176.31		6.84	-4.16E-02	1.18E-01	4.52E-01
		380.45		1.52	-2.72E-01		2.07E+00
		427.87		29.60	3.06E-02		1.18E-01
		463.36		10.49	2.30E-01		3.87E-01
		600.60		17.65	-2.39E-02		2.09E-01
		606.71		4.98	1.55E+00		1.23E+00
		635.95		11.22	1.33E-01		3.95E-01

Analysis Report for 24-Sep-19-10016

L1-12108A-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	3.61E-01	1.18E-01	2.04E+00
Ba-133	79.61	2.65	-1.36E+00	6.68E-02	2.85E+00
	81.00	32.90	-1.31E-01		1.88E-01
	276.40	7.16	1.98E-01		4.68E-01
	302.85	18.34	-9.08E-03		1.85E-01
	356.01	62.05	-6.53E-02		6.68E-02
	383.85	8.94	1.24E-01		3.72E-01
Cs-134	475.36	1.48	2.38E+00	5.61E-02	2.60E+00
	563.25	8.34	-3.95E-01		4.68E-01
	569.33	15.37	-1.53E-01		2.05E-01
	604.72	97.62	-1.59E-02		5.69E-02
	795.86	85.46	-3.56E-03		5.61E-02
	801.95	8.69	1.70E-01		5.24E-01
	1038.61	0.99	4.14E+00		4.77E+00
	1167.97	1.79	9.53E-01		3.37E+00
	1365.19	3.02	-2.46E-02		1.72E+00
Cs-137	661.66	85.10	-5.22E-03	4.39E-02	4.39E-02
Eu-152	121.78	28.67	4.96E-02	1.19E-01	1.19E-01
	244.70	7.61	-4.82E-02		4.58E-01
	295.94	0.45	5.59E+00		9.57E+00
	344.28	26.60	4.40E-02		1.31E-01
	367.79	0.86	2.04E+00		4.16E+00
	411.12	2.24	1.39E+00		1.53E+00
	443.96	2.83	7.99E-01		1.21E+00
	488.68	0.42	-3.13E+00		8.27E+00
	563.99	0.49	-1.42E+01		6.95E+00
	586.26	0.46	-5.94E+00		1.29E+01
	678.62	0.47	3.62E+00		7.33E+00
	688.67	0.86	2.52E+00		4.39E+00
	719.35	0.28	1.01E+01		1.62E+01
	778.90	12.96	-5.89E-03		2.86E-01
	810.45	0.32	5.12E+00		1.44E+01
	867.37	4.26	-5.54E-01		1.05E+00
	919.33	0.43	-6.30E+00		1.15E+01
	964.08	14.65	1.00E-01		4.26E-01
	1085.87	10.24	-1.23E-01		5.35E-01
	1089.74	1.73	-9.42E-01		3.07E+00
	1112.07	13.69	1.67E-01		4.43E-01
	1212.95	1.43	1.13E+00		5.14E+00
	1249.94	0.19	-3.02E+01		3.12E+01
	1299.14	1.63	-1.06E+00		2.99E+00
	1408.01	21.07	2.70E-03		2.18E-01
	1457.64	0.50	1.92E+02		4.68E+01
	1528.10	0.28	-4.29E+00		9.59E+00
Eu-154	123.07	40.40	1.77E-02	8.34E-02	8.34E-02
	247.93	6.89	1.56E-01		4.47E-01
	591.76	4.95	5.83E-01		7.69E-01
	692.42	1.78	3.28E-01		2.06E+00
	723.30	20.06	-4.56E-02		2.17E-01
	756.80	4.52	5.80E-01		1.07E+00
	873.18	12.08	-3.73E-02		4.09E-01

Analysis Report for 24-Sep-19-10016

L1-12108A-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.68E-01	8.34E-02	4.54E-01
	1004.76	18.01	-6.63E-02		2.80E-01
	1274.43	34.80	9.89E-02		1.75E-01
	1596.48	1.80	-5.57E-01		2.17E+00
Eu-155	45.30	1.31	-6.32E+00	1.82E-01	1.05E+01
	60.01	1.22	4.72E+00		1.27E+01
	86.55	30.70	3.91E-02		1.82E-01
	105.31	21.10	-1.20E-01		1.92E-01
Ra-226	186.21	3.64	5.31E-01	9.41E-01	9.41E-01
Pa-231	27.36	10.30	9.23E-01	1.25E+00	1.25E+00
	283.69	1.70	2.55E-01		1.93E+00
	300.07	2.47	6.82E-02		1.51E+00
	302.65	2.20	-3.28E-01		1.52E+00
	330.06	1.40	-1.47E+00		2.38E+00
U-235	143.76	10.96	1.13E-01	5.96E-02	3.14E-01
	163.33	5.08	-1.19E-02		6.45E-01
	185.71	57.20	1.86E-02		5.96E-02
	202.11	1.08	5.13E-02		2.83E+00
	205.31	5.01	2.71E-02		6.37E-01
Am-241	59.54	35.90	1.46E-01	4.41E-01	4.41E-01

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

Apex-Gamma

Analysis Report for 24-Sep-19-10017
L1-12108A-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10017
Sample Description	: L1-12108A-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.701E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:20:00PM
Acquisition Started	: 9/24/2019 9:31:22AM
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	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79800
Fill Height	: 1701.15 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 9:46:29AM

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

DATA VALIDATED 9/24/19 -1600
J Graham

Analysis Report for 24-Sep-19-10017

L1-12108A-FSGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	92.60	367 -	378	371.61	4.02E+01	12.94	5.08E+01	0.45
2	238.71	947 -	960	955.32	1.34E+02	17.02	5.66E+01	1.39
3	295.39	1176 -	1187	1181.80	2.27E+01	10.93	3.83E+01	0.36
4	351.88	1401 -	1414	1407.51	6.73E+01	12.76	3.47E+01	0.66
5	510.84	2037 -	2049	2042.84	4.53E+01	9.58	1.77E+01	0.83
6	583.23	2325 -	2339	2332.24	4.98E+01	9.06	1.13E+01	0.31
7	609.36	2429 -	2443	2436.72	6.20E+01	10.27	1.50E+01	1.09
8	727.46	2903 -	2914	2908.95	1.89E+01	5.23	3.11E+00	0.62
9	911.24	3638 -	3651	3643.98	2.10E+01	7.77	1.40E+01	0.35
10	1120.47	4475 -	4487	4481.17	2.35E+01	6.38	6.50E+00	0.35
11	1460.79	5831 -	5856	5843.53	4.16E+02	20.40	0.00E+00	1.83

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	5.34E-02	1.19E-02
K-40	1.00	1460.82	*	10.66	8.48E+00	5.55E-01
Tl-208	1.00	583.19	*	85.00	6.97E-02	1.34E-02
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	3.89E-01	1.10E-01
		785.37		1.10		

Analysis Report for 24-Sep-19-10017

L1-12108A-FSGS-011SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-212	0.99	1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.07E-01	3.11E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.67E-01	2.94E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.87E-01	7.86E-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	9.28E-02	4.53E-02
		351.93	*	35.60	1.61E-01	3.31E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.30E-01	4.83E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
Ac228-XR	0.94	89.96		1.90		
		93.35	*	3.10	1.25E+00	4.53E-01
Th-234	0.99	92.38		2.13		
		92.80	*	2.10	2.19E+00	7.67E-01
		112.81		0.21		
U235-XR	0.95	89.96		3.47		
		93.35	*	5.60	6.94E-01	2.34E-01
		105.60		1.32		

Analysis Report for 24-Sep-19-10017

L1-12108A-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
	An Pk	0.996	5.34E-02	1.19E-02	
	K-40	1.000	8.48E+00	5.55E-01	
	Tl-208	1.000	6.97E-02	1.34E-02	
X	Bi-211	0.900			
	Bi-212	0.998	3.89E-01	1.10E-01	
	Pb-212	0.999	2.07E-01	3.11E-02	
	Bi-214	0.999	1.82E-01	2.75E-02	
	Pb-214	0.998	1.37E-01	2.67E-02	
	Ac-228	1.000	1.30E-01	4.83E-02	
?	Ac228-XR	0.945	1.25E+00	4.53E-01	
?	Th-234	0.997	2.19E+00	7.67E-01	
?	U235-XR	0.952	6.94E-01	2.34E-01	

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

Errors quoted at 1.000sigma

Analysis Report for 24-Sep-19-10017

L1-12108A-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 9:46:29AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	5.34E-02	3.07E-02	3.07E-02
	BE-7	477.60		10.44	3.92E-01	4.55E-01	4.55E-01
+	K-40	1460.82	*	10.66	8.48E+00	5.86E-02	5.86E-02
	Mn-54	834.85		99.98	3.15E-02	5.65E-02	5.65E-02
	Co-60	1173.23		99.85	1.60E-02	4.61E-02	5.39E-02
		1332.49		99.98	4.43E-03		4.61E-02
	Nb-94	702.65		99.81	-1.23E-02	4.47E-02	4.47E-02
		871.09		99.89	1.62E-02		4.83E-02
	Ag-108m	79.13		6.60	-1.94E-01	3.84E-02	1.49E+00
		433.94		90.50	-2.27E-02		3.84E-02
		614.28		89.80	-3.94E-02		6.70E-02
		722.94		90.80	6.77E-03		5.39E-02
	Sb-125	176.31		6.84	-9.77E-02	1.22E-01	4.98E-01
		380.45		1.52	7.87E-01		2.10E+00
		427.87		29.60	-5.65E-02		1.22E-01
		463.36		10.49	7.24E-02		3.22E-01
		600.60		17.65	3.37E-02		2.27E-01
		606.71		4.98	1.73E+00		1.27E+00
		635.95		11.22	-4.67E-01		3.03E-01

Analysis Report for 24-Sep-19-10017

L1-12108A-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-4.08E-01	1.22E-01	1.93E+00
Ba-133	79.61	2.65	-1.39E-02	7.51E-02	3.60E+00
	81.00	32.90	-5.10E-02		2.53E-01
	276.40	7.16	1.12E-01		5.36E-01
	302.85	18.34	-7.56E-03		1.89E-01
	356.01	62.05	4.74E-03		7.51E-02
	383.85	8.94	-1.43E-01		3.58E-01
Cs-134	475.36	1.48	1.30E+00	5.49E-02	2.91E+00
	563.25	8.34	2.13E-01		4.87E-01
	569.33	15.37	-4.95E-02		2.82E-01
	604.72	97.62	-2.67E-04		5.94E-02
	795.86	85.46	-7.85E-03		5.49E-02
	801.95	8.69	-1.18E-01		5.63E-01
	1038.61	0.99	9.53E-01		5.71E+00
	1167.97	1.79	2.83E+00		2.91E+00
	1365.19	3.02	-8.61E-02		1.39E+00
Cs-137	661.66	85.10	1.00E-02	4.75E-02	4.75E-02
Eu-152	121.78	28.67	-1.51E-01	1.23E-01	1.29E-01
	244.70	7.61	3.15E-01		4.98E-01
	295.94	0.45	3.31E+00		9.04E+00
	344.28	26.60	-1.10E-01		1.23E-01
	367.79	0.86	-1.25E+00		4.04E+00
	411.12	2.24	-5.74E-01		1.57E+00
	443.96	2.83	-1.70E-02		1.23E+00
	488.68	0.42	1.51E+00		7.59E+00
	563.99	0.49	1.90E+00		8.07E+00
	586.26	0.46	1.71E+01		1.21E+01
	678.62	0.47	-2.51E+00		8.24E+00
	688.67	0.86	1.22E+00		4.95E+00
	719.35	0.28	1.00E+01		1.49E+01
	778.90	12.96	-2.87E-03		3.18E-01
	810.45	0.32	1.17E+01		1.59E+01
	867.37	4.26	-2.71E-02		1.14E+00
	919.33	0.43	-1.31E+00		1.16E+01
	964.08	14.65	3.89E-01		4.52E-01
	1085.87	10.24	3.21E-02		5.00E-01
	1089.74	1.73	1.25E+00		3.10E+00
	1112.07	13.69	-1.93E-01		3.92E-01
	1212.95	1.43	-2.86E+00		4.55E+00
	1249.94	0.19	4.27E+00		2.77E+01
	1299.14	1.63	-9.21E-01		3.53E+00
	1408.01	21.07	7.53E-03		2.15E-01
	1457.64	0.50	1.72E+02		4.37E+01
	1528.10	0.28	-1.79E+00		1.24E+01
Eu-154	123.07	40.40	2.22E-02	9.63E-02	9.63E-02
	247.93	6.89	-3.97E-01		4.85E-01
	591.76	4.95	3.47E-01		8.26E-01
	692.42	1.78	4.19E-01		2.34E+00
	723.30	20.06	1.71E-03		2.44E-01
	756.80	4.52	3.69E-01		8.97E-01
	873.18	12.08	1.95E-01		3.95E-01

Analysis Report for 24-Sep-19-10017

L1-12108A-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.72E-01	9.63E-02	4.48E-01
	1004.76	18.01	6.53E-02		2.58E-01
	1274.43	34.80	-2.84E-03		1.58E-01
	1596.48	1.80	2.22E-01		2.13E+00
Eu-155	45.30	1.31	4.20E+00	1.93E-01	2.02E+01
	60.01	1.22	-6.09E+00		1.99E+01
	86.55	30.70	-2.43E-01		1.93E-01
	105.31	21.10	5.66E-02		2.09E-01
Ra-226	186.21	3.64	4.61E-01	1.04E+00	1.04E+00
Pa-231	27.36	10.30	1.10E+00	1.39E+00	2.17E+00
	283.69	1.70	-5.32E-01		1.97E+00
	300.07	2.47	-5.53E-01		1.39E+00
	302.65	2.20	-4.35E-01		1.54E+00
	330.06	1.40	-7.26E-02		2.53E+00
U-235	143.76	10.96	9.99E-02	6.52E-02	3.52E-01
	163.33	5.08	-1.36E-01		6.41E-01
	185.71	57.20	8.72E-04		6.52E-02
	202.11	1.08	-7.14E-01		3.24E+00
	205.31	5.01	8.92E-02		6.95E-01
Am-241	59.54	35.90	-1.02E-01	7.08E-01	7.08E-01

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

Apex-Gamma

Analysis Report for 24-Sep-19-10018

L1-12108A-FSGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10018
Sample Description	: L1-12108A-FSGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.696E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:22:00PM
Acquisition Started	: 9/24/2019 9:52:39AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79801
Fill Height	: 1695.69 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 10:07:42AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 9/24/19 -1600

J Grodon

Analysis Report for 24-Sep-19-10018

L1-12108A-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	477.47	1.08E+02	19.50	1.20E+02	1.08
2	295.17	586 -	595	590.39	6.08E+01	14.39	6.42E+01	1.00
3	351.89	700 -	708	703.72	1.09E+02	13.73	3.61E+01	1.13
4	583.05	1160 -	1171	1165.70	4.25E+01	10.32	2.55E+01	1.31
5	609.25	1214 -	1223	1218.07	8.67E+01	11.80	2.33E+01	1.73
6	1460.92	2914 -	2928	2921.90	4.80E+02	22.16	3.75E+00	1.92

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.79E+00	5.57E-01
Tl-208	0.99	583.19	*	85.00	5.36E-02	1.34E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.48E-01	2.95E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.10E-01	3.13E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 24-Sep-19-10018

L1-12108A-FSGS-012SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.24E-01	5.59E-02
		351.93	*	35.60	2.34E-01	3.50E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	8.79E+00	5.57E-01	
	Tl-208	0.997	5.36E-02	1.34E-02	
X	Bi-211	0.898			
	Pb-212	1.000	1.48E-01	2.95E-02	
	Bi-214	1.000	2.10E-01	3.13E-02	
	Pb-214	1.000	2.31E-01	2.97E-02	

Analysis Report for 24-Sep-19-10018

L1-12108A-FSGS-012SS

? = 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 24-Sep-19-10018

L1-12108A-FSGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 10:07:42AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	8.33E-02	5.95E-02	5.95E-02
	BE-7	477.60		10.44	1.33E-01	3.86E-01	3.86E-01
+	K-40	1460.82	*	10.66	8.79E+00	2.57E-01	2.57E-01
	Mn-54	834.85		99.98	1.51E-02	4.00E-02	4.00E-02
	Co-60	1173.23		99.85	-2.79E-02	4.54E-02	5.60E-02
		1332.49		99.98	-7.81E-03		4.54E-02
	Nb-94	702.65		99.81	7.69E-03	3.87E-02	3.94E-02
		871.09		99.89	-3.75E-03		3.87E-02
	Ag-108m	79.13		6.60	6.34E-01	3.62E-02	1.16E+00
		433.94		90.50	6.96E-03		3.62E-02
		614.28		89.80	-2.43E-02		6.01E-02
		722.94		90.80	2.03E-02		5.04E-02
	Sb-125	176.31		6.84	2.15E-01	1.08E-01	5.11E-01
		380.45		1.52	-1.13E+00		2.19E+00
		427.87		29.60	-5.48E-02		1.08E-01
		463.36		10.49	1.17E-01		3.53E-01
		600.60		17.65	-1.08E-02		2.09E-01
		606.71		4.98	-6.72E-01		1.29E+00
		635.95		11.22	5.79E-02		3.26E-01

Analysis Report for 24-Sep-19-10018

L1-12108A-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.53E-01	1.08E-01	1.89E+00
Ba-133	79.61	2.65	7.82E-01	7.40E-02	2.72E+00
	81.00	32.90	-2.55E-01		1.80E-01
	276.40	7.16	-2.21E-01		4.25E-01
	302.85	18.34	6.65E-02		1.72E-01
	356.01	62.05	-1.19E-02		7.40E-02
	383.85	8.94	8.46E-02		3.76E-01
Cs-134	475.36	1.48	2.81E-01	4.95E-02	2.47E+00
	563.25	8.34	9.48E-02		3.85E-01
	569.33	15.37	-5.16E-02		2.16E-01
	604.72	97.62	-5.55E-02		5.53E-02
	795.86	85.46	3.13E-02		4.95E-02
	801.95	8.69	1.20E-01		4.83E-01
	1038.61	0.99	5.54E-01		5.14E+00
	1167.97	1.79	-5.53E-01		3.13E+00
	1365.19	3.02	-6.48E-01		1.21E+00
Cs-137	661.66	85.10	-9.46E-03	4.39E-02	4.39E-02
Eu-152	121.78	28.67	6.30E-02	1.19E-01	1.19E-01
	244.70	7.61	5.78E-02		4.75E-01
	295.94	0.45	8.17E+00		9.23E+00
	344.28	26.60	-1.03E-01		1.21E-01
	367.79	0.86	-1.36E+00		3.37E+00
	411.12	2.24	4.00E-01		1.63E+00
	443.96	2.83	-4.14E-01		1.09E+00
	488.68	0.42	3.39E+00		8.75E+00
	563.99	0.49	9.83E-01		6.42E+00
	586.26	0.46	-2.24E+00		1.08E+01
	678.62	0.47	3.77E-01		7.32E+00
	688.67	0.86	2.23E+00		5.13E+00
	719.35	0.28	-5.23E+00		1.36E+01
	778.90	12.96	-3.34E-01		2.73E-01
	810.45	0.32	-5.50E+00		1.24E+01
	867.37	4.26	2.22E-01		9.78E-01
	919.33	0.43	-4.07E+00		1.04E+01
	964.08	14.65	6.09E-02		4.04E-01
	1085.87	10.24	2.69E-01		5.32E-01
	1089.74	1.73	-1.00E+00		2.79E+00
	1112.07	13.69	5.69E-02		3.90E-01
	1212.95	1.43	-3.53E-01		4.31E+00
	1249.94	0.19	-3.64E+00		3.04E+01
	1299.14	1.63	-1.53E+00		3.17E+00
	1408.01	21.07	7.22E-02		1.88E-01
	1457.64	0.50	-3.23E+00		4.22E+01
	1528.10	0.28	5.44E+00		1.29E+01
Eu-154	123.07	40.40	7.35E-03	8.14E-02	8.14E-02
	247.93	6.89	-1.72E-01		4.56E-01
	591.76	4.95	1.21E-01		7.36E-01
	692.42	1.78	4.46E-01		2.35E+00
	723.30	20.06	9.80E-02		2.27E-01
	756.80	4.52	-1.54E-01		8.08E-01
	873.18	12.08	3.55E-03		3.16E-01

Analysis Report for 24-Sep-19-10018

L1-12108A-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	8.85E-02	8.14E-02	4.82E-01
	1004.76	18.01	-1.47E-02		2.58E-01
	1274.43	34.80	0.00E+00		1.57E-01
	1596.48	1.80	8.71E-02		1.81E+00
Eu-155	45.30	1.31	2.75E+00	1.79E-01	1.16E+01
	60.01	1.22	-2.29E+00		1.19E+01
	86.55	30.70	4.14E-02		1.79E-01
	105.31	21.10	3.77E-02		1.95E-01
Ra-226	186.21	3.64	7.55E-01	9.87E-01	9.87E-01
Pa-231	27.36	10.30	6.67E-01	1.10E+00	1.10E+00
	283.69	1.70	1.23E-01		1.81E+00
	300.07	2.47	-2.51E-01		1.29E+00
	302.65	2.20	5.53E-01		1.43E+00
	330.06	1.40	1.06E+00		2.46E+00
U-235	143.76	10.96	1.40E-01	6.27E-02	2.92E-01
	163.33	5.08	-3.63E-01		6.62E-01
	185.71	57.20	4.52E-02		6.27E-02
	202.11	1.08	7.72E-01		3.12E+00
	205.31	5.01	-3.69E-02		6.69E-01
Am-241	59.54	35.90	-1.51E-01	4.06E-01	4.06E-01

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

Apex-Gamma

Analysis Report for 24-Sep-19-10019

L1-12108A-FSGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10019
Sample Description	: L1-12108A-FSGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.901E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:24:00PM
Acquisition Started	: 9/24/2019 9:52:51AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.3 seconds
Dead Time	: 0.15 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79802
Fill Height	: 1900.65 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 10:07:55AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/24/19 -1600

J Graham

Analysis Report for 24-Sep-19-10019

L1-12108A-FSGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.64	946 -	959	954.64	9.59E+01	15.55	5.31E+01	0.88
2	351.92	1399 -	1412	1407.41	6.37E+01	13.00	3.83E+01	0.81
3	583.19	2327 -	2338	2331.97	3.61E+01	7.81	9.95E+00	0.92
4	608.95	2430 -	2444	2434.97	4.80E+01	8.60	9.02E+00	0.82
5	910.94	3637 -	3649	3642.72	3.63E+01	6.97	4.71E+00	0.85
6	1460.32	5830 -	5851	5841.11	3.18E+02	18.42	5.53E+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	0.96	1460.82	*	10.66	7.52E+00	5.44E-01
Tl-208	1.00	583.19	*	85.00	5.77E-02	1.30E-02
Bi-211	0.89	351.07	*	13.02	4.71E-01	1.03E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.66E-01	3.01E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.48E-01	2.79E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 24-Sep-19-10019

L1-12108A-FSGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.72E-01	3.77E-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	2.58E-01	5.07E-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 24-Sep-19-10019

L1-12108A-FSGS-013SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.961	7.52E+00	5.44E-01	
	Tl-208	1.000	5.77E-02	1.30E-02	
?	Bi-211	0.891	4.71E-01	1.03E-01	
	Pb-212	1.000	1.66E-01	3.01E-02	
	Bi-214	0.991	1.48E-01	2.79E-02	
?	Pb-214	1.000	1.72E-01	3.77E-02	
	Ac-228	0.997	2.58E-01	5.07E-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 24-Sep-19-10019

L1-12108A-FSGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 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	1.60E-02	5.37E-02	5.37E-02
	BE-7	477.60		10.44	-3.10E-01	3.89E-01	3.89E-01
+	K-40	1460.82	*	10.66	7.52E+00	4.34E-01	4.34E-01
	Mn-54	834.85		99.98	-2.50E-03	5.02E-02	5.02E-02
	Co-60	1173.23		99.85	-2.14E-02	4.43E-02	6.23E-02
		1332.49		99.98	-1.99E-02		4.43E-02
	Nb-94	702.65		99.81	-4.06E-02	4.36E-02	4.36E-02
		871.09		99.89	1.46E-02		4.77E-02
	Ag-108m	79.13		6.60	3.56E-01	4.22E-02	1.86E+00
		433.94		90.50	8.72E-04		4.22E-02
		614.28		89.80	-1.85E-02		5.44E-02
		722.94		90.80	2.97E-03		6.24E-02
	Sb-125	176.31		6.84	1.11E-01	1.37E-01	5.72E-01
		380.45		1.52	3.73E-01		2.50E+00
		427.87		29.60	9.04E-02		1.37E-01
		463.36		10.49	9.83E-02		3.82E-01
		600.60		17.65	3.13E-02		2.47E-01
		606.71		4.98	1.53E+00		1.24E+00
		635.95		11.22	-2.68E-01		3.59E-01

Analysis Report for 24-Sep-19-10019

L1-12108A-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.22E+00	1.37E-01	2.59E+00
Ba-133	79.61	2.65	-9.35E-01	7.57E-02	4.41E+00
	81.00	32.90	-5.10E-02		3.20E-01
	276.40	7.16	4.39E-01		5.51E-01
	302.85	18.34	7.95E-02		2.00E-01
	356.01	62.05	-7.17E-02		7.57E-02
	383.85	8.94	1.46E-01		4.36E-01
Cs-134	475.36	1.48	1.68E+00	6.13E-02	2.77E+00
	563.25	8.34	-3.72E-01		4.15E-01
	569.33	15.37	1.36E-02		2.35E-01
	604.72	97.62	-1.72E-02		6.13E-02
	795.86	85.46	-1.12E-02		6.23E-02
	801.95	8.69	5.01E-01		5.67E-01
	1038.61	0.99	5.33E+00		6.59E+00
	1167.97	1.79	1.51E-01		3.31E+00
	1365.19	3.02	7.64E-01		1.76E+00
Cs-137	661.66	85.10	-2.65E-02	5.22E-02	5.22E-02
Eu-152	121.78	28.67	-1.41E-02	1.52E-01	1.65E-01
	244.70	7.61	5.04E-02		5.50E-01
	295.94	0.45	4.44E+00		9.33E+00
	344.28	26.60	9.45E-02		1.52E-01
	367.79	0.86	-4.04E+00		3.78E+00
	411.12	2.24	-5.95E-01		1.83E+00
	443.96	2.83	2.40E-01		1.34E+00
	488.68	0.42	-2.37E+00		8.50E+00
	563.99	0.49	-9.08E+00		6.88E+00
	586.26	0.46	3.84E+00		1.22E+01
	678.62	0.47	-2.24E+00		8.88E+00
	688.67	0.86	-8.59E-01		5.01E+00
	719.35	0.28	9.26E+00		1.91E+01
	778.90	12.96	-2.24E-01		3.23E-01
	810.45	0.32	-2.19E+00		1.31E+01
	867.37	4.26	1.54E-01		1.16E+00
	919.33	0.43	5.94E+00		1.28E+01
	964.08	14.65	1.12E-01		4.46E-01
	1085.87	10.24	9.22E-03		5.86E-01
	1089.74	1.73	1.01E+00		3.58E+00
	1112.07	13.69	-2.59E-01		3.95E-01
	1212.95	1.43	-2.99E+00		4.79E+00
	1249.94	0.19	-7.77E+00		3.53E+01
	1299.14	1.63	1.03E+00		3.46E+00
	1408.01	21.07	-2.39E-01		2.10E-01
	1457.64	0.50	1.66E+02		4.51E+01
	1528.10	0.28	-1.23E+01		1.26E+01
Eu-154	123.07	40.40	5.60E-02	1.20E-01	1.20E-01
	247.93	6.89	2.10E-01		5.50E-01
	591.76	4.95	-7.39E-01		7.72E-01
	692.42	1.78	-1.32E+00		2.31E+00
	723.30	20.06	-7.36E-02		2.80E-01
	756.80	4.52	-1.66E-01		1.06E+00
	873.18	12.08	-1.35E-01		3.96E-01

Analysis Report for 24-Sep-19-10019

L1-12108A-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.34E-02	1.20E-01	4.81E-01
	1004.76	18.01	-4.11E-02		2.65E-01
	1274.43	34.80	6.67E-03		2.00E-01
	1596.48	1.80	-5.45E-01		2.20E+00
Eu-155	45.30	1.31	-1.03E+01	2.60E-01	3.10E+01
	60.01	1.22	-1.40E+01		2.97E+01
	86.55	30.70	1.79E-02		2.60E-01
	105.31	21.10	5.70E-02		3.00E-01
Ra-226	186.21	3.64	5.05E-01	1.05E+00	1.05E+00
Pa-231	27.36	10.30	3.80E+00	1.44E+00	3.50E+00
	283.69	1.70	-4.84E-01		2.13E+00
	300.07	2.47	-1.06E+00		1.44E+00
	302.65	2.20	5.12E-01		1.68E+00
	330.06	1.40	1.26E+00		2.78E+00
U-235	143.76	10.96	7.71E-02	6.50E-02	4.28E-01
	163.33	5.08	-3.71E-01		8.01E-01
	185.71	57.20	6.73E-03		6.50E-02
	202.11	1.08	5.00E-01		3.47E+00
	205.31	5.01	-2.83E-02		7.41E-01
Am-241	59.54	35.90	-4.94E-01	1.08E+00	1.08E+00

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

Apex-Gamma

Analysis Report for 24-Sep-19-10020

L1-12108A-FSGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10020
Sample Description	: L1-12108A-FSGS-014SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.781E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:26:00PM
Acquisition Started	: 9/24/2019 9:52:59AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79803
Fill Height	: 1780.53 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 10:08:02AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/24/19 -1600

J Graham

Analysis Report for 24-Sep-19-10020

L1-12108A-FSGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.73	947 -	961	954.50	1.49E+02	17.19	5.06E+01	0.82
2	295.17	1174 -	1187	1179.97	3.55E+01	11.07	3.05E+01	0.46
3	351.92	1402 -	1415	1406.71	9.48E+01	13.81	3.42E+01	0.57
4	583.32	2324 -	2338	2331.39	4.99E+01	8.56	8.08E+00	0.55
5	609.37	2428 -	2442	2435.53	6.19E+01	9.69	1.11E+01	1.76
6	910.83	3636 -	3645	3640.77	1.70E+01	6.31	1.00E+01	0.45
7	1460.18	5826 -	5851	5838.68	4.71E+02	22.00	3.12E+00	1.60

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	1.02E+01	6.48E-01
Tl-208	0.99	583.19	*	85.00	7.28E-02	1.32E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.32E-01	3.26E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.74E-01	2.91E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 24-Sep-19-10020

L1-12108A-FSGS-014SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.48E-01	4.76E-02
		351.93	*	35.60	2.32E-01	3.86E-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	1.10E-01	4.12E-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 24-Sep-19-10020

L1-12108A-FSGS-014SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.937	1.02E+01	6.48E-01	
	Tl-208	0.997	7.28E-02	1.32E-02	
X	Bi-211	0.890			
	Pb-212	0.999	2.32E-01	3.26E-02	
	Bi-214	1.000	1.74E-01	2.91E-02	
	Pb-214	1.000	1.99E-01	3.00E-02	
	Ac-228	0.993	1.10E-01	4.12E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 24-Sep-19-10020

L1-12108A-FSGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 10:08:02AM
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	5.74E-02	5.66E-02	5.66E-02
	BE-7	477.60		10.44	2.51E-01	4.22E-01	4.22E-01
+	K-40	1460.82	*	10.66	1.02E+01	3.25E-01	3.25E-01
	Mn-54	834.85		99.98	2.33E-04	5.06E-02	5.06E-02
	Co-60	1173.23		99.85	-5.94E-03	4.87E-02	6.88E-02
		1332.49		99.98	-1.83E-02		4.87E-02
	Nb-94	702.65		99.81	-1.03E-03	4.11E-02	4.11E-02
		871.09		99.89	4.46E-03		4.12E-02
	Ag-108m	79.13		6.60	-1.30E-01	3.88E-02	1.19E+00
		433.94		90.50	-9.88E-03		3.88E-02
		614.28		89.80	-3.93E-02		5.64E-02
		722.94		90.80	-3.24E-02		5.06E-02
	Sb-125	176.31		6.84	1.30E-01	1.20E-01	4.76E-01
		380.45		1.52	1.52E+00		2.37E+00
		427.87		29.60	2.39E-02		1.20E-01
		463.36		10.49	9.45E-02		3.55E-01
		600.60		17.65	1.31E-02		2.25E-01
		606.71		4.98	1.54E+00		1.24E+00
		635.95		11.22	2.02E-01		3.77E-01

Analysis Report for 24-Sep-19-10020

L1-12108A-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.41E-01	1.20E-01	2.13E+00
Ba-133	79.61	2.65	-6.98E-02	7.11E-02	2.87E+00
	81.00	32.90	-3.67E-01		1.97E-01
	276.40	7.16	7.23E-02		4.69E-01
	302.85	18.34	1.12E-01		1.84E-01
	356.01	62.05	-1.04E-02		7.11E-02
	383.85	8.94	7.80E-03		3.53E-01
Cs-134	475.36	1.48	-3.56E-01	5.08E-02	2.80E+00
	563.25	8.34	-6.70E-01		4.90E-01
	569.33	15.37	9.35E-02		2.77E-01
	604.72	97.62	-1.25E-02		5.32E-02
	795.86	85.46	-1.38E-02		5.08E-02
	801.95	8.69	-5.95E-02		4.94E-01
	1038.61	0.99	3.80E+00		4.98E+00
	1167.97	1.79	1.23E+00		3.71E+00
	1365.19	3.02	1.58E-01		1.56E+00
Cs-137	661.66	85.10	1.35E-02	4.41E-02	4.41E-02
Eu-152	121.78	28.67	-4.53E-03	1.20E-01	1.21E-01
	244.70	7.61	1.19E-01		4.96E-01
	295.94	0.45	1.87E-01		8.40E+00
	344.28	26.60	-2.63E-02		1.20E-01
	367.79	0.86	1.34E+00		3.81E+00
	411.12	2.24	4.55E-01		1.65E+00
	443.96	2.83	7.49E-01		1.27E+00
	488.68	0.42	1.46E+00		9.17E+00
	563.99	0.49	-1.41E+01		8.30E+00
	586.26	0.46	9.52E-01		1.18E+01
	678.62	0.47	3.06E+00		8.49E+00
	688.67	0.86	-2.83E-01		4.10E+00
	719.35	0.28	6.91E+00		1.58E+01
	778.90	12.96	1.17E-01		3.68E-01
	810.45	0.32	-7.69E+00		1.29E+01
	867.37	4.26	3.53E-01		1.00E+00
	919.33	0.43	2.56E+00		1.13E+01
	964.08	14.65	1.60E-01		4.57E-01
	1085.87	10.24	-2.22E-01		5.19E-01
	1089.74	1.73	-2.21E+00		3.03E+00
	1112.07	13.69	1.37E-01		4.41E-01
	1212.95	1.43	1.36E+00		4.91E+00
	1249.94	0.19	-4.41E+00		2.77E+01
	1299.14	1.63	-2.42E+00		3.49E+00
	1408.01	21.07	1.27E-01		2.07E-01
	1457.64	0.50	2.13E+02		4.93E+01
	1528.10	0.28	-7.65E+00		1.52E+01
Eu-154	123.07	40.40	1.85E-02	8.62E-02	8.62E-02
	247.93	6.89	5.42E-02		4.84E-01
	591.76	4.95	-9.21E-01		7.38E-01
	692.42	1.78	5.61E-01		2.18E+00
	723.30	20.06	-1.36E-01		2.32E-01
	756.80	4.52	1.53E-01		1.10E+00
	873.18	12.08	-1.67E-01		3.35E-01

Analysis Report for 24-Sep-19-10020

L1-12108A-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	2.41E-01	8.62E-02	5.02E-01
	1004.76	18.01	1.14E-01		3.06E-01
	1274.43	34.80	-3.50E-02		1.67E-01
	1596.48	1.80	1.10E+00		2.26E+00
Eu-155	45.30	1.31	4.38E+00	1.92E-01	1.24E+01
	60.01	1.22	4.21E+00		1.27E+01
	86.55	30.70	8.98E-02		2.00E-01
	105.31	21.10	1.96E-02		1.92E-01
Ra-226	186.21	3.64	4.95E-01	9.65E-01	9.65E-01
Pa-231	27.36	10.30	3.05E-01	1.17E+00	1.17E+00
	283.69	1.70	-8.59E-01		1.79E+00
	300.07	2.47	-2.85E-01		1.30E+00
	302.65	2.20	1.24E+00		1.52E+00
	330.06	1.40	2.47E-01		2.21E+00
U-235	143.76	10.96	1.78E-01	6.13E-02	3.32E-01
	163.33	5.08	2.79E-01		6.09E-01
	185.71	57.20	2.54E-02		6.13E-02
	202.11	1.08	-6.98E-01		2.89E+00
	205.31	5.01	-2.34E-01		6.26E-01
Am-241	59.54	35.90	4.12E-02	4.35E-01	4.35E-01

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

Apex-Gamma

Analysis Report for 24-Sep-19-10021

L1-12108A-FSGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10021
Sample Description	: L1-12108A-FSGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.800E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:28:00PM
Acquisition Started	: 9/24/2019 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	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79804
Fill Height	: 1800.13 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 10:08:12AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 9/24/19 -1600

J Graham

Analysis Report for 24-Sep-19-10021

L1-12108A-FSGS-015SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.11	305 -	313	309.75	3.05E+01	11.11	4.35E+01	0.77
2	238.65	948 -	961	955.07	9.91E+01	17.10	6.99E+01	0.49
3	295.17	1177 -	1186	1180.90	3.56E+01	10.89	3.64E+01	0.40
4	338.22	1347 -	1357	1352.95	2.97E+01	10.10	3.03E+01	0.76
5	352.01	1401 -	1414	1408.05	6.83E+01	11.43	2.27E+01	0.96
6	510.46	2035 -	2046	2041.32	3.00E+01	8.85	1.80E+01	0.65
7	583.06	2323 -	2337	2331.55	5.45E+01	8.72	7.50E+00	0.59
8	609.40	2427 -	2445	2436.88	7.32E+01	11.45	1.68E+01	1.18
9	911.17	3638 -	3649	3643.72	2.24E+01	7.02	1.06E+01	0.78
10	1460.85	5831 -	5856	5843.75	4.31E+02	21.06	3.08E+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
An Pk	0.95	511.00	*	100.00	3.51E-02	1.06E-02
K-40	1.00	1460.82	*	10.66	8.67E+00	5.67E-01
Tl-208	0.99	583.19	*	85.00	7.56E-02	1.29E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.52E-01	2.89E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		

Analysis Report for 24-Sep-19-10021

L1-12108A-FSGS-015SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	1.00	77.11	*	17.10	2.81E-01	1.06E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	1.95E-01	3.27E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.44E-01	4.57E-02
		351.93	*	35.60	1.62E-01	3.00E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	4.95E-01	1.88E-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	2.16E-01	7.57E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.37E-01	4.32E-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 24-Sep-19-10021

L1-12108A-FSGS-015SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.954	3.51E-02	1.06E-02	
	K-40	1.000	8.67E+00	5.67E-01	
	Tl-208	0.997	7.56E-02	1.29E-02	
X	Bi-211	0.867			
	Pb-212	1.000	1.52E-01	2.89E-02	
?	Pb212-XR	1.000	2.81E-01	1.06E-01	
	Bi-214	1.000	1.95E-01	3.27E-02	
	Pb-214	0.999	1.57E-01	2.51E-02	
?	Pb214-XR	1.000	4.95E-01	1.88E-01	
	Ac-228	1.000	1.56E-01	3.75E-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 24-Sep-19-10021

L1-12108A-FSGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 10:08:12AM
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	3.51E-02	3.09E-02	3.09E-02
	BE-7	477.60		10.44	3.97E-01	4.19E-01	4.19E-01
+	K-40	1460.82	*	10.66	8.67E+00	3.00E-01	3.00E-01
	Mn-54	834.85		99.98	1.45E-02	4.88E-02	4.88E-02
	Co-60	1173.23		99.85	1.85E-02	5.00E-02	7.25E-02
		1332.49		99.98	-1.86E-02		5.00E-02
	Nb-94	702.65		99.81	-6.66E-04	3.38E-02	3.38E-02
		871.09		99.89	4.97E-03		5.08E-02
	Ag-108m	79.13		6.60	-4.36E-01	4.17E-02	1.36E+00
		433.94		90.50	1.66E-02		4.17E-02
		614.28		89.80	-7.47E-03		6.84E-02
		722.94		90.80	-1.57E-02		4.54E-02
	Sb-125	176.31		6.84	-2.59E-01	1.16E-01	4.84E-01
		380.45		1.52	-1.16E+00		2.17E+00
		427.87		29.60	-5.33E-02		1.16E-01
		463.36		10.49	2.57E-01		3.74E-01
		600.60		17.65	8.41E-02		2.47E-01
		606.71		4.98	1.93E+00		1.34E+00
		635.95		11.22	-2.11E-01		3.71E-01

Analysis Report for 24-Sep-19-10021

L1-12108A-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	4.58E-01	1.16E-01	2.41E+00
Ba-133	79.61	2.65	-6.58E-01	7.01E-02	3.32E+00
	81.00	32.90	-1.36E-01		2.27E-01
	276.40	7.16	3.37E-01		5.32E-01
	302.85	18.34	-1.24E-01		2.03E-01
	356.01	62.05	-3.08E-02		7.01E-02
	383.85	8.94	4.19E-02		3.86E-01
Cs-134	475.36	1.48	3.23E+00	5.37E-02	2.82E+00
	563.25	8.34	-2.46E-01		4.23E-01
	569.33	15.37	-8.34E-03		2.46E-01
	604.72	97.62	-1.12E-03		6.29E-02
	795.86	85.46	4.11E-02		5.37E-02
	801.95	8.69	-1.07E-01		5.24E-01
	1038.61	0.99	-4.00E+00		5.44E+00
	1167.97	1.79	-4.67E+00		3.84E+00
	1365.19	3.02	-9.60E-01		1.37E+00
Cs-137	661.66	85.10	5.58E-03	5.43E-02	5.43E-02
Eu-152	121.78	28.67	4.24E-02	1.34E-01	1.35E-01
	244.70	7.61	-2.84E-01		4.61E-01
	295.94	0.45	5.29E+00		1.00E+01
	344.28	26.60	-4.41E-02		1.34E-01
	367.79	0.86	1.41E-01		4.07E+00
	411.12	2.24	2.67E-01		1.41E+00
	443.96	2.83	-1.59E-01		1.12E+00
	488.68	0.42	8.10E+00		9.05E+00
	563.99	0.49	-3.68E+00		7.35E+00
	586.26	0.46	-5.63E+00		1.19E+01
	678.62	0.47	3.17E+00		8.51E+00
	688.67	0.86	2.31E-01		4.90E+00
	719.35	0.28	7.42E-01		1.25E+01
	778.90	12.96	-2.66E-02		3.73E-01
	810.45	0.32	6.46E+00		1.34E+01
	867.37	4.26	8.61E-01		1.29E+00
	919.33	0.43	-8.33E-01		1.17E+01
	964.08	14.65	-3.82E-02		3.83E-01
	1085.87	10.24	1.36E-01		6.09E-01
	1089.74	1.73	2.82E+00		3.65E+00
	1112.07	13.69	-4.23E-01		4.08E-01
	1212.95	1.43	1.17E+00		4.88E+00
	1249.94	0.19	-5.29E+00		2.83E+01
	1299.14	1.63	1.11E+00		3.54E+00
	1408.01	21.07	2.83E-02		1.79E-01
	1457.64	0.50	1.87E+02		4.42E+01
	1528.10	0.28	-6.49E+00		1.23E+01
Eu-154	123.07	40.40	-2.11E-02	9.31E-02	9.31E-02
	247.93	6.89	-2.60E-01		4.79E-01
	591.76	4.95	5.03E-01		8.27E-01
	692.42	1.78	3.71E-01		2.29E+00
	723.30	20.06	9.13E-02		2.14E-01
	756.80	4.52	-7.00E-01		9.14E-01
	873.18	12.08	1.25E-02		3.96E-01

Analysis Report for 24-Sep-19-10021

L1-12108A-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.52E-01	9.31E-02	4.78E-01
	1004.76	18.01	-1.99E-01		2.41E-01
	1274.43	34.80	2.80E-03		1.58E-01
	1596.48	1.80	-1.90E+00		1.74E+00
Eu-155	45.30	1.31	1.22E+01	2.17E-01	2.19E+01
	60.01	1.22	3.59E+00		2.23E+01
	86.55	30.70	1.06E-01		2.17E-01
	105.31	21.10	-1.22E-01		2.20E-01
Ra-226	186.21	3.64	5.60E-01	1.05E+00	1.05E+00
Pa-231	27.36	10.30	1.53E+00	1.58E+00	2.27E+00
	283.69	1.70	-3.97E-01		1.95E+00
	300.07	2.47	-1.40E+00		1.58E+00
	302.65	2.20	-7.43E-01		1.69E+00
	330.06	1.40	-5.00E-01		2.55E+00
U-235	143.76	10.96	5.13E-03	6.62E-02	3.51E-01
	163.33	5.08	1.56E-01		6.58E-01
	185.71	57.20	4.47E-02		6.62E-02
	202.11	1.08	-4.21E+00		2.99E+00
	205.31	5.01	-3.35E-01		6.97E-01
Am-241	59.54	35.90	8.86E-02	7.98E-01	7.98E-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 24-Sep-19-10022
L1-12108A-FSGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10022
Sample Description	: L1-12108A-FSGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.646E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:30:00PM
Acquisition Started	: 9/24/2019 10:19:01AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79805
Fill Height	: 1646.44 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 10:34:04AM

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

DATA VALIDATED 9/24/19 -1600
J Graham/

Analysis Report for 24-Sep-19-10022

L1-12108A-FSGS-016SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.70	473 -	482	477.58	1.07E+02	19.93	1.25E+02	1.22
2	338.34	674 -	680	676.65	2.29E+01	9.78	3.81E+01	1.13
3	351.96	699 -	707	703.87	1.12E+02	13.90	3.83E+01	1.38
4	583.24	1160 -	1170	1166.09	7.59E+01	11.04	1.91E+01	1.36
5	609.51	1213 -	1222	1218.60	7.97E+01	10.80	1.63E+01	1.17
6	911.10	1818 -	1826	1821.65	2.36E+01	7.88	1.74E+01	1.05
7	969.17	1932 -	1941	1937.81	2.11E+01	6.60	9.92E+00	0.96
8	1460.83	2914 -	2928	2921.72	4.36E+02	21.01	1.89E+00	2.23

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	8.04E+00	5.22E-01
Tl-208	1.00	583.19	*	85.00	9.64E-02	1.52E-02
Bi-211	0.88	351.07	*	13.02	6.60E-01	9.79E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.49E-01	3.01E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.94E-01	2.88E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 24-Sep-19-10022

L1-12108A-FSGS-016SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.42E-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	1.52E-01	6.62E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.32E-01	4.44E-02
		964.77		4.99		
		968.97	*	15.80	2.00E-01	6.34E-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 24-Sep-19-10022

L1-12108A-FSGS-016SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	8.04E+00	5.22E-01	
	Tl-208	1.000	9.64E-02	1.52E-02	
?	Bi-211	0.881	6.60E-01	9.79E-02	
	Pb-212	0.999	1.49E-01	3.01E-02	
	Bi-214	0.998	1.94E-01	2.88E-02	
?	Pb-214	0.513	2.42E-01	3.57E-02	
	Ac-228	0.998	1.54E-01	3.19E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 24-Sep-19-10022

L1-12108A-FSGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 10:34:04AM
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	6.25E-02	5.55E-02	5.55E-02
	BE-7	477.60		10.44	2.12E-01	3.88E-01	3.88E-01
+	K-40	1460.82	*	10.66	8.04E+00	1.99E-01	1.99E-01
	Mn-54	834.85		99.98	-1.17E-02	3.36E-02	3.36E-02
	Co-60	1173.23		99.85	-2.52E-02	3.59E-02	5.38E-02
		1332.49		99.98	-3.54E-02		3.59E-02
	Nb-94	702.65		99.81	7.04E-04	3.55E-02	4.01E-02
		871.09		99.89	-9.10E-03		3.55E-02
	Ag-108m	79.13		6.60	4.43E-01	3.54E-02	1.11E+00
		433.94		90.50	-6.11E-03		3.54E-02
		614.28		89.80	-1.05E-01		5.27E-02
		722.94		90.80	9.27E-03		4.79E-02
	Sb-125	176.31		6.84	-2.47E-03	1.06E-01	5.11E-01
		380.45		1.52	-3.21E-01		2.01E+00
		427.87		29.60	3.30E-02		1.06E-01
		463.36		10.49	4.65E-02		3.23E-01
		600.60		17.65	1.37E-01		2.26E-01
		606.71		4.98	-2.48E-01		1.21E+00
		635.95		11.22	-1.26E-01		3.07E-01

Analysis Report for 24-Sep-19-10022

L1-12108A-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	3.49E-01	1.06E-01	2.10E+00
Ba-133	79.61	2.65	4.30E-01	7.13E-02	2.60E+00
	81.00	32.90	-1.72E-01		1.73E-01
	276.40	7.16	-5.96E-03		4.30E-01
	302.85	18.34	5.92E-02		1.82E-01
	356.01	62.05	-1.06E-01		7.13E-02
	383.85	8.94	4.40E-02		3.43E-01
Cs-134	475.36	1.48	1.47E+00	3.78E-02	2.57E+00
	563.25	8.34	-3.68E-02		3.92E-01
	569.33	15.37	3.99E-02		2.31E-01
	604.72	97.62	-2.09E-03		5.36E-02
	795.86	85.46	-2.32E-02		3.78E-02
	801.95	8.69	-2.92E-02		4.47E-01
	1038.61	0.99	1.12E+00		4.64E+00
	1167.97	1.79	3.18E-01		3.04E+00
	1365.19	3.02	1.58E-01		1.41E+00
Cs-137	661.66	85.10	6.20E-03	4.19E-02	4.19E-02
Eu-152	121.78	28.67	-3.44E-02	1.05E-01	1.05E-01
	244.70	7.61	-3.36E-01		4.47E-01
	295.94	0.45	8.98E+00		9.18E+00
	344.28	26.60	-6.35E-02		1.23E-01
	367.79	0.86	-4.49E-01		3.29E+00
	411.12	2.24	3.79E-01		1.41E+00
	443.96	2.83	-5.18E-01		1.09E+00
	488.68	0.42	5.13E-01		8.34E+00
	563.99	0.49	-8.80E-01		6.55E+00
	586.26	0.46	-5.96E+00		1.25E+01
	678.62	0.47	-3.45E+00		6.78E+00
	688.67	0.86	-6.94E-01		4.20E+00
	719.35	0.28	8.14E+00		1.54E+01
	778.90	12.96	3.02E-02		2.55E-01
	810.45	0.32	6.31E-01		1.23E+01
	867.37	4.26	-4.82E-01		8.65E-01
	919.33	0.43	8.46E-01		1.06E+01
	964.08	14.65	-4.63E-02		3.15E-01
	1085.87	10.24	-1.48E-01		4.45E-01
	1089.74	1.73	3.40E-01		2.88E+00
	1112.07	13.69	1.18E-01		3.49E-01
	1212.95	1.43	-1.39E+00		3.79E+00
	1249.94	0.19	-1.84E+01		2.80E+01
	1299.14	1.63	-3.27E-02		2.88E+00
	1408.01	21.07	7.95E-02		1.95E-01
	1457.64	0.50	-4.98E+00		4.05E+01
	1528.10	0.28	-1.08E+00		1.06E+01
Eu-154	123.07	40.40	8.59E-03	7.84E-02	7.84E-02
	247.93	6.89	1.31E-01		4.61E-01
	591.76	4.95	-1.60E-01		6.98E-01
	692.42	1.78	-7.33E-01		2.04E+00
	723.30	20.06	6.42E-02		2.19E-01
	756.80	4.52	3.18E-01		8.61E-01
	873.18	12.08	-1.42E-01		2.89E-01

Analysis Report for 24-Sep-19-10022

L1-12108A-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-8.87E-02	7.84E-02	3.99E-01
	1004.76	18.01	1.30E-01		2.53E-01
	1274.43	34.80	2.82E-02		1.76E-01
	1596.48	1.80	-2.28E+00		1.59E+00
Eu-155	45.30	1.31	-8.67E-03	1.69E-01	1.17E+01
	60.01	1.22	1.70E+00		1.27E+01
	86.55	30.70	5.22E-02		1.69E-01
	105.31	21.10	3.54E-02		1.89E-01
Ra-226	186.21	3.64	3.67E-01	9.75E-01	9.75E-01
Pa-231	27.36	10.30	-1.84E-01	8.83E-01	8.83E-01
	283.69	1.70	3.26E-01		1.76E+00
	300.07	2.47	-1.79E+00		1.33E+00
	302.65	2.20	4.92E-01		1.51E+00
	330.06	1.40	1.18E+00		2.45E+00
U-235	143.76	10.96	-5.28E-02	6.28E-02	2.77E-01
	163.33	5.08	8.31E-02		6.76E-01
	185.71	57.20	4.51E-02		6.28E-02
	202.11	1.08	-2.24E+00		2.79E+00
	205.31	5.01	-2.27E-01		6.27E-01
Am-241	59.54	35.90	1.94E-01	4.56E-01	4.56E-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 24-Sep-19-10023
L1-12108A-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 24-Sep-19-10023
Sample Description	: L1-12108A-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.687E+03 grams
Facility	: Default
Sample Taken On	: 9/18/2019 1:32:00PM
Acquisition Started	: 9/24/2019 10:19:09AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 9/24/2019
Efficiency Calibration Description	:
Sample Number	: 79806
Fill Height	: 1687.36 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/24/2019 10:34:12AM

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

DATA VALIDATED 9/24/19 -1600
J Graham/

Analysis Report for 24-Sep-19-10023

L1-12108A-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	950 -	958	954.34	1.04E+02	14.14	4.51E+01	0.87
2	338.19	1347 -	1357	1352.52	2.49E+01	10.26	3.31E+01	0.70
3	351.73	1398 -	1414	1406.67	8.67E+01	12.39	2.13E+01	0.80
4	609.09	2429 -	2441	2435.51	5.25E+01	8.79	9.45E+00	1.01
5	1460.41	5830 -	5853	5841.47	3.91E+02	20.37	6.00E+00	1.58

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.82	*	10.66	9.49E+00	6.44E-01
Bi-211	0.93	351.07	*	13.02	6.51E-01	1.07E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.83E-01	2.89E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.65E-01	2.94E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		

Analysis Report for 24-Sep-19-10023

L1-12108A-FSGS-017SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.38E-01	3.90E-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	2.10E-01	8.82E-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

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

Analysis Report for 24-Sep-19-10023

L1-12108A-FSGS-017SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.973	9.49E+00	6.44E-01	
?	Bi-211	0.932	6.51E-01	1.07E-01	
	Pb-212	0.999	1.83E-01	2.89E-02	
	Bi-214	0.996	1.65E-01	2.94E-02	
?	Pb-214	0.996	2.38E-01	3.90E-02	
	Ac-228	1.000	2.10E-01	8.82E-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 24-Sep-19-10023

L1-12108A-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/24/2019 10:34:12AM
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	3.56E-02	6.12E-02	6.12E-02
	BE-7	477.60		10.44	2.36E-01	5.20E-01	5.20E-01
+	K-40	1460.82	*	10.66	9.49E+00	4.73E-01	4.73E-01
	Mn-54	834.85		99.98	3.58E-02	5.60E-02	5.60E-02
	Co-60	1173.23		99.85	3.14E-02	5.88E-02	6.78E-02
		1332.49		99.98	-1.50E-02		5.88E-02
	Nb-94	702.65		99.81	-2.56E-02	4.60E-02	4.60E-02
		871.09		99.89	-1.64E-02		5.76E-02
	Ag-108m	79.13		6.60	7.41E-01	4.73E-02	2.20E+00
		433.94		90.50	-2.12E-03		4.73E-02
		614.28		89.80	-3.10E-02		5.32E-02
		722.94		90.80	-1.24E-02		6.38E-02
	Sb-125	176.31		6.84	1.93E-01	1.43E-01	6.26E-01
		380.45		1.52	1.42E+00		2.78E+00
		427.87		29.60	-4.19E-03		1.43E-01
		463.36		10.49	2.98E-01		4.44E-01
		600.60		17.65	3.36E-02		2.68E-01
		606.71		4.98	1.23E+00		1.35E+00
		635.95		11.22	-1.54E-01		3.48E-01

Analysis Report for 24-Sep-19-10023

L1-12108A-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.49E+00	1.43E-01	2.22E+00
Ba-133	79.61	2.65	-1.84E+00	7.07E-02	5.09E+00
	81.00	32.90	-2.04E-01		3.52E-01
	276.40	7.16	1.89E-01		6.30E-01
	302.85	18.34	1.07E-01		2.24E-01
	356.01	62.05	-2.37E-02		7.07E-02
	383.85	8.94	-3.24E-02		4.67E-01
Cs-134	475.36	1.48	1.83E+00	5.87E-02	3.44E+00
	563.25	8.34	6.54E-02		5.49E-01
	569.33	15.37	-1.41E-01		2.56E-01
	604.72	97.62	-4.16E-02		6.98E-02
	795.86	85.46	-2.30E-02		5.87E-02
	801.95	8.69	3.15E-01		5.89E-01
	1038.61	0.99	-1.99E-01		6.33E+00
	1167.97	1.79	-1.69E+00		3.73E+00
	1365.19	3.02	1.88E+00		2.12E+00
Cs-137	661.66	85.10	2.61E-03	5.70E-02	5.70E-02
Eu-152	121.78	28.67	4.31E-02	1.46E-01	1.68E-01
	244.70	7.61	-1.68E-02		5.72E-01
	295.94	0.45	4.31E+00		1.09E+01
	344.28	26.60	1.91E-02		1.46E-01
	367.79	0.86	-1.25E+00		4.39E+00
	411.12	2.24	2.16E-01		1.86E+00
	443.96	2.83	-1.98E-01		1.43E+00
	488.68	0.42	-2.13E+00		9.51E+00
	563.99	0.49	4.74E+00		9.19E+00
	586.26	0.46	1.58E+01		1.41E+01
	678.62	0.47	2.42E+00		8.44E+00
	688.67	0.86	-9.05E-01		5.58E+00
	719.35	0.28	3.07E+00		1.79E+01
	778.90	12.96	5.92E-02		3.80E-01
	810.45	0.32	-9.45E-01		1.34E+01
	867.37	4.26	-2.39E-01		1.38E+00
	919.33	0.43	4.24E+00		1.33E+01
	964.08	14.65	2.06E-01		4.32E-01
	1085.87	10.24	-9.87E-02		5.54E-01
	1089.74	1.73	-3.01E-01		3.40E+00
	1112.07	13.69	-1.07E-01		4.63E-01
	1212.95	1.43	-2.55E+00		4.91E+00
	1249.94	0.19	-2.94E+01		3.41E+01
	1299.14	1.63	1.14E+00		4.13E+00
	1408.01	21.07	-2.34E-01		2.41E-01
	1457.64	0.50	2.09E+02		5.12E+01
	1528.10	0.28	1.52E+01		2.10E+01
Eu-154	123.07	40.40	-6.45E-03	1.18E-01	1.18E-01
	247.93	6.89	-1.29E-01		5.91E-01
	591.76	4.95	-8.96E-01		8.98E-01
	692.42	1.78	-8.79E-02		2.92E+00
	723.30	20.06	1.97E-01		2.98E-01
	756.80	4.52	-5.20E-01		9.30E-01
	873.18	12.08	-5.98E-01		4.59E-01

Analysis Report for 24-Sep-19-10023

L1-12108A-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	4.02E-01	1.18E-01	5.63E-01
	1004.76	18.01	1.16E-01		3.15E-01
	1274.43	34.80	-1.21E-02		1.94E-01
	1596.48	1.80	-7.72E-01		1.73E+00
Eu-155	45.30	1.31	3.08E+00	2.77E-01	3.16E+01
	60.01	1.22	1.66E-01		3.22E+01
	86.55	30.70	5.22E-02		2.84E-01
	105.31	21.10	-1.10E-01		2.77E-01
Ra-226	186.21	3.64	-2.48E-01	1.15E+00	1.15E+00
Pa-231	27.36	10.30	3.64E+00	1.72E+00	3.81E+00
	283.69	1.70	-1.19E+00		2.36E+00
	300.07	2.47	-2.40E-01		1.72E+00
	302.65	2.20	1.03E+00		1.88E+00
	330.06	1.40	-5.75E-01		2.99E+00
U-235	143.76	10.96	1.50E-01	7.40E-02	4.23E-01
	163.33	5.08	8.72E-02		8.99E-01
	185.71	57.20	5.97E-04		7.40E-02
	202.11	1.08	2.06E-01		3.79E+00
	205.31	5.01	-8.75E-01		7.58E-01
Am-241	59.54	35.90	1.03E-01	1.15E+00	1.15E+00

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

Apex-Gamma

Analysis Report for 25-Sep-19-10013

L1-12108A-FSGS-002SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 25-Sep-19-10013
Sample Description	: L1-12108A-FSGS-002SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.497E+03 grams
Facility	: Default
Sample Taken On	: 9/17/2019 8:00:00AM
Acquisition Started	: 9/25/2019 7:21:16AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/24/2019
Efficiency Calibration Used Done On	: 9/25/2019
Efficiency Calibration Description	:
Sample Number	: 79871
Fill Height	: 1497.47 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/25/2019 7:36:18AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated
1600 9-25-19

Analysis Report for 25-Sep-19-10013

L1-12108A-FSGS-002SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.72	946 -	962	954.46	1.06E+02	19.48	8.73E+01	1.15
2	351.95	1398 -	1414	1406.81	9.18E+01	12.58	2.13E+01	1.01
3	511.13	2033 -	2047	2042.87	5.24E+01	10.59	2.06E+01	0.59
4	582.76	2324 -	2335	2329.17	2.50E+01	8.37	1.80E+01	0.67
5	609.30	2428 -	2442	2435.25	5.61E+01	10.24	1.69E+01	0.66
6	911.12	3636 -	3648	3641.94	3.35E+01	7.12	6.45E+00	0.54
7	1460.30	5826 -	5851	5839.13	4.30E+02	20.74	0.00E+00	2.17

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	6.83E-02	1.46E-02
K-40	0.95	1460.82	*	10.66	9.71E+00	6.30E-01
Tl-208	0.97	583.19	*	85.00	3.78E-02	1.29E-02
Bi-211	0.88	351.07	*	13.02	6.34E-01	1.01E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.68E-01	3.39E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.63E-01	3.14E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 25-Sep-19-10013

L1-12108A-FSGS-002SB

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	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.32E-01	3.68E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.27E-01	4.91E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 25-Sep-19-10013

L1-12108A-FSGS-002SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.997	6.83E-02	1.46E-02	
	K-40	0.957	9.71E+00	6.30E-01	
	Tl-208	0.972	3.78E-02	1.29E-02	
?	Bi-211	0.884	6.34E-01	1.01E-01	
	Pb-212	0.999	1.68E-01	3.39E-02	
	Bi-214	1.000	1.63E-01	3.14E-02	
?	Pb-214	0.513	2.32E-01	3.68E-02	
	Ac-228	1.000	2.27E-01	4.91E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 25-Sep-19-10013

L1-12108A-FSGS-002SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/25/2019 7:36:18AM
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	6.83E-02	3.79E-02	3.79E-02
	BE-7	477.60		10.44	-1.37E-01	3.57E-01	3.57E-01
+	K-40	1460.82	*	10.66	9.71E+00	6.49E-02	6.49E-02
	Mn-54	834.85		99.98	-1.12E-02	5.22E-02	5.22E-02
	Co-60	1173.23		99.85	4.45E-02	4.96E-02	7.26E-02
		1332.49		99.98	-7.84E-03		4.96E-02
	Nb-94	702.65		99.81	-2.75E-02	5.08E-02	5.08E-02
		871.09		99.89	3.73E-02		5.42E-02
	Ag-108m	79.13		6.60	6.18E-01	4.10E-02	1.21E+00
		433.94		90.50	2.29E-02		4.10E-02
		614.28		89.80	-1.57E-02		5.71E-02
		722.94		90.80	9.35E-03		5.57E-02
	Sb-125	176.31		6.84	-5.23E-02	1.20E-01	4.41E-01
		380.45		1.52	-3.63E-02		2.26E+00
		427.87		29.60	8.49E-03		1.20E-01
		463.36		10.49	2.46E-01		3.57E-01
		600.60		17.65	1.90E-01		2.45E-01
		606.71		4.98	1.86E+00		1.35E+00
		635.95		11.22	-2.32E-03		3.28E-01

Analysis Report for 25-Sep-19-10013

L1-12108A-FSGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.45E+00	1.20E-01	2.21E+00
Ba-133	79.61	2.65	1.96E+00	6.94E-02	2.98E+00
	81.00	32.90	-1.41E-01		2.01E-01
	276.40	7.16	-6.11E-02		4.26E-01
	302.85	18.34	1.53E-02		1.85E-01
	356.01	62.05	-1.78E-02		6.94E-02
	383.85	8.94	-1.31E-01		3.65E-01
Cs-134	475.36	1.48	-6.33E-01	5.78E-02	2.25E+00
	563.25	8.34	-5.46E-01		5.48E-01
	569.33	15.37	-1.11E-01		2.72E-01
	604.72	97.62	-2.64E-02		5.93E-02
	795.86	85.46	-4.96E-03		5.78E-02
	801.95	8.69	2.49E-01		5.31E-01
	1038.61	0.99	2.36E+00		5.56E+00
	1167.97	1.79	-5.70E+00		3.52E+00
	1365.19	3.02	8.57E-01		1.68E+00
Cs-137	661.66	85.10	-1.32E-02	4.88E-02	4.88E-02
Eu-152	121.78	28.67	-6.74E-02	1.12E-01	1.12E-01
	244.70	7.61	7.08E-02		4.54E-01
	295.94	0.45	2.50E-01		8.89E+00
	344.28	26.60	-2.23E-02		1.25E-01
	367.79	0.86	-2.38E+00		3.59E+00
	411.12	2.24	-3.57E-01		1.60E+00
	443.96	2.83	-2.41E-02		1.33E+00
	488.68	0.42	-5.14E+00		9.32E+00
	563.99	0.49	-1.47E+00		9.08E+00
	586.26	0.46	-6.18E+00		1.21E+01
	678.62	0.47	5.52E+00		8.55E+00
	688.67	0.86	-2.90E+00		4.67E+00
	719.35	0.28	9.57E+00		1.64E+01
	778.90	12.96	-3.17E-01		2.88E-01
	810.45	0.32	-9.05E+00		1.35E+01
	867.37	4.26	1.00E+00		1.31E+00
	919.33	0.43	6.16E-01		1.08E+01
	964.08	14.65	2.15E-01		4.20E-01
	1085.87	10.24	-8.92E-02		5.50E-01
	1089.74	1.73	-6.95E-02		3.16E+00
	1112.07	13.69	2.66E-01		4.24E-01
	1212.95	1.43	-1.52E-01		5.29E+00
	1249.94	0.19	-7.69E+00		3.32E+01
	1299.14	1.63	1.60E+00		3.52E+00
	1408.01	21.07	-3.06E-02		2.01E-01
	1457.64	0.50	2.06E+02		4.94E+01
	1528.10	0.28	4.42E+00		1.20E+01
Eu-154	123.07	40.40	-1.22E-02	8.00E-02	8.00E-02
	247.93	6.89	-2.85E-01		4.24E-01
	591.76	4.95	-2.49E-01		7.19E-01
	692.42	1.78	-6.97E-01		2.48E+00
	723.30	20.06	3.63E-02		2.53E-01
	756.80	4.52	-6.16E-02		9.14E-01
	873.18	12.08	2.45E-01		4.66E-01

Analysis Report for 25-Sep-19-10013

L1-12108A-FSGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-9.71E-02	8.00E-02	5.00E-01
	1004.76	18.01	1.50E-01		3.07E-01
	1274.43	34.80	-3.13E-02		1.56E-01
	1596.48	1.80	4.31E-01		1.61E+00
Eu-155	45.30	1.31	6.77E-01	1.87E-01	1.18E+01
	60.01	1.22	-4.31E-01		1.30E+01
	86.55	30.70	1.02E-01		1.87E-01
	105.31	21.10	8.83E-02		2.06E-01
Ra-226	186.21	3.64	4.78E-01	1.01E+00	1.01E+00
Pa-231	27.36	10.30	5.03E-01	1.26E+00	1.26E+00
	283.69	1.70	3.79E-01		1.82E+00
	300.07	2.47	-1.88E+00		1.29E+00
	302.65	2.20	8.77E-02		1.53E+00
	330.06	1.40	8.71E-01		2.43E+00
U-235	143.76	10.96	-3.52E-03	6.48E-02	2.85E-01
	163.33	5.08	1.02E-03		6.55E-01
	185.71	57.20	3.87E-02		6.48E-02
	202.11	1.08	-2.08E+00		2.73E+00
	205.31	5.01	-9.12E-02		5.90E-01
Am-241	59.54	35.90	8.17E-02	4.47E-01	4.47E-01

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

Apex-Gamma

Analysis Report for 25-Sep-19-10014

L1-12108A-FSGS-009SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 25-Sep-19-10014
Sample Description	: L1-12108A-FSGS-009SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.573E+03 grams
Facility	: Default
Sample Taken On	: 9/17/2019 8:10:00AM
Acquisition Started	: 9/25/2019 7:21:22AM
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	: 9/25/2019
Efficiency Calibration Description	:
Sample Number	: 79872
Fill Height	: 1573.06 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/25/2019 7:36:26AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated
1600 9-25-19

Analysis Report for 25-Sep-19-10014

L1-12108A-FSGS-009SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.67	949 -	961	955.17	1.03E+02	16.21	6.05E+01	0.73
2	295.33	1173 -	1186	1181.53	4.14E+01	11.37	3.16E+01	0.71
3	351.91	1402 -	1413	1407.65	6.91E+01	10.97	1.99E+01	1.02
4	583.18	2325 -	2339	2332.04	4.45E+01	8.97	1.25E+01	0.96
5	609.20	2428 -	2445	2436.05	5.45E+01	10.54	1.75E+01	0.87
6	910.99	3635 -	3649	3643.00	3.05E+01	8.14	1.25E+01	0.59
7	1460.78	5831 -	5856	5843.48	4.46E+02	21.41	3.06E+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	1.00	1460.82	*	10.66	9.26E+00	6.00E-01
Tl-208	1.00	583.19	*	85.00	6.32E-02	1.33E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.60E-01	2.84E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.49E-01	3.02E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 25-Sep-19-10014

L1-12108A-FSGS-009SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.71E-01	4.90E-02
		351.93	*	35.60	1.67E-01	2.97E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.91E-01	5.18E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 25-Sep-19-10014

L1-12108A-FSGS-009SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	9.26E+00	6.00E-01	
	Tl-208	1.000	6.32E-02	1.33E-02	
X	Bi-211	0.892			
	Pb-212	1.000	1.60E-01	2.84E-02	
	Bi-214	0.999	1.49E-01	3.02E-02	
	Pb-214	0.999	1.68E-01	2.54E-02	
	Ac-228	0.998	1.91E-01	5.18E-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 25-Sep-19-10014

L1-12108A-FSGS-009SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/25/2019 7:36:26AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	9.11E-02	5.91E-02	5.91E-02
	BE-7	477.60		10.44	1.20E-01	4.02E-01	4.02E-01
+	K-40	1460.82	*	10.66	9.26E+00	3.09E-01	3.09E-01
	Mn-54	834.85		99.98	2.41E-02	5.10E-02	5.10E-02
	Co-60	1173.23		99.85	-4.40E-02	4.94E-02	5.74E-02
		1332.49		99.98	-4.75E-03		4.94E-02
	Nb-94	702.65		99.81	-1.81E-02	3.33E-02	3.33E-02
		871.09		99.89	-9.03E-03		4.65E-02
	Ag-108m	79.13		6.60	-6.12E-01	3.96E-02	1.50E+00
		433.94		90.50	1.50E-02		3.96E-02
		614.28		89.80	8.12E-04		6.41E-02
		722.94		90.80	4.98E-03		4.91E-02
	Sb-125	176.31		6.84	-2.24E-01	1.22E-01	4.96E-01
		380.45		1.52	3.30E-01		2.24E+00
		427.87		29.60	-1.40E-02		1.22E-01
		463.36		10.49	-7.69E-02		3.34E-01
		600.60		17.65	-3.06E-02		2.22E-01
		606.71		4.98	1.80E+00		1.28E+00
		635.95		11.22	9.28E-02		3.72E-01

Analysis Report for 25-Sep-19-10014

L1-12108A-FSGS-009SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.07E-01	1.22E-01	2.36E+00
Ba-133	79.61	2.65	5.44E-01	7.68E-02	3.66E+00
	81.00	32.90	-3.61E-01		2.52E-01
	276.40	7.16	-1.13E-01		5.18E-01
	302.85	18.34	1.13E-01		2.07E-01
	356.01	62.05	-2.93E-02		7.68E-02
	383.85	8.94	-1.51E-01		3.59E-01
Cs-134	475.36	1.48	3.63E-01	5.09E-02	2.52E+00
	563.25	8.34	-1.80E-01		4.68E-01
	569.33	15.37	2.32E-01		2.59E-01
	604.72	97.62	3.69E-03		6.11E-02
	795.86	85.46	-8.52E-03		5.09E-02
	801.95	8.69	2.94E-01		5.32E-01
	1038.61	0.99	6.63E+00		6.16E+00
	1167.97	1.79	2.42E+00		3.63E+00
	1365.19	3.02	-5.06E-01		1.75E+00
Cs-137	661.66	85.10	-1.86E-03	4.63E-02	4.63E-02
Eu-152	121.78	28.67	-9.43E-03	1.32E-01	1.35E-01
	244.70	7.61	-1.68E-04		5.04E-01
	295.94	0.45	-2.66E+00		9.49E+00
	344.28	26.60	-5.36E-02		1.32E-01
	367.79	0.86	-1.29E-01		3.62E+00
	411.12	2.24	1.47E+00		1.86E+00
	443.96	2.83	-8.21E-02		1.35E+00
	488.68	0.42	7.54E-01		8.41E+00
	563.99	0.49	5.04E+00		8.18E+00
	586.26	0.46	6.27E+00		1.17E+01
	678.62	0.47	2.42E+00		9.40E+00
	688.67	0.86	-2.79E+00		5.10E+00
	719.35	0.28	4.90E-01		1.53E+01
	778.90	12.96	-1.50E-01		3.48E-01
	810.45	0.32	7.01E-01		1.25E+01
	867.37	4.26	-2.30E-01		1.16E+00
	919.33	0.43	-1.34E+01		1.08E+01
	964.08	14.65	3.07E-01		3.86E-01
	1085.87	10.24	-1.93E-01		5.75E-01
	1089.74	1.73	-2.35E+00		3.37E+00
	1112.07	13.69	-1.08E-01		4.72E-01
	1212.95	1.43	-4.44E+00		5.03E+00
	1249.94	0.19	7.85E+00		2.97E+01
	1299.14	1.63	-5.56E-01		3.31E+00
	1408.01	21.07	-3.42E-02		2.32E-01
	1457.64	0.50	2.02E+02		4.65E+01
	1528.10	0.28	2.44E+00		9.09E+00
Eu-154	123.07	40.40	-4.54E-02	9.58E-02	9.58E-02
	247.93	6.89	-1.42E-01		4.72E-01
	591.76	4.95	5.47E-01		8.01E-01
	692.42	1.78	2.33E+00		2.56E+00
	723.30	20.06	-1.92E-01		2.17E-01
	756.80	4.52	8.05E-01		1.08E+00
	873.18	12.08	-2.32E-01		3.86E-01

Analysis Report for 25-Sep-19-10014

L1-12108A-FSGS-009SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.71E-01	9.58E-02	4.78E-01
	1004.76	18.01	2.40E-02		2.71E-01
	1274.43	34.80	1.79E-02		1.88E-01
	1596.48	1.80	-8.25E-01		2.28E+00
Eu-155	45.30	1.31	-3.03E+00	2.14E-01	1.81E+01
	60.01	1.22	3.25E+00		2.26E+01
	86.55	30.70	-5.51E-02		2.21E-01
	105.31	21.10	-9.72E-02		2.14E-01
Ra-226	186.21	3.64	3.47E-01	9.73E-01	9.73E-01
Pa-231	27.36	10.30	2.98E+00	1.59E+00	2.46E+00
	283.69	1.70	-4.89E-03		2.04E+00
	300.07	2.47	1.32E-01		1.59E+00
	302.65	2.20	6.86E-01		1.73E+00
	330.06	1.40	4.80E-01		2.58E+00
U-235	143.76	10.96	-9.63E-02	6.23E-02	3.22E-01
	163.33	5.08	1.97E-01		6.68E-01
	185.71	57.20	1.40E-02		6.23E-02
	202.11	1.08	-1.35E+00		3.28E+00
	205.31	5.01	-1.76E-01		7.06E-01
Am-241	59.54	35.90	-1.41E-01	7.76E-01	7.76E-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-46226

October 21, 2019

Patricia Giza
Zion Solutions, LLC
101 Shiloh Blvd
Zion, IL 60099

CASE NARRATIVE
Work Order # 19-10019-OR

SAMPLE RECEIPT

This work order contains eight soil samples received 10/04/2019. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-12202-C-FSGS-013-SB-A	19-10019-04	L1-12202-F-FJGS-005-SS-A	19-10019-08
L1-12202-D-FSGS-015-SB-A	19-10019-05	L1-10220-I-FIGS-011-SS-A	19-10019-09
L1-12109-A-FSGS-008-SS-A	19-10019-06	L1-12108-A-FSGS-015-SS-A	19-10019-10
L1-12109-A-FSGS-013-SS-A	19-10019-07	L1-12108-A-FSGS-005-SS-A	19-10019-11

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 selectively extracted and precipitated. Precipitates were then mounted on 47mm filters. Filters were reweighed to determine aliquot size. Sample activities were determined by gas flow proportional counting.

Samples demonstrated acceptable results for all Total Strontium analyses. Strontium-90 results are reported from Total Strontium 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 an acceptable relative percent difference and normalized difference. 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 a round-bottomed distillation flask and attached to a single stage still. A portion of each middle distillation fraction was transferred to a liquid scintillation vial and cocktail was added. Samples were counted by beta liquid scintillation.

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

NICKEL-63

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

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

GAMMA SPECTROSCOPY

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

ANALYTICAL RESULTS CONTINUED

GAMMA SPECTROSCOPY CONTINUED

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

CERTIFICATION OF ACCURACY

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

M.R. McDougall
Laboratory Manager

Date: 10/21/2019

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10019
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
19-10019-01	LCS	KNOWN	10/04/19 00:00	10/4/2019	10/9/2019	19-10019	Tritium	LANL ER-210 Modified	2.05E+02	7.39E+00				pCi/g
19-10019-01	LCS	SPIKE	10/04/19 00:00	10/4/2019	10/9/2019	19-10019	Tritium	LANL ER-210 Modified	2.03E+02	7.67E+00	1.37E+01	5.52E+00		pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/9/2019	19-10019	Tritium	LANL ER-210 Modified	-3.80E-01	3.21E+00	3.21E+00	5.59E+00	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/9/2019	19-10019	Tritium	LANL ER-210 Modified	-7.50E-01	3.15E+00	3.15E+00	5.51E+00	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/9/2019	19-10019	Tritium	LANL ER-210 Modified	7.46E-01	3.19E+00	3.19E+00	5.49E+00	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/9/2019	19-10019	Tritium	LANL ER-210 Modified	7.46E-01	3.19E+00	3.19E+00	5.49E+00	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/9/2019	19-10019	Tritium	LANL ER-210 Modified	-1.82E-01	3.08E+00	3.08E+00	5.36E+00	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/9/2019	19-10019	Tritium	LANL ER-210 Modified	-1.76E-01	2.97E+00	2.97E+00	5.17E+00	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/9/2019	19-10019	Tritium	LANL ER-210 Modified	9.29E-01	3.18E+00	3.18E+00	5.46E+00	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/10/2019	19-10019	Tritium	LANL ER-210 Modified	1.99E+00	3.14E+00	3.15E+00	5.33E+00	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/10/2019	19-10019	Tritium	LANL ER-210 Modified	-1.29E+00	3.07E+00	3.07E+00	5.41E+00	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/10/2019	19-10019	Tritium	LANL ER-210 Modified	-3.70E-01	3.12E+00	3.12E+00	5.44E+00	U	pCi/g
19-10019-01	LCS	KNOWN	10/04/19 00:00	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	1.44E+03	4.32E+01				pCi/g
19-10019-01	LCS	SPIKE	10/04/19 00:00	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	1.35E+03	1.26E+01	8.03E+01	3.24E+00		pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	0.00E+00	1.85E+00	1.85E+00	3.19E+00	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	5.53E-01	1.94E+00	1.94E+00	3.31E+00	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	1.30E+00	1.96E+00	1.97E+00	3.32E+00	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	9.00E-02	1.87E+00	1.87E+00	3.23E+00	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	1.46E+00	1.94E+00	1.94E+00	3.27E+00	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	1.41E+00	1.87E+00	1.87E+00	3.16E+00	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	2.51E+00	1.94E+00	1.95E+00	3.22E+00	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	-9.08E-02	1.89E+00	1.89E+00	3.26E+00	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	5.29E-01	1.85E+00	1.85E+00	3.17E+00	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/10/2019	19-10019	Nickel-63	ASTM 3500-Ni Modified	-4.11E-01	2.13E+00	2.13E+00	3.69E+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: 19-10019
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
19-10019-01	LCS	KNOWN	10/04/19 00:00	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	5.06E+01	2.83E-01				pCi/g
19-10019-01	LCS	SPIKE	10/04/19 00:00	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	4.79E+01	2.57E+00	1.69E+01	8.94E-01		pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	3.69E-01	2.95E-01	3.21E-01	5.87E-01	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	1.02E-01	3.57E-01	3.59E-01	7.52E-01	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	1.21E-01	3.43E-01	3.46E-01	7.20E-01	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	1.82E-01	3.26E-01	3.32E-01	6.77E-01	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	1.65E-01	2.82E-01	2.88E-01	5.86E-01	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	6.07E-02	2.94E-01	2.95E-01	6.23E-01	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	-1.77E-01	3.21E-01	3.26E-01	7.07E-01	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	-1.86E-02	3.15E-01	3.15E-01	6.78E-01	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	5.83E-02	3.72E-01	3.73E-01	7.89E-01	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/10/2019	19-10019	Strontium-90	ElChroM SRW01 Modified	7.81E-03	2.71E-01	2.71E-01	5.79E-01	U	pCi/g
19-10019-01	LCS	KNOWN	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
19-10019-01	LCS	KNOWN	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
19-10019-01	LCS	SPIKE	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	1.54E+02	1.30E+01	1.52E+01	1.52E+00		pCi/g
19-10019-01	LCS	SPIKE	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	8.34E+01	7.61E+00	8.73E+00	1.32E+00		pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10019
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
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Actinium-228	EPA 901.1 Modified	1.81E-02	6.84E-02	6.84E-02	1.18E-01	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Silver-108m	EPA 901.1 Modified	3.84E-03	2.04E-02	2.04E-02	2.29E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Americium-241	EPA 901.1 Modified	2.24E-02	3.53E-02	3.53E-02	5.30E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Barium-133	EPA 901.1 Modified	-2.06E-02	3.24E-02	3.24E-02	3.28E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Bismuth-214	EPA 901.1 Modified	5.25E-02	4.32E-02	4.33E-02	8.12E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	-4.43E-04	1.57E-02	1.57E-02	3.67E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Cesium-134	EPA 901.1 Modified	-3.67E-03	1.58E-02	1.58E-02	2.65E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	5.54E-03	1.55E-02	1.55E-02	3.09E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Europium-152	EPA 901.1 Modified	-4.50E-02	8.73E-02	8.73E-02	8.06E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Europium-154	EPA 901.1 Modified	3.56E-02	4.94E-02	4.95E-02	4.13E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Europium-155	EPA 901.1 Modified	3.37E-02	3.72E-02	3.72E-02	5.44E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Holmium-166m	EPA 901.1 Modified	-8.65E-03	3.63E-02	3.64E-02	3.38E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Iodine-129	EPA 901.1 Modified	9.17E-02	2.11E+00	2.11E+00	2.22E+00	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Potassium-40	EPA 901.1 Modified	1.84E-01	2.16E-01	2.16E-01	4.55E-01	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Manganese-54	EPA 901.1 Modified	1.13E-02	1.78E-02	1.78E-02	3.37E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Molybdenum-93	EPA 901.1 Modified	3.69E-03	1.64E-02	1.64E-02	2.71E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Niobium-94	EPA 901.1 Modified	8.17E-03	1.81E-02	1.81E-02	2.91E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Lead-210	EPA 901.1 Modified	1.17E+00	7.90E-01	7.92E-01	1.28E+00	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Lead-212	EPA 901.1 Modified	5.71E-02	4.35E-02	4.36E-02	6.97E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Lead-214	EPA 901.1 Modified	4.39E-02	4.01E-02	4.01E-02	8.40E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Promethium-145	EPA 901.1 Modified	4.80E-02	4.25E-01	4.25E-01	6.14E-01	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Radium-226	EPA 901.1 Modified	5.25E-02	4.32E-02	4.33E-02	8.12E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Antimony-125	EPA 901.1 Modified	0.00E+00	4.09E-02	4.09E-02	7.29E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Thorium-234	EPA 901.1 Modified	2.75E-01	3.77E-01	3.77E-01	5.54E-01	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Thallium-208	EPA 901.1 Modified	7.62E-02	4.65E-02	4.67E-02	7.96E-02	U	pCi/g
19-10019-02	MBL	BLANK	10/04/19 00:00	10/4/2019	10/7/2019	19-10019	Uranium-235	EPA 901.1 Modified	-1.44E-03	1.36E-01	1.36E-01	1.82E-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:	19-10019
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
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Actinium-228	EPA 901.1 Modified	5.24E-01	1.72E-01	1.74E-01	2.88E-01		pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Silver-108m	EPA 901.1 Modified	-3.74E-03	4.63E-02	4.63E-02	5.94E-02	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Americium-241	EPA 901.1 Modified	-7.57E-02	5.95E-02	5.96E-02	8.02E-02	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Barium-133	EPA 901.1 Modified	-1.52E-02	1.55E-02	1.55E-02	8.67E-02	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Bismuth-214	EPA 901.1 Modified	3.31E-01	1.18E-01	1.20E-01	1.89E-01		pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	6.34E-02	5.37E-02	5.38E-02	1.02E-01	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Cesium-134	EPA 901.1 Modified	-7.53E-02	6.57E-02	6.58E-02	6.89E-02	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	4.44E-02	4.26E-02	4.27E-02	7.66E-02	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Europium-152	EPA 901.1 Modified	2.72E-02	7.57E-02	7.57E-02	1.30E-01	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Europium-154	EPA 901.1 Modified	1.03E-01	1.65E-01	1.65E-01	6.49E-02	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Europium-155	EPA 901.1 Modified	8.51E-02	6.06E-02	6.07E-02	1.26E-01	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Holmium-166m	EPA 901.1 Modified	-5.03E-02	6.87E-02	6.87E-02	5.87E-02	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Iodine-129	EPA 901.1 Modified	7.18E-02	1.38E-01	1.38E-01	2.30E-01	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Potassium-40	EPA 901.1 Modified	1.24E+01	2.44E+00	2.52E+00	8.62E-01		pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Manganese-54	EPA 901.1 Modified	4.00E-02	3.92E-02	3.93E-02	7.30E-02	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Molybdenum-93	EPA 901.1 Modified	-1.63E-03	3.69E-02	3.69E-02	5.82E-02	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Niobium-94	EPA 901.1 Modified	1.82E-02	3.41E-02	3.41E-02	6.04E-02	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Lead-210	EPA 901.1 Modified	8.65E-01	6.11E-01	6.13E-01	9.55E-01	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Lead-212	EPA 901.1 Modified	3.39E-01	7.25E-02	7.46E-02	1.62E-01		pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Lead-214	EPA 901.1 Modified	4.25E-01	1.03E-01	1.05E-01	1.56E-01		pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Promethium-145	EPA 901.1 Modified	5.27E-02	1.04E-01	1.04E-01	1.55E-01	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Radium-226	EPA 901.1 Modified	3.31E-01	1.18E-01	1.20E-01	1.89E-01		pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Antimony-125	EPA 901.1 Modified	3.82E-02	1.17E-01	1.17E-01	1.71E-01	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Thorium-234	EPA 901.1 Modified	7.67E-02	5.66E-01	5.67E-01	8.14E-01	U	pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Thallium-208	EPA 901.1 Modified	3.18E-01	1.51E-01	1.51E-01	2.29E-01		pCi/g
19-10019-03	DUP	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Uranium-235	EPA 901.1 Modified	-1.06E-01	1.99E-01	2.00E-01	2.84E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10019
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Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Actinium-228	EPA 901.1 Modified	3.85E-01	1.66E-01	1.68E-01	3.88E-01	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Silver-108m	EPA 901.1 Modified	5.25E-03	3.05E-02	3.05E-02	5.64E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Americium-241	EPA 901.1 Modified	-6.11E-02	6.19E-02	6.19E-02	8.39E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Barium-133	EPA 901.1 Modified	-5.28E-03	2.43E-02	2.43E-02	9.02E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Bismuth-214	EPA 901.1 Modified	3.72E-01	9.55E-02	9.74E-02	3.67E-01		pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	1.57E-02	5.28E-02	5.28E-02	9.04E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Cesium-134	EPA 901.1 Modified	-9.66E-02	6.97E-02	6.98E-02	7.83E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	3.86E-02	4.55E-02	4.55E-02	7.98E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Europium-152	EPA 901.1 Modified	4.97E-02	1.01E-01	1.01E-01	1.35E-01	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Europium-154	EPA 901.1 Modified	2.63E-02	1.49E-01	1.49E-01	6.81E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Europium-155	EPA 901.1 Modified	4.56E-02	6.69E-02	6.70E-02	9.94E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Holmium-166m	EPA 901.1 Modified	3.50E-02	7.29E-02	7.29E-02	5.43E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Iodine-129	EPA 901.1 Modified	-2.87E-02	1.56E-01	1.56E-01	2.26E-01	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Potassium-40	EPA 901.1 Modified	1.19E+01	2.34E+00	2.42E+00	6.95E-01		pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Manganese-54	EPA 901.1 Modified	9.87E-03	3.89E-02	3.89E-02	6.53E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Molybdenum-93	EPA 901.1 Modified	-1.15E-03	2.03E-02	2.03E-02	6.01E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Niobium-94	EPA 901.1 Modified	1.43E-02	4.08E-02	4.08E-02	7.00E-02	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Lead-210	EPA 901.1 Modified	4.02E-01	6.50E-01	6.51E-01	9.79E-01	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Lead-212	EPA 901.1 Modified	3.45E-01	7.39E-02	7.60E-02	1.55E-01		pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Lead-214	EPA 901.1 Modified	4.19E-01	9.43E-02	9.67E-02	1.45E-01		pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Promethium-145	EPA 901.1 Modified	1.92E-02	1.07E-01	1.07E-01	1.57E-01	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Radium-226	EPA 901.1 Modified	3.72E-01	9.55E-02	9.74E-02	3.67E-01		pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Antimony-125	EPA 901.1 Modified	7.63E-03	5.07E-02	5.07E-02	1.66E-01	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Thorium-234	EPA 901.1 Modified	8.33E-01	5.37E-01	5.39E-01	8.37E-01	U	pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Thallium-208	EPA 901.1 Modified	3.63E-01	1.66E-01	1.67E-01	2.56E-01		pCi/g
19-10019-04	DO	L1-12202-C-FSGS-013-SB-A	09/16/19 08:30	10/4/2019	10/7/2019	19-10019	Uranium-235	EPA 901.1 Modified	8.95E-02	2.01E-01	2.01E-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: 19-10019
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
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Actinium-228	EPA 901.1 Modified	1.04E+00	2.44E-01	2.50E-01	4.43E-01		pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Silver-108m	EPA 901.1 Modified	2.00E-03	2.70E-02	2.70E-02	5.77E-02	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Americium-241	EPA 901.1 Modified	8.32E-02	9.11E-02	9.12E-02	1.80E-01	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Barium-133	EPA 901.1 Modified	3.93E-03	3.56E-02	3.56E-02	9.23E-02	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Bismuth-214	EPA 901.1 Modified	1.21E+00	1.80E-01	1.91E-01	2.06E-01		pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	-1.44E-02	7.16E-02	7.16E-02	9.44E-02	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Cesium-134	EPA 901.1 Modified	8.37E-03	2.45E-02	2.45E-02	5.96E-02	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	-3.31E-02	6.85E-02	6.85E-02	9.62E-02	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Europium-152	EPA 901.1 Modified	1.16E-02	1.55E-01	1.55E-01	2.37E-01	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Europium-154	EPA 901.1 Modified	-9.38E-02	2.06E-01	2.06E-01	1.21E-01	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Europium-155	EPA 901.1 Modified	2.66E-01	1.44E-01	1.44E-01	1.83E-01	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Holmium-166m	EPA 901.1 Modified	-5.15E-03	5.68E-02	5.68E-02	9.21E-02	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Iodine-129	EPA 901.1 Modified	1.44E-01	3.97E+00	3.97E+00	3.91E+00	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Potassium-40	EPA 901.1 Modified	2.76E+01	3.33E+00	3.62E+00	1.12E+00		pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Manganese-54	EPA 901.1 Modified	-2.18E-02	5.73E-02	5.74E-02	8.23E-02	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Molybdenum-93	EPA 901.1 Modified	-1.28E-03	4.57E-02	4.57E-02	6.18E-02	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Niobium-94	EPA 901.1 Modified	-3.91E-02	5.49E-02	5.49E-02	7.38E-02	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Lead-210	EPA 901.1 Modified	2.53E+00	1.80E+00	1.80E+00	2.88E+00	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Lead-212	EPA 901.1 Modified	8.42E-01	1.39E-01	1.46E-01	2.34E-01		pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Lead-214	EPA 901.1 Modified	1.32E+00	1.94E-01	2.06E-01	2.69E-01		pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Promethium-145	EPA 901.1 Modified	4.93E-01	5.82E-01	5.82E-01	1.05E+00	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Radium-226	EPA 901.1 Modified	1.21E+00	1.80E-01	1.91E-01	2.06E-01		pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Antimony-125	EPA 901.1 Modified	-1.32E-02	1.16E-01	1.16E-01	1.89E-01	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Thorium-234	EPA 901.1 Modified	2.10E+00	1.65E+00	1.65E+00	2.71E+00	U	pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Thallium-208	EPA 901.1 Modified	6.62E-01	1.44E-01	1.48E-01	1.55E-01		pCi/g
19-10019-05	TRG	L1-12202-D-FSGS-015-SB-A	09/16/19 13:00	10/4/2019	10/7/2019	19-10019	Uranium-235	EPA 901.1 Modified	1.55E-01	3.83E-01	3.83E-01	5.11E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10019
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
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Actinium-228	EPA 901.1 Modified	1.96E-01	1.54E-01	1.54E-01	2.90E-01	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Silver-108m	EPA 901.1 Modified	-2.41E-02	3.72E-02	3.73E-02	3.80E-02	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Americium-241	EPA 901.1 Modified	9.25E-02	7.62E-02	7.63E-02	1.09E-01	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Barium-133	EPA 901.1 Modified	9.38E-03	2.24E-02	2.24E-02	6.23E-02	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Bismuth-214	EPA 901.1 Modified	2.61E-01	7.81E-02	7.92E-02	1.35E-01		pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	-1.28E-02	4.43E-02	4.43E-02	5.95E-02	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Cesium-134	EPA 901.1 Modified	-2.00E-03	1.65E-02	1.65E-02	3.92E-02	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	-1.06E-02	3.16E-02	3.16E-02	4.67E-02	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Europium-152	EPA 901.1 Modified	6.16E-02	1.38E-01	1.38E-01	1.34E-01	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Europium-154	EPA 901.1 Modified	4.54E-02	1.21E-01	1.21E-01	6.57E-02	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Europium-155	EPA 901.1 Modified	9.79E-02	7.02E-02	7.04E-02	1.07E-01	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Holmium-166m	EPA 901.1 Modified	-6.42E-03	6.17E-02	6.17E-02	5.27E-02	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Iodine-129	EPA 901.1 Modified	1.33E+00	6.05E+00	6.05E+00	2.77E+00	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Potassium-40	EPA 901.1 Modified	1.16E+01	1.62E+00	1.73E+00	7.84E-01		pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Manganese-54	EPA 901.1 Modified	-9.54E-03	2.61E-02	2.61E-02	4.44E-02	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Molybdenum-93	EPA 901.1 Modified	-1.04E-02	2.83E-02	2.83E-02	3.39E-02	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Niobium-94	EPA 901.1 Modified	2.52E-02	3.38E-02	3.38E-02	5.56E-02	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Lead-210	EPA 901.1 Modified	1.51E+00	1.09E+00	1.09E+00	1.78E+00	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Lead-212	EPA 901.1 Modified	2.91E-01	7.08E-02	7.23E-02	1.39E-01		pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Lead-214	EPA 901.1 Modified	2.69E-01	7.08E-02	7.22E-02	2.20E-01		pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Promethium-145	EPA 901.1 Modified	2.70E-01	5.32E-01	5.32E-01	7.57E-01	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Radium-226	EPA 901.1 Modified	2.61E-01	7.81E-02	7.92E-02	1.35E-01		pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Antimony-125	EPA 901.1 Modified	-2.27E-02	7.07E-02	7.07E-02	1.16E-01	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Thorium-234	EPA 901.1 Modified	6.75E-01	7.48E-01	7.49E-01	1.04E+00	U	pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Thallium-208	EPA 901.1 Modified	2.02E-01	7.06E-02	7.13E-02	1.09E-01		pCi/g
19-10019-06	TRG	L1-12109-A-FSGS-008-SS-A	09/17/19 09:14	10/4/2019	10/7/2019	19-10019	Uranium-235	EPA 901.1 Modified	1.47E-01	2.11E-01	2.11E-01	2.96E-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

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Patricia Giza		SDG:	19-10019
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
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Actinium-228	EPA 901.1 Modified	2.42E-01	2.17E-01	2.18E-01	3.99E-01	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Silver-108m	EPA 901.1 Modified	3.60E-03	2.87E-02	2.87E-02	6.24E-02	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Americium-241	EPA 901.1 Modified	-4.81E-02	7.72E-02	7.73E-02	1.08E-01	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Barium-133	EPA 901.1 Modified	-1.65E-03	2.64E-02	2.64E-02	1.11E-01	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Bismuth-214	EPA 901.1 Modified	3.02E-01	1.30E-01	1.31E-01	1.99E-01		pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	5.35E-03	6.83E-02	6.83E-02	1.07E-01	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Cesium-134	EPA 901.1 Modified	1.31E-02	2.85E-02	2.85E-02	8.15E-02	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	-1.33E-02	6.10E-02	6.10E-02	8.39E-02	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Europium-152	EPA 901.1 Modified	-8.22E-02	1.32E-01	1.32E-01	1.66E-01	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Europium-154	EPA 901.1 Modified	-1.43E-02	1.81E-01	1.81E-01	8.75E-02	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Europium-155	EPA 901.1 Modified	3.86E-02	9.04E-02	9.04E-02	1.33E-01	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Holmium-166m	EPA 901.1 Modified	2.47E-02	1.04E-01	1.04E-01	5.43E-02	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Iodine-129	EPA 901.1 Modified	2.37E-03	5.61E-02	5.61E-02	8.24E-02	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Potassium-40	EPA 901.1 Modified	1.24E+01	1.80E+00	1.91E+00	1.13E-01		pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Manganese-54	EPA 901.1 Modified	-3.38E-02	5.65E-02	5.66E-02	8.25E-02	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Molybdenum-93	EPA 901.1 Modified	1.24E-03	5.24E-02	5.24E-02	5.94E-02	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Niobium-94	EPA 901.1 Modified	1.72E-02	4.06E-02	4.06E-02	7.07E-02	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Lead-210	EPA 901.1 Modified	3.61E-01	5.73E-01	5.73E-01	8.80E-01	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Lead-212	EPA 901.1 Modified	2.78E-01	7.53E-02	7.67E-02	1.62E-01		pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Lead-214	EPA 901.1 Modified	2.44E-01	1.00E-01	1.01E-01	1.94E-01		pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Promethium-145	EPA 901.1 Modified	-4.23E-02	6.86E-02	6.87E-02	9.63E-02	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Radium-226	EPA 901.1 Modified	3.02E-01	1.30E-01	1.31E-01	1.99E-01		pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Antimony-125	EPA 901.1 Modified	8.50E-02	1.35E-01	1.35E-01	2.05E-01	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Thorium-234	EPA 901.1 Modified	1.26E+00	6.83E-01	6.86E-01	1.09E+00	U	pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Thallium-208	EPA 901.1 Modified	2.66E-01	1.14E-01	1.15E-01	5.52E-02		pCi/g
19-10019-07	TRG	L1-12109-A-FSGS-013-SS-A	09/17/19 09:24	10/4/2019	10/7/2019	19-10019	Uranium-235	EPA 901.1 Modified	8.23E-02	2.22E-01	2.22E-01	3.38E-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: 19-10019
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
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Actinium-228	EPA 901.1 Modified	3.10E-01	1.07E-01	1.09E-01	2.83E-01		pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Silver-108m	EPA 901.1 Modified	6.23E-03	1.76E-02	1.76E-02	3.81E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Americium-241	EPA 901.1 Modified	1.38E-02	7.25E-02	7.25E-02	9.64E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Barium-133	EPA 901.1 Modified	-8.87E-03	1.89E-02	1.89E-02	4.96E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Bismuth-214	EPA 901.1 Modified	2.26E-01	7.52E-02	7.61E-02	1.27E-01		pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	1.89E-02	4.21E-02	4.21E-02	5.06E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Cesium-134	EPA 901.1 Modified	1.67E-04	1.62E-02	1.62E-02	4.04E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	6.23E-02	4.56E-02	4.57E-02	7.25E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Europium-152	EPA 901.1 Modified	5.89E-02	1.36E-01	1.36E-01	1.23E-01	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Europium-154	EPA 901.1 Modified	-5.61E-02	1.20E-01	1.20E-01	6.50E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Europium-155	EPA 901.1 Modified	6.95E-02	7.12E-02	7.12E-02	9.77E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Holmium-166m	EPA 901.1 Modified	-1.87E-02	5.24E-02	5.25E-02	5.61E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Iodine-129	EPA 901.1 Modified	-1.82E+00	7.95E+00	7.95E+00	2.68E+00	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Potassium-40	EPA 901.1 Modified	7.96E+00	1.31E+00	1.37E+00	1.00E+00		pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Manganese-54	EPA 901.1 Modified	-2.47E-02	3.62E-02	3.62E-02	4.93E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Molybdenum-93	EPA 901.1 Modified	-2.52E-02	3.14E-02	3.14E-02	3.99E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Niobium-94	EPA 901.1 Modified	-1.57E-02	2.83E-02	2.83E-02	4.00E-02	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Lead-210	EPA 901.1 Modified	5.46E-01	1.03E+00	1.03E+00	1.62E+00	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Lead-212	EPA 901.1 Modified	2.95E-01	8.99E-02	9.12E-02	1.26E-01		pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Lead-214	EPA 901.1 Modified	2.38E-01	6.75E-02	6.86E-02	1.26E-01		pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Promethium-145	EPA 901.1 Modified	1.39E-01	5.17E-01	5.17E-01	7.56E-01	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Radium-226	EPA 901.1 Modified	2.26E-01	7.52E-02	7.61E-02	1.27E-01		pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Antimony-125	EPA 901.1 Modified	8.00E-02	6.52E-02	6.53E-02	1.26E-01	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Thorium-234	EPA 901.1 Modified	1.81E-01	7.22E-01	7.22E-01	9.65E-01	U	pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Thallium-208	EPA 901.1 Modified	1.66E-01	6.44E-02	6.50E-02	8.12E-02		pCi/g
19-10019-08	TRG	L1-12202-F-FJGS-005-SS-A	09/17/19 09:52	10/4/2019	10/7/2019	19-10019	Uranium-235	EPA 901.1 Modified	2.20E-01	1.96E-01	1.97E-01	2.88E-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: 19-10019
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
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Actinium-228	EPA 901.1 Modified	1.81E-01	2.68E-01	2.68E-01	4.68E-01	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Silver-108m	EPA 901.1 Modified	4.30E-02	5.73E-02	5.73E-02	8.38E-02	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Americium-241	EPA 901.1 Modified	-1.69E-02	4.15E-02	4.15E-02	1.19E-01	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Barium-133	EPA 901.1 Modified	1.16E-03	2.76E-02	2.76E-02	1.22E-01	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Bismuth-214	EPA 901.1 Modified	3.77E-01	1.53E-01	1.54E-01	1.79E-01		pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	6.80E-02	8.51E-02	8.52E-02	1.47E-01	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Cesium-134	EPA 901.1 Modified	0.00E+00	2.51E-02	2.51E-02	9.79E-02	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	4.30E-01	9.93E-02	1.02E-01	1.08E-01		pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Europium-152	EPA 901.1 Modified	-8.30E-03	1.30E-01	1.30E-01	1.87E-01	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Europium-154	EPA 901.1 Modified	-1.12E-01	2.22E-01	2.22E-01	9.69E-02	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Europium-155	EPA 901.1 Modified	5.78E-02	7.85E-02	7.85E-02	1.34E-01	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Holmium-166m	EPA 901.1 Modified	1.20E-01	8.31E-02	8.33E-02	8.38E-02	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Iodine-129	EPA 901.1 Modified	9.81E-02	2.29E-01	2.29E-01	3.42E-01	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Potassium-40	EPA 901.1 Modified	1.55E+01	3.15E+00	3.25E+00	1.02E+00		pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Manganese-54	EPA 901.1 Modified	3.44E-02	5.84E-02	5.84E-02	1.03E-01	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Molybdenum-93	EPA 901.1 Modified	1.43E-02	5.78E-02	5.78E-02	9.58E-02	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Niobium-94	EPA 901.1 Modified	-2.74E-03	5.20E-02	5.20E-02	8.46E-02	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Lead-210	EPA 901.1 Modified	1.52E+00	1.19E+00	1.20E+00	1.97E+00	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Lead-212	EPA 901.1 Modified	5.23E-01	1.39E-01	1.42E-01	1.93E-01		pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Lead-214	EPA 901.1 Modified	3.72E-01	1.48E-01	1.49E-01	2.72E-01		pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Promethium-145	EPA 901.1 Modified	-1.43E-01	1.65E-01	1.65E-01	2.26E-01	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Radium-226	EPA 901.1 Modified	3.77E-01	1.53E-01	1.54E-01	1.79E-01		pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Antimony-125	EPA 901.1 Modified	-1.05E-01	1.90E-01	1.90E-01	2.46E-01	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Thorium-234	EPA 901.1 Modified	9.90E-01	8.19E-01	8.21E-01	1.35E+00	U	pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Thallium-208	EPA 901.1 Modified	4.18E-01	1.99E-01	2.00E-01	3.00E-01		pCi/g
19-10019-09	TRG	L1-10220-I-FIGS-011-SS-A	09/17/19 08:38	10/4/2019	10/7/2019	19-10019	Uranium-235	EPA 901.1 Modified	1.58E-01	2.63E-01	2.63E-01	4.06E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:

SDG:	19-10019
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
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Actinium-228	EPA 901.1 Modified	3.51E-01	1.74E-01	1.75E-01	4.02E-01	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Silver-108m	EPA 901.1 Modified	-1.07E-02	5.71E-02	5.71E-02	6.15E-02	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Americium-241	EPA 901.1 Modified	-5.88E-02	7.44E-02	7.44E-02	1.03E-01	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Barium-133	EPA 901.1 Modified	4.38E-03	2.47E-02	2.47E-02	1.13E-01	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Bismuth-214	EPA 901.1 Modified	1.71E-01	1.16E-01	1.16E-01	1.96E-01	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	2.97E-02	6.19E-02	6.19E-02	9.33E-02	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Cesium-134	EPA 901.1 Modified	-1.17E-03	3.12E-02	3.12E-02	7.81E-02	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	7.77E-03	4.20E-02	4.20E-02	8.80E-02	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Europium-152	EPA 901.1 Modified	8.18E-02	1.36E-01	1.36E-01	1.57E-01	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Europium-154	EPA 901.1 Modified	-7.26E-02	1.64E-01	1.64E-01	8.17E-02	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Europium-155	EPA 901.1 Modified	5.15E-02	6.37E-02	6.38E-02	1.07E-01	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Holmium-166m	EPA 901.1 Modified	6.30E-02	3.82E-02	3.83E-02	6.52E-02	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Iodine-129	EPA 901.1 Modified	-3.73E-02	5.49E-02	5.49E-02	7.76E-02	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Potassium-40	EPA 901.1 Modified	9.89E+00	1.62E+00	1.70E+00	1.05E+00		pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Manganese-54	EPA 901.1 Modified	-1.21E-02	5.03E-02	5.03E-02	8.00E-02	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Molybdenum-93	EPA 901.1 Modified	4.37E-02	4.24E-02	4.25E-02	6.90E-02	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Niobium-94	EPA 901.1 Modified	-3.19E-02	4.94E-02	4.95E-02	7.02E-02	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Lead-210	EPA 901.1 Modified	2.80E-01	5.57E-01	5.57E-01	8.47E-01	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Lead-212	EPA 901.1 Modified	3.30E-01	1.11E-01	1.13E-01	1.69E-01		pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Lead-214	EPA 901.1 Modified	2.60E-01	9.86E-02	9.95E-02	1.83E-01		pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Promethium-145	EPA 901.1 Modified	-3.51E-02	6.68E-02	6.68E-02	9.47E-02	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Radium-226	EPA 901.1 Modified	1.71E-01	1.16E-01	1.16E-01	1.96E-01	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Antimony-125	EPA 901.1 Modified	-7.49E-02	1.43E-01	1.43E-01	1.86E-01	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Thorium-234	EPA 901.1 Modified	4.59E-01	6.86E-01	6.87E-01	1.04E+00	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Thallium-208	EPA 901.1 Modified	1.36E-01	1.80E-01	1.80E-01	2.77E-01	U	pCi/g
19-10019-10	TRG	L1-12108-A-FSGS-015-SS-A	09/18/19 13:38	10/4/2019	10/7/2019	19-10019	Uranium-235	EPA 901.1 Modified	3.67E-01	2.07E-01	2.08E-01	3.45E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:	
SDG:	19-10019
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
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Actinium-228	EPA 901.1 Modified	2.38E-01	2.40E-01	2.40E-01	4.35E-01	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Silver-108m	EPA 901.1 Modified	-3.12E-02	5.27E-02	5.27E-02	7.27E-02	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Americium-241	EPA 901.1 Modified	-4.18E-02	7.76E-02	7.76E-02	1.09E-01	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Barium-133	EPA 901.1 Modified	4.80E-03	2.91E-02	2.91E-02	1.18E-01	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Bismuth-214	EPA 901.1 Modified	2.50E-01	1.32E-01	1.33E-01	2.33E-01		pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Cobalt-60	EPA 901.1 Modified	-3.61E-02	7.71E-02	7.71E-02	1.07E-01	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Cesium-134	EPA 901.1 Modified	-4.71E-03	3.62E-02	3.62E-02	8.80E-02	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Cesium-137	EPA 901.1 Modified	5.78E-02	5.65E-02	5.66E-02	9.21E-02	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Europium-152	EPA 901.1 Modified	-6.18E-02	1.87E-01	1.87E-01	1.80E-01	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Europium-154	EPA 901.1 Modified	4.84E-02	1.93E-01	1.93E-01	9.27E-02	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Europium-155	EPA 901.1 Modified	7.79E-02	6.97E-02	6.99E-02	1.38E-01	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Holmium-166m	EPA 901.1 Modified	1.63E-02	1.07E-01	1.07E-01	6.63E-02	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Iodine-129	EPA 901.1 Modified	-4.37E-02	5.83E-02	5.83E-02	8.16E-02	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Potassium-40	EPA 901.1 Modified	1.31E+01	1.94E+00	2.05E+00	5.57E-01		pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Manganese-54	EPA 901.1 Modified	5.25E-03	5.59E-02	5.59E-02	9.26E-02	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Molybdenum-93	EPA 901.1 Modified	8.50E-03	5.71E-02	5.71E-02	7.36E-02	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Niobium-94	EPA 901.1 Modified	-1.66E-02	5.75E-02	5.75E-02	8.09E-02	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Lead-210	EPA 901.1 Modified	-1.33E-01	6.57E-01	6.57E-01	9.57E-01	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Lead-212	EPA 901.1 Modified	2.44E-01	1.28E-01	1.29E-01	2.06E-01		pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Lead-214	EPA 901.1 Modified	2.93E-01	1.03E-01	1.04E-01	1.92E-01		pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Promethium-145	EPA 901.1 Modified	-1.27E-02	7.33E-02	7.33E-02	1.07E-01	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Radium-226	EPA 901.1 Modified	2.50E-01	1.32E-01	1.33E-01	2.33E-01		pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Antimony-125	EPA 901.1 Modified	2.82E-02	1.61E-01	1.61E-01	2.27E-01	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Thorium-234	EPA 901.1 Modified	2.12E-01	7.32E-01	7.32E-01	1.10E+00	U	pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Thallium-208	EPA 901.1 Modified	1.63E-01	9.09E-02	9.13E-02	5.97E-02		pCi/g
19-10019-11	TRG	L1-12108-A-FSGS-005-SS-A	09/18/19 13:08	10/4/2019	10/7/2019	19-10019	Uranium-235	EPA 901.1 Modified	1.14E-01	2.43E-01	2.43E-01	3.72E-01	U	pCi/g

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

ZION SOLUTIONS LLC
An EnergySolutions Company

REC'D OCT 04 2019

ZS-WM-131
Revision 0
Information Use

Attachment 1 – Chain-of-Custody Form

19-10019

	Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
	L1-12204-B-FSGS-010-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	2/9/19	1407	5 ROC HTD	NA	889.81 g
	L1-12202-E-FSGS-007-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/10/19	0942	5 ROC HTD	NA	1202.80 g
	L1-12202-E-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/10/19	0952	5 ROC HTD	NA	1189.10 g
	L1-12202-F-FSGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/10/19	1308	5 ROC HTD	NA	1045.64 g
	L1-12202-F-FSGS-010-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/10/19	1318	5 ROC HTD	NA	1107.70 g
	L1-12202-C-FSGS-007-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/11/19	0912	5 ROC HTD	NA	1054.03 g
	L1-12202-D-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/11/19	0836	5 ROC HTD	NA	913.68 g
	L1-12110-A-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/16/19	1324	5 ROC HTD	NA	958.11 g
	L1-12110-A-FSGS-014-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/16/19	1326	5 ROC HTD	NA	1084.06 g
4	L1-12202-C-FSGS-013-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/16/19	0830	5 ROC HTD	NA	1082.40 g
5	L1-12202-D-FSGS-015-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/16/19	1300	5 ROC HTD	NA	922.89 g
6	L1-12109-A-FSGS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/17/19	0914	5 ROC HTD	NA	1030.30 g
7	L1-12109-A-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/17/19	0924	5 ROC HTD	NA	968.97 g
8	L1-12202-F-FJGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/17/19	0952	5 ROC HTD	NA	1017.40 g
9	L1-10220-I-FIGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/17/19	0838	5 ROC HTD	NA	749.70 g
10	L1-12108-A-FSGS-015-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/18/19	1328	5 ROC HTD	NA	948.00 g
11	L1-12108-A-FSGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/18/19	1308	5 ROC HTD	NA	935.70 g

Rec BS 0743 10-4-19

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ZIONSOLUTIONS LLC
An EnergySolutions Company

19-10019

REC'D OCT 04 2019

ZS-WM-131
Revision 0
Information Use

Laboratory:	Date Submitted To Lab:		Ship Container No.:	Cooler Temperature:	Airbill Number:
EBERLINE LABS			**NA**	**N/A**	FedEx First Overnight 8132-0229-0210

Relinquished by: Jack Mucia	Date (mm/dd/yyyy): 10/1/19	Time: 1430	Received by: Richard F. Rickert	Date: (mm/dd/yyyy): 10/4/2019	1430
Relinquished by: Richard F. Rickert	Date (mm/dd/yyyy): 10/02/2019	Time: 1600	Received by: FedEx First Overnight	Date: (mm/dd/yyyy): 10/02/2019	1600
Relinquished by: Fedex	Date (mm/dd/yyyy):	Time:	Received by: Randolph Spencer	Date: (mm/dd/yyyy): 10/4/2019	0743
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	

Comments

PO # 67718 HTD's 7 day Turn Around

19-10019

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