ZION SOLUTIONS LLC
An EnergySolutions Company

ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

SOUTH HALF OF FUEL & AUXILIARY BUILDINGS

SURVEY UNIT 12107

REVISION 1

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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 Derived Concentration Guideline Level
BcSOF	Base Case Sum of Fractions
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
FHB	Fuel Handling Building
FSS	Final Status Survey
GPS	Global Positioning System
HTD	Hard-to-Detect
HSA	Historical Site Assessment
IC	Insignificant Contributor
LBGR	Lower Bound of the Gray Region
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Count Rate
NAD	North American Datum
NaI	Sodium Iodide
OpDCGL	Operational Derived Concentration Guideline Level
OpSOF	Operational Sum of Fractions
ORISE	Oak Ridge Institute for Science and Education
QAPP	Quality Assurance Project Plan
QC	Quality Control

RE	Radiological Engineer
ROC	Radionuclides of Concern
SOF	Sum of Fractions
TEDE	Total Effective Dose Equivalent
TSD	Technical Support Document
UBGR	Upper Bound of the Gray Region
VSP	Visual Sample Plan
ZNPS	Zion Nuclear Power Station
ZSRP	Zion Station Restoration Project

1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for Survey Unit 12107, "South Half of Fuel & Auxiliary Buildings," 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 (L1-12107A-F) was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, *"Final Status Survey Package Development"* (Reference 3), the ZSRP LTP, and guidance from NUREG-1575, "*Multi-Agency Radiation Survey and Site Investigation Manual"* (MARSSIM) (Reference 4).

This open land survey unit has a MARSSIM classification of 1. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I (α) and Type II (β) decision error rates were set at 0.05. Seventeen (17) systematic surface soil samples were acquired from the survey unit. In addition, surface scanning was performed on 100% of the total surface area in the survey unit. No areas of elevated activity were detected during the scans. The analytical results for all soil samples taken in survey unit 12107 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 0.073. The mean OpSOF for the systematic samples was 0.038. The mean Base Case SOF (BcSOF), when the analytical results were compared to the Base Case DCGLs (BcDCGL), was 0.010, which results in a dose assigned to the survey unit of 0.246 mrem/year Total Effective Dose Equivalent (TEDE). Therefore, the null hypothesis is rejected and survey unit 12107 is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 12107, "South Half of Fuel & Auxiliary Buildings," is a Class 1 open land survey unit and is 1,934 m^2 in size. It is bounded on the west by survey unit 12202B, the south by survey unit 12108, the east by survey unit 12205C, and the north by survey unit 12106.

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

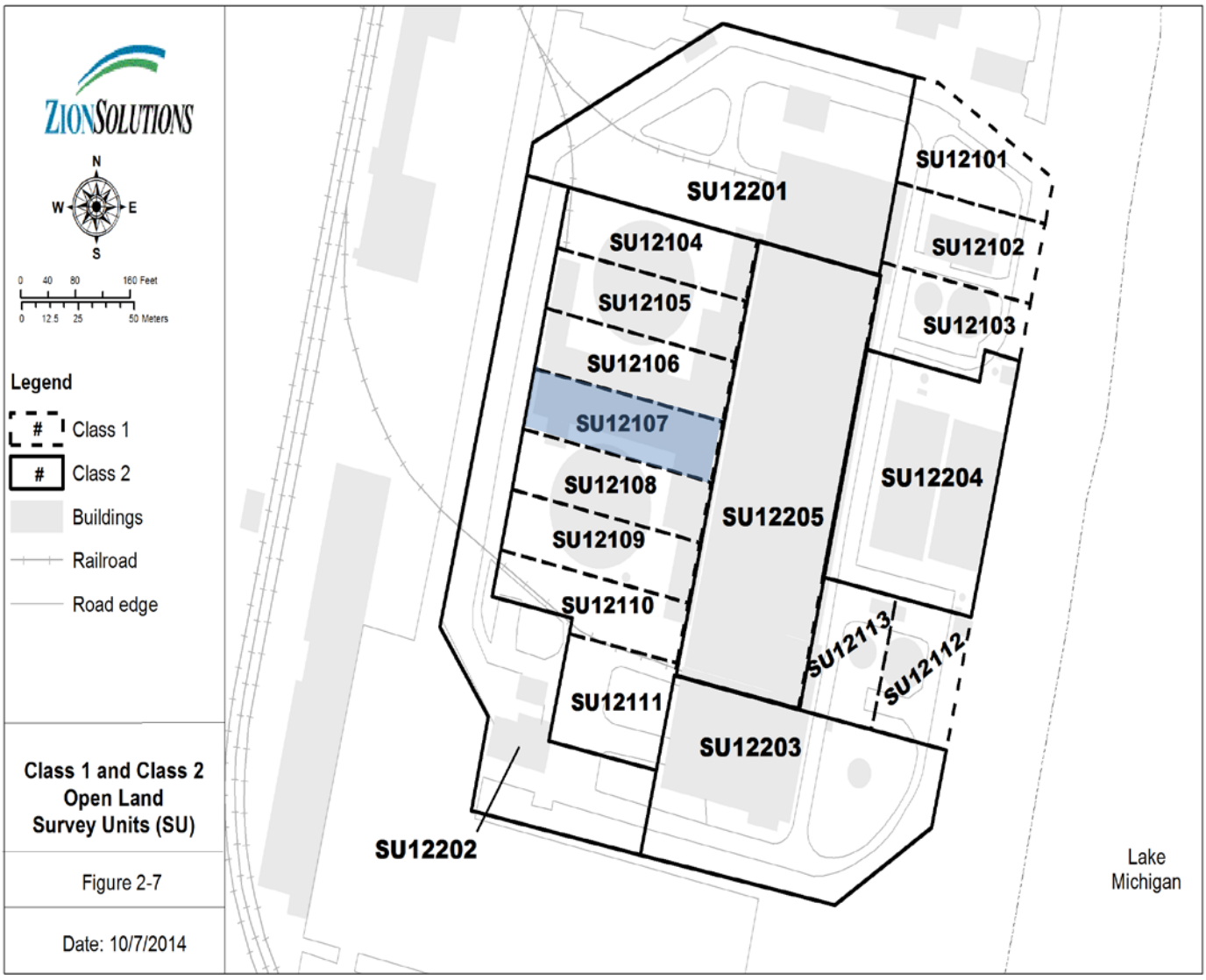
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 12107 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 part of the south half of survey unit 10105 as identified in the *"Zion Station Historical Site Assessment"* (HSA) (Reference 6). Subsequently, this area was described as survey unit 12107, a Class 1 open land survey unit, and described it as the "Area Around the South Half of Fuel Handling and Auxiliary Buildings" in Table 2-4 of the LTP as represented in Figure 2-7 of the LTP, which is replicated below as Figure 1.

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



This area contained the footprint of the south half of the Fuel Handling Building (FHB) and the Auxiliary Building, the Unit 1 Auxiliary Transformer and the Diesel Oil Tank – Tanker Connection Point.

The HSA notes that there were eleven separate substantial spills of mixtures of spent resins and water in this and adjacent areas with contamination levels up to 675,000 dpm/100cm^2 and dose rates as high as 310 mR/h. In adjacent survey units 12109 and 12110, the HSA estimated that over 100 gallons of spent resin may have leaked into the concrete/soil.

In the spring of 2018, an area was excavated to expose the remaining foundation of the FHB and Car Shed. This excavation included the west half of survey units 12105, 12106, and 12107. A Final Status Survey (L1-12107K-F) was performed on the subsurface soil and foundation concrete located within the area of survey unit 12107. The results of the FSS are included as an Addendum to this Release Record.

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 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 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 one 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 24, 2019, prior to performing FSS. The purpose of the walk-down was to assess the physical condition of the survey unit, evaluate access points and travel paths and identify potentially hazardous conditions. A final classification assessment was performed in accordance with ZS-LT-300-001-002, as part of the survey design for FSS. The assessment confirmed that survey unit 12107 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 12107 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 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 Minimum Detectable Concentration (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 (BcDCGLss)

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

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

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

Each radionuclide-specific BcDCGL is equivalent to the level of residual radioactivity (above background levels) that could, when considered independently, result in a TEDE of 25 mrem/year to an Average Member of the Critical Group (AMCG). To ensure that the summation of dose from each source term is 25 mrem/year or less after all FSS is completed, the BcDCGLs are reduced based on an expected, or *a priori*, fraction of the 25 mrem/year dose limit from each source term. The reduced DCGLs, or "Operational" DCGLs, can be related to the BcDCGLs as an expected fraction of dose based on an *a priori* assessment of what the expected dose should be based on the results of site characterization, process knowledge and the extent of planned remediation. The OpDCGL is then used as the DCGL for the FSS design of the survey unit (calculation of surrogate DCGLs, investigations levels, etc.). Details of the OpDCGLs derived for each dose component and the basis for the applied *a priori* dose fractions are provided in Zion*Solutions* TSD 17-004, *"Operational Derived Concentration Guideline Levels for Final Status Survey"* (Reference 10).

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

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

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

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

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

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

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

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

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

5. SURVEY DESIGN

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

The DQO process determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 would be the ROC in survey unit 12107. During FSS, concentrations for Hard-to-Detect (HTD) ROC Ni-63 and Sr-90 were inferred using a surrogate approach. Cs-137 is the principle surrogate radionuclide for Sr-90 and Co-60 is the principle surrogate radionuclide for Ni-63. The mean, maximum and 95% Upper Confidence Level (UCL) of the surrogate ratios for concrete core samples taken in the Auxiliary Building basement were calculated in TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* and are presented in Table 6. The maximum ratios were used in the surrogate calculations during FSS unless area specific ratios were 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 12107, 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 5000 counts per minute (cpm)
- scan speed of 0.5 m/sec
- distance from detector to surface of 2"
- isotopic mix of 95% Cs-137 and 5% Co-60

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

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

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

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

The computer program Visual Sample Plan (VSP) was used to generate the sample map, in accordance with ZS-LT-300-001-001. The map used was provided by the Survey Mapping/Computer Assisted Design Specialist, with coordinates based on the Illinois State Plane NAD 1983 standard topographical grid coordinate system. The number of samples generated by VSP for a systematic triangular grid was 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: $A = \frac{A_{SU}}{N} = \frac{1934}{17} = 113.8\ m^2$

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

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

The implementation of quality control (QC) measures as referenced by LTP, Section 5.9 and Zion*Solutions* 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 (L1-12107A-FQGS-009-SS) was selected randomly for split sample analysis for the FSS of this survey unit.

ZS-LT-01 also requires that replicate surveys be performed on 5% of all scan locations chosen at random. This requirement is being met by performing QC replicate scans on 5% of all the Class 1 open land areas. A replicate measurement is an independent direct measurement performed by a qualified technician, other than the one who obtained the original measurement, with a separate but similar instrument. Survey unit 12107 was chosen at random for a 100% QC replicate scan. Addendum 2 to the sample plan was written to direct the performance of replicate scans.

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 L1-12107A-FSGS-010-SB and L1-12107A-FSGS-017-SB were selected for this survey unit.

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

Table 8 - Systematic Sample Measurement Locations

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L1-12107A-FSGS-001-SS	641757.67	343672.37
L1-12107A-FSGS-002-SS	641767.60	343632.25
L1-12107A-FSGS-003-SS	641767.60	343643.72
L1-12107A-FSGS-004-SS	641767.60	343655.18
L1-12107A-FSGS-005-SS	641767.60	343666.64
L1-12107A-FSGS-006-SS	641777.52	343592.13
L1-12107A-FSGS-007-SS	641777.52	343603.60
L1-12107A-FSGS-008-SS	641777.52	343615.06
L1-12107A-FSGS-009-SS	641777.52	343626.52
L1-12107A-FSGS-010-SS	641777.52	343637.98
L1-12107A-FSGS-011-SS	641777.52	343649.45
L1-12107A-FSGS-012-SS	641777.52	343660.91
L1-12107A-FSGS-013-SS	641777.52	343672.37
L1-12107A-FSGS-014-SS	641787.45	343597.86
L1-12107A-FSGS-015-SS	641787.45	343609.33
L1-12107A-FSGS-016-SS	641787.45	343620.79
L1-12107A-FSGS-017-SS	641787.45	343632.25
L1-12107A-FSGS-010-SB	641777.52	343637.98
L1-12107A-FSGS-017-SB	641787.45	343632.25

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. One (1) sample, L1-12107A-FSGS-010-SB, exceeded on OpSOF of 0.1 during the FSS of survey unit 12107.

An additional soil sample, L1-12107A-FSGS-012-SS, was selected to meet the requirement that 10% of the samples collected for the FSS of survey unit 12107 be analyzed for HTD

ROC. This sample were selected based on exhibiting the highest OpSOF of the remaining samples. Each sample was sent off-site (Eberline Analytical) for analysis of the HTD ROC as specified in LTP, Section 5.1. Eberline analytical reports are provided in Attachment 8.

Table 9 provides a synopsis of the survey design for survey unit 12107.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	1,934 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	11.5 m	(LTP, Section 5.6.4.5.2)
DCGLs	• Co-60 – 1.091 pCi/g • Cs-134 – 1.733 pCi/g • Cs-137 – 3.630 pCi/g • Ni-63 – 914.458 pCi/g • Sr-90 – 3.095 pCi/g	Operational DCGLs for Surface Soils, (LTP, Table 5-7)
HTD ROC Analysis	A minimum of two (2) soil samples selected for HTD ROC analysis	(LTP, Section 5.1)
Measurement Investigation Level	Operational DCGL	(LTP, Table 5-25)
Scan Survey Area Coverage	100%	(LTP, Table 5-24)
QC	One (1) surface soil sample selected randomly for split sample analysis 100% replicate scans	(LTP, Section 5.9)
Number of Subsurface Soil Samples	Two (2) - systematic surface soil sample locations 10 and 17	(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 L1-12107A-F, which was developed in accordance with 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 12107, 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. 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 12107.

FSS field activities were conducted under FSS Sample Plan L1-12107A-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 initial FSS field activities were performed during normal working hours starting on September 25, 2019, and concluding on September 30, 2019. The QC replicate scan surveys were performed on October 10, 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 initial FSS or QC scans.

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

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

Table 10 - Instruments and Detectors

Instrument/Detector Type	Serial #	Calibration Due Date
Ludlum 2350-1/Ludlum 44-10	304718/PR363311	9/19/2020(1)
Ludlum 2350-1/Ludlum 44-10	304711/PR321902	1/18/2020(1)
Ludlum 2350-1/Ludlum 44-10	216166/PR372106	11/29/2019(1)
Ludlum 2350-1/Ludlum 44-10	304726/PR363452	8/28/2020(1)
Ludlum 2350-1/Ludlum 44-10	216173/ES0118	12/6/2019(1)
Ludlum 2350-1/Ludlum 44-10	266656/PR311750	7/24/2020(2)
Ludlum 2350-1/Ludlum 44-10	293136/PR316938	6/18/2020(2)
Ludlum 2350-1/Ludlum 44-10	266657/PR308037	5/13/2020(2)
Ludlum 2350-1/Ludlum 44-10	304730/PR375273	1/16/2020(2)

(1) Instrument used for the initial FSS scans
(2) Instruments used for the QC replicate scans

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

Two (2) samples (L1-12107A-FSGS-012-SS, and L1-12107A-FSGS-010-SB) were selected for HTD radionuclide analysis. One (1) surface soil sample (L1-12107A-FQGS-009-SS) was selected randomly for QC sample analysis.

7. SURVEY RESULTS

One hundred percent (100%) of the surface of the survey unit was scanned for elevated radiation levels. Eighty-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 initial FSS scan results. Complete scan results, including the results of the QC scan, 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	2235	2622	None	None
Row 2	2282	2622	None	None
Row 3	2289	2622	None	None
Row 4	2201	2622	None	None

Table 11 (continued) - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[1] (cpm)	# of Scan Alarms	Investigation Samples
Row 5	2285	2622	None	None
Row 6	2275	2622	None	None
Row 7	2299	2622	None	None
Row 8	2293	2622	None	None
Row 9	2253	2622	None	None
Row 10	2263	2622	None	None
Row 11	2306	2622	None	None
Row 12	2275	2622	None	None
Row 13	2237	2622	None	None
Row 14	2258	2622	None	None
Row 15	2308	2622	None	None
Row 16	2387	2622	None	None
Row 17	2228	2622	None	None
Row 18	2188	2622	None	None
Row 19	2291	2622	None	None
Row 20	2301	2622	None	None
Row 21	2195	2622	None	None
Row 22	2280	2622	None	None
Row 23	2203	2720	None	None
Row 24	2210	2720	None	None
Row 25	2177	2720	None	None
Row 26	2207	2720	None	None
Row 27	2261	2720	None	None
Row 28	2202	2720	None	None
Row 29	2191	2720	None	None
Row 30	2190	2720	None	None
Row 31	2209	2720	None	None
Row 32	2129	2720	None	None
Row 33	2167	2720	None	None
Row 34	2387	2949	None	None
Row 35	2228	2720	None	None
Row 36	2181	2720	None	None
Row 37	2164	2720	None	None
Row 38	2780	2937	None	None
Row 39	2653	2937	None	None
Row 40	2688	2937	None	None
Row 41	2659	2937	None	None
Row 42	2868	2937	None	None
Row 43	2769	2937	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 44	2715	2937	None	None
Row 45	2547	2955	None	None
Row 46	2866	2955	None	None
Row 47	2744	2955	None	None
Row 48	2898	2955	None	None
Row 49	2954	2955	None	None
Row 50	2814	2955	None	None
Row 51	2900	2955	None	None
Row 52	2938	2955	None	None
Row 53	2915	2955	None	None
Row 54	2921	2955	None	None
Row 55	2947	2955	None	None
Row 56	2786	2955	None	None
Row 57	2817	2955	None	None
Row 58	2743	2955	None	None
Row 59	2952	2955	None	None
Row 60	2706	2955	None	None
Row 61	2801	2955	None	None
Row 62	2857	2955	None	None
Row 63	2748	2955	None	None
Row 64	2898	2955	None	None
Row 65	2637	2955	None	None
Row 66	2725	3067	None	None
Row 67	2876	3067	None	None
Row 68	2844	3067	None	None
Row 69	2638	3067	None	None
Row 70	2670	3067	None	None
Row 71	2626	3067	None	None
Row 72	2539	3067	None	None
Row 73	2593	3067	None	None
Row 74	2623	3067	None	None
Row 75	2605	3067	None	None
Row 76	2485	3067	None	None
Row 77	2519	3067	None	None
Row 78	2457	3067	None	None
Row 79	2573	3067	None	None
Row 80	2457	3067	None	None
Row 81	2438	3067	None	None
Row 82	2421	3067	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	2492	3067	None	None
Row 84	2372	3067	None	None
Row 85	2399	3067	None	None
Row 86	2496	3067	None	None

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

The seventeen (17) soil samples taken for non-parametric statistical testing and the two (2) subsurface soil samples were analyzed using the on-site gamma spectroscopy system. Summaries of the sample analysis results are provided in Tables 12 and 13, respectively. The basic statistics for the systematic sample population are summarized in Table 19. The gamma spectroscopy results no samples with activity levels above the MDC for Cs-137, Co-60 or Cs-134. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6. The mean of the gamma spectroscopic analysis results for the sample population indicated that Cs-137 was present at levels lower than the concentrations of Cs-137 expected to be found in off-site soil in the vicinity of the ZNPS as presented in Zion*Solutions* TSD 13-004, "*Examination of Cs-137 Global Fallout In Soils At Zion Station*" (Reference 15). The complete gamma spectroscopy reports are presented in Attachment 7.

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

MEASUREMENT ID	Co-60[1] (pCi/g)	Cs-134[1] (pCi/g)	Cs-137[1] (pCi/g)	Ni-63[2] (pCi/g)	Sr-90[2] (pCi/g)
L1-12107A-FSGS-001-SS	4.47E-02	2.08E-02	2.68E-02	8.07E+00	5.36E-05
L1-12107A-FSGS-002-SS	2.31E-02	1.70E-02	9.11E-03	4.17E+00	1.82E-05
L1-12107A-FSGS-003-SS	1.98E-02	1.11E-02	0.00E+00	3.57E+00	0.00E+00
L1-12107A-FSGS-004-SS	4.12E-02	1.50E-02	3.00E-02	7.43E+00	6.00E-05
L1-12107A-FSGS-005-SS	5.38E-02	0.00E+00	4.07E-02	9.71E+00	8.14E-05
L1-12107A-FSGS-006-SS	0.00E+00	1.76E-03	0.00E+00	0.00E+00	0.00E+00
L1-12107A-FSGS-007-SS	2.95E-02	0.00E+00	1.03E-02	5.32E+00	2.06E-05
L1-12107A-FSGS-008-SS	5.04E-03	8.28E-03	0.00E+00	9.09E-01	0.00E+00
L1-12107A-FSGS-009-SS	6.61E-03	1.79E-02	2.49E-02	1.19E+00	4.98E-05
L1-12107A-FSGS-010-SS	3.94E-03	8.49E-03	0.00E+00	7.11E-01	0.00E+00
L1-12107A-FSGS-011-SS	4.12E-02	1.48E-02	0.00E+00	7.43E+00	0.00E+00

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)
L1-12107A-FSGS-012-SS	6.09E-02	1.42E-02	0.00E+00	1.10E+01	0.00E+00
L1-12107A-FSGS-013-SS	4.51E-03	2.92E-03	2.07E-03	8.14E-01	4.14E-06
L1-12107A-FSGS-014-SS	3.04E-02	2.60E-02	1.49E-02	5.49E+00	2.98E-05
L1-12107A-FSGS-015-SS	1.76E-02	1.36E-02	1.58E-02	3.18E+00	3.16E-05
L1-12107A-FSGS-016-SS	4.28E-02	2.86E-02	0.00E+00	7.72E+00	0.00E+00
L1-12107A-FSGS-017-SS	7.32E-03	4.74E-04	2.27E-02	1.32E+00	4.54E-05

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

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

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L1-12107A-FSGS-010-SB	4.11E-02	2.44E-02	0.00E+00	7.42E+00	0.00E+00
L1-12107A-FSGS-017-SB	2.13E-02	2.20E-02	1.60E-02	3.84E+00	3.20E-05

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

The off-site laboratory, Eberline Analytical, processed the two (2) samples selected for HTD ROC analysis. Samples L1-12107A-FSGS-012-SS-A and L1-12107A-FSGS-010-SB-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 results are provided in Table 14.

Table 14 - Off-Site Analysis Results

Sample # L1-12107A-FSGS-012-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	9.06E-03	2.90E-02	6.22E-02	No
Cs-134	-1.52E-01	7.02E-02	5.43E-02	No
Cs-137	-1.73E-02	3.68E-02	5.32E-02	No
Ni-63	4.93E-01	1.72E+00	2.94E+00	No
Sr-90	-1.58E-01	2.93E-01	6.42E-01	No

Table 14 (continued) - Off-Site Analysis Results

Sample # L1-12107A-FSGS-010-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	1.79E-02	5.34E-02	7.01E-02	No
Cs-134	-6.64E-03	1.80E-02	4.79E-02	No
Cs-137	3.82E-03	4.16E-02	6.50E-02	No
Ni-63	1.96E+00	1.99E+00	3.33E+00	No
Sr-90(1)	6.44E-02	4.08E-02	7.95E-02	No

(1) Sr-90 recounted February 2020 to achieve adequate MDC. (1)

The implementation of survey specific QC measures included the collection of one (1) systematic sample (L1-12107A-FQGS-009-SS) for "split sample" analysis. The on-site laboratory analyzed the designated QC sample using the on-site gamma spectroscopy system. Gamma spectroscopy results (summarized in Table 15) indicate that concentrations for Cs-137, Co-60 and Cs-134 were less than MDC in the sample. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6.

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

MEASUREMENT ID	Co-60(1) (pCi/g)	Cs-134(1) (pCi/g)	Cs-137(1) (pCi/g)	Ni-63(2) (pCi/g)	Sr-90(2) (pCi/g)
L1-12107A-FQGS-009-SS	2.77E-02	3.16E-02	3.16E-02	5.00E+00	6.32E-05

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

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

Equation 6

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

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 12107 are provided in Table 16. The results of the unity rule calculations for the ROC for the subsurface samples are provided in Table 17, and the results for the QC samples are presented in Table 18.

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12107A-FSGS-001-SS	4.10E-02	1.20E-02	7.38E-03	8.82E-03	1.73E-05	0.069
L1-12107A-FSGS-002-SS	2.12E-02	9.81E-03	2.51E-03	4.56E-03	5.89E-06	0.038
L1-12107A-FSGS-003-SS	1.81E-02	6.41E-03	0.00E+00	3.91E-03	0.00E+00	0.028
L1-12107A-FSGS-004-SS	3.78E-02	8.66E-03	8.26E-03	8.13E-03	1.94E-05	0.063
L1-12107A-FSGS-005-SS	4.93E-02	0.00E+00	1.12E-02	1.06E-02	2.63E-05	0.071
L1-12107A-FSGS-006-SS	0.00E+00	1.02E-03	0.00E+00	0.00E+00	0.00E+00	0.001
L1-12107A-FSGS-007-SS	2.70E-02	0.00E+00	2.84E-03	5.82E-03	6.66E-06	0.036
L1-12107A-FSGS-008-SS	4.62E-03	4.78E-03	0.00E+00	9.95E-04	0.00E+00	0.010
L1-12107A-FSGS-009-SS	6.06E-03	1.03E-02	6.86E-03	1.30E-03	1.61E-05	0.025
L1-12107A-FSGS-010-SS	3.61E-03	4.90E-03	0.00E+00	7.77E-04	0.00E+00	0.009
L1-12107A-FSGS-011-SS	3.78E-02	8.54E-03	0.00E+00	8.13E-03	0.00E+00	0.054
L1-12107A-FSGS-012-SS	5.58E-02	8.19E-03	0.00E+00	1.20E-02	0.00E+00	0.076
L1-12107A-FSGS-013-SS	4.13E-03	1.68E-03	5.70E-04	8.90E-04	1.34E-06	0.007
L1-12107A-FSGS-014-SS	2.79E-02	1.50E-02	4.10E-03	6.00E-03	9.63E-06	0.053
L1-12107A-FSGS-015-SS	1.61E-02	7.85E-03	4.35E-03	3.47E-03	1.02E-05	0.032
L1-12107A-FSGS-016-SS	3.92E-02	1.65E-02	0.00E+00	8.45E-03	0.00E+00	0.064
L1-12107A-FSGS-017-SS	6.71E-03	2.74E-04	6.25E-03	1.44E-03	1.47E-05	0.015

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 = 0.076

Mean Systematic Measurement OpSOF = 0.038

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

MEASUREMENT ID	Fraction of the OpDCGLs for Subsurface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12107A-FSGS-010-SB	4.67E-02	2.15E-02	0.00E+00	3.80E-02	0.00E+00	0.106
L1-12107A-FSGS-017-SB	2.42E-02	1.93E-02	8.06E-03	1.97E-02	7.53E-05	0.071

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12107A-FQGS-009-SS	2.54E-02	1.82E-02	8.71E-03	5.47E-03	2.04E-05	0.058

Table 19 - Basic Statistical Properties of Systematic Sample Population

ROC	Mean (pCi/g)	Median (pCi/g)	Max (pCi/g)	Min (pCi/g)	Std. Dev. (pCi/g)	BcDCGL (pCi/g)	Avg. SOF per ROC	Avg. Dose Per ROC
Co-60	2.54E-02	2.31E-02	6.09E-02	0.00E+00	0.019	4.26	5.97E-03	1.49E-01
Cs-134	1.18E-02	1.36E-02	2.86E-02	0.00E+00	0.009	6.77	1.75E-03	4.36E-02
Cs-137	1.16E-02	9.11E-03	4.07E-02	0.00E+00	0.013	14.18	8.18E-04	2.05E-02
Ni-63	4.59E+00	4.17E+00	1.10E+01	0.00E+00	3.499	3572.1	1.28E-03	3.21E-02
Sr-90	2.32E-05	1.82E-05	8.14E-05	0.00E+00	0.000	12.09	1.92E-06	4.80E-05

The mean BcSOF for survey unit 12107 is 0.010, which equates to a dose of 0.246 mrem/year TEDE.

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

8. QUALITY CONTROL

The on-site laboratory processed one (1) split sample, L1-12107A-FQGS-009-SS, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in ZS-LT-01, *"Quality Assurance Project Plan (for Characterization and FSS)."* The standard and comparison samples did not both have a positive result for a gamma-emitting ROC, therefore K-40 was used in the QC comparisons. There was acceptable agreement between standard and comparison results when using K-40. Refer to Attachment 5 for data and QC analysis results.

QC scans were performed on one hundred percent (100%) of the surface of the survey unit using latching mode. Readings were recorded at approximately 10-meter intervals during the scans. No elevated measurement locations were identified by the QC scans. There was acceptable agreement between field scan results.

9. INVESTIGATIONS AND RESULTS

No investigations were performed in survey unit 12107.

10. REMEDIATION AND RESULTS

No remediation was performed in this survey unit.

11. CHANGES FROM THE SURVEY PLAN

Addendum 2 to the FSS plan was written to direct the performance of QC gamma scans.

12. DATA QUALITY ASSESSMENT

The DQO sample design and data were reviewed in accordance with Zion*Solutions* procedure ZS-LT-300-001-004, *"Final Status Survey Data Assessment"* (Reference 16) for completeness

and consistency. Documentation was complete and legible. Surveys and sample collection were consistent with the DQOs. The sampling design had adequate power as indicated by the Retrospective Power Curve.

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

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

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

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

13. ANOMALIES

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

14. CONCLUSION

Survey unit 12107 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 Operational DCGL 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 0.010, which results in a dose contribution from soil in survey unit 12107 of 0.246 mrem/year, based on the average concentration of the ROC in samples used for non-parametric statistical sampling.

The conclusion of this Release Record is that survey unit 12107 is acceptable for unrestricted release.

15. REFERENCES

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

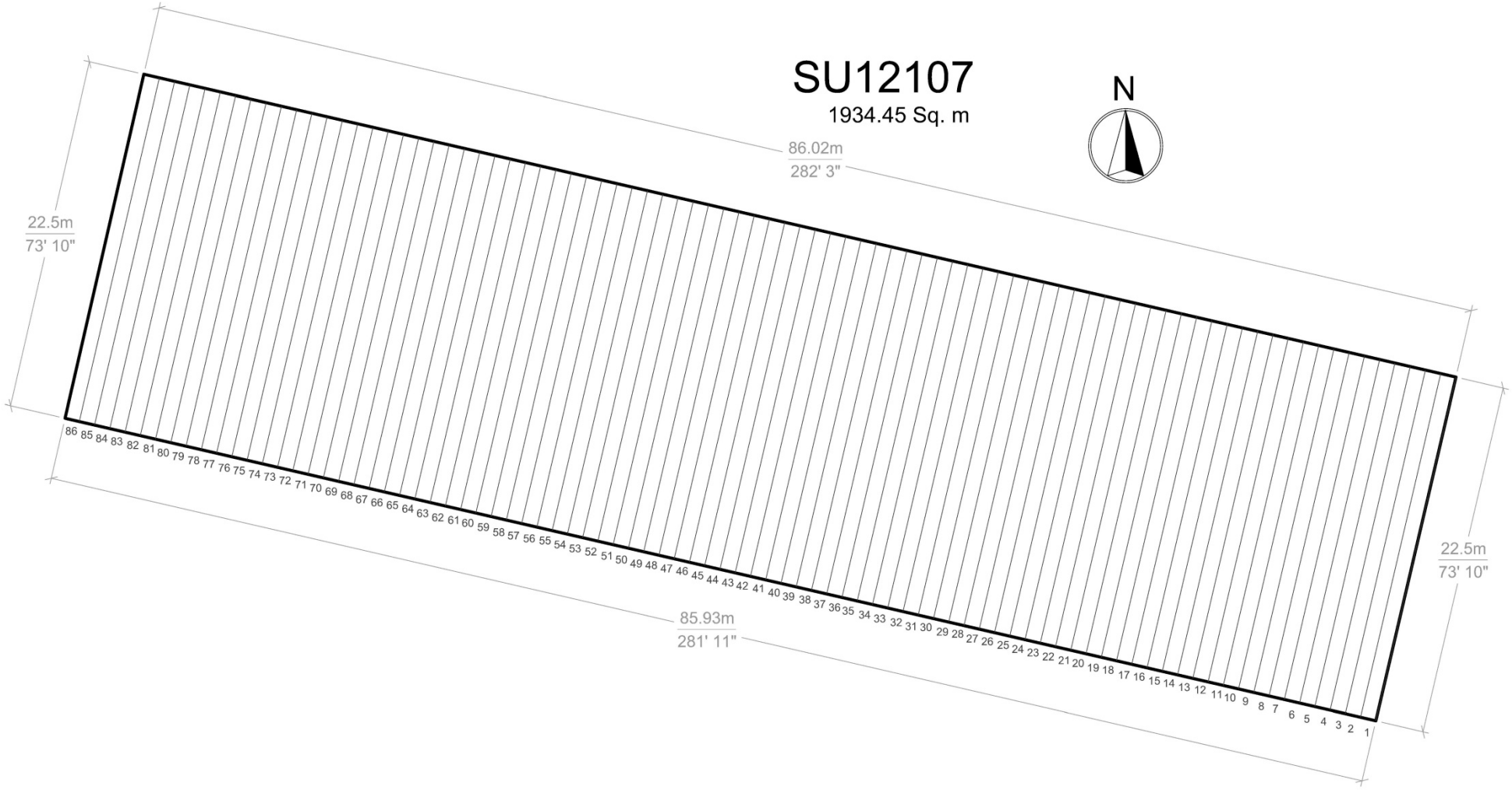
16. ATTACHMENTS

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

ATTACHMENT 1
FIGURE AND MAP

Survey Unit 12107 Final Status Survey Boundaries and Systematic Sample Points

Survey Unit 12107 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
ORIGINAL SCANS									
44-10	PR363311	304718	12107	GS001	9/25/2019 9:19	2235	1954	2622	No
44-10	PR363311	304718	12107	GS001	9/25/2019 9:21	2113	1954	2622	No
44-10	PR363311	304718	12107	GS001	9/25/2019 9:23	2215	1954	2622	No
44-10	PR363311	304718	12107	GS002	9/25/2019 9:25	2282	1954	2622	No
44-10	PR363311	304718	12107	GS002	9/25/2019 9:27	2238	1954	2622	No
44-10	PR363311	304718	12107	GS002	9/25/2019 9:29	2250	1954	2622	No
44-10	PR363311	304718	12107	GS003	9/25/2019 9:31	2289	1954	2622	No
44-10	PR363311	304718	12107	GS003	9/25/2019 9:33	2282	1954	2622	No
44-10	PR363311	304718	12107	GS003	9/25/2019 9:35	2269	1954	2622	No
44-10	PR363311	304718	12107	GS004	9/25/2019 9:37	2170	1954	2622	No
44-10	PR363311	304718	12107	GS004	9/25/2019 9:39	2197	1954	2622	No
44-10	PR363311	304718	12107	GS004	9/25/2019 9:41	2201	1954	2622	No
44-10	PR363311	304718	12107	GS005	9/25/2019 9:43	2285	1954	2622	No
44-10	PR363311	304718	12107	GS005	9/25/2019 9:45	2249	1954	2622	No
44-10	PR363311	304718	12107	GS005	9/25/2019 9:47	2076	1954	2622	No
44-10	PR363311	304718	12107	GS006	9/25/2019 9:49	2226	1954	2622	No
44-10	PR363311	304718	12107	GS006	9/25/2019 9:51	2275	1954	2622	No
44-10	PR363311	304718	12107	GS006	9/25/2019 9:53	2205	1954	2622	No
44-10	PR363311	304718	12107	GS007	9/25/2019 9:55	2299	1954	2622	No
44-10	PR363311	304718	12107	GS007	9/25/2019 10:05	2197	1954	2622	No
44-10	PR363311	304718	12107	GS007	9/25/2019 10:07	2210	1954	2622	No
44-10	PR363311	304718	12107	GS008	9/25/2019 10:09	2293	1954	2622	No
44-10	PR363311	304718	12107	GS008	9/25/2019 10:11	2189	1954	2622	No
44-10	PR363311	304718	12107	GS008	9/25/2019 10:13	2129	1954	2622	No
44-10	PR363311	304718	12107	GS009	9/25/2019 10:15	2253	1954	2622	No
44-10	PR363311	304718	12107	GS009	9/25/2019 10:17	2233	1954	2622	No
44-10	PR363311	304718	12107	GS009	9/25/2019 10:19	2181	1954	2622	No
44-10	PR363311	304718	12107	GS010	9/25/2019 10:21	2263	1954	2622	No
44-10	PR363311	304718	12107	GS010	9/25/2019 10:23	2120	1954	2622	No
44-10	PR363311	304718	12107	GS010	9/25/2019 10:25	2207	1954	2622	No
44-10	PR363311	304718	12107	GS011	9/25/2019 10:27	2196	1954	2622	No
44-10	PR363311	304718	12107	GS011	9/25/2019 10:29	2306	1954	2622	No
44-10	PR363311	304718	12107	GS011	9/25/2019 10:31	2277	1954	2622	No
44-10	PR363311	304718	12107	GS012	9/25/2019 12:22	2163	1954	2622	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR363311	304718	12107	GS012	9/25/2019 12:24	2184	1954	2622	No
44-10	PR363311	304718	12107	GS012	9/25/2019 12:26	2275	1954	2622	No
44-10	PR363311	304718	12107	GS013	9/25/2019 12:28	2168	1954	2622	No
44-10	PR363311	304718	12107	GS013	9/25/2019 12:30	2237	1954	2622	No
44-10	PR363311	304718	12107	GS013	9/25/2019 12:32	2229	1954	2622	No
44-10	PR363311	304718	12107	GS014	9/25/2019 12:34	2213	1954	2622	No
44-10	PR363311	304718	12107	GS014	9/25/2019 12:36	2163	1954	2622	No
44-10	PR363311	304718	12107	GS014	9/25/2019 12:38	2258	1954	2622	No
44-10	PR363311	304718	12107	GS015	9/25/2019 12:40	2225	1954	2622	No
44-10	PR363311	304718	12107	GS015	9/25/2019 12:42	2308	1954	2622	No
44-10	PR363311	304718	12107	GS015	9/25/2019 12:44	2220	1954	2622	No
44-10	PR363311	304718	12107	GS016	9/25/2019 12:46	2387	1954	2622	No
44-10	PR363311	304718	12107	GS016	9/25/2019 12:48	2196	1954	2622	No
44-10	PR363311	304718	12107	GS016	9/25/2019 12:50	2201	1954	2622	No
44-10	PR363311	304718	12107	GS017	9/25/2019 12:52	2228	1954	2622	No
44-10	PR363311	304718	12107	GS017	9/25/2019 12:54	2209	1954	2622	No
44-10	PR363311	304718	12107	GS017	9/25/2019 12:56	2088	1954	2622	No
44-10	PR363311	304718	12107	GS018	9/25/2019 12:58	2159	1954	2622	No
44-10	PR363311	304718	12107	GS018	9/25/2019 13:00	2188	1954	2622	No
44-10	PR363311	304718	12107	GS018	9/25/2019 13:02	2164	1954	2622	No
44-10	PR363311	304718	12107	GS019	9/25/2019 13:04	2291	1954	2622	No
44-10	PR363311	304718	12107	GS019	9/25/2019 13:06	2136	1954	2622	No
44-10	PR363311	304718	12107	GS019	9/25/2019 13:08	2249	1954	2622	No
44-10	PR363311	304718	12107	GS020	9/25/2019 13:10	2079	1954	2622	No
44-10	PR363311	304718	12107	GS020	9/25/2019 13:12	2301	1954	2622	No
44-10	PR363311	304718	12107	GS020	9/25/2019 13:14	2215	1954	2622	No
44-10	PR363311	304718	12107	GS021	9/25/2019 13:16	2195	1954	2622	No
44-10	PR363311	304718	12107	GS021	9/25/2019 13:18	2172	1954	2622	No
44-10	PR363311	304718	12107	GS021	9/25/2019 13:20	2108	1954	2622	No
44-10	PR363311	304718	12107	GS022	9/25/2019 13:22	2126	1954	2622	No
44-10	PR363311	304718	12107	GS022	9/25/2019 13:24	2186	1954	2622	No
44-10	PR363311	304718	12107	GS022	9/25/2019 13:26	2280	1954	2622	No
44-10	PR321902	304711	12107	GS023	9/25/2019 9:17	2085	2037	2720	No
44-10	PR321902	304711	12107	GS023	9/25/2019 9:20	2195	2037	2720	No
44-10	PR321902	304711	12107	GS023	9/25/2019 9:22	2203	2037	2720	No
44-10	PR321902	304711	12107	GS024	9/25/2019 9:26	2210	2037	2720	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR321902	304711	12107	GS024	9/25/2019 9:28	2150	2037	2720	No
44-10	PR321902	304711	12107	GS024	9/25/2019 9:30	2120	2037	2720	No
44-10	PR321902	304711	12107	GS025	9/25/2019 9:34	2123	2037	2720	No
44-10	PR321902	304711	12107	GS025	9/25/2019 9:37	2177	2037	2720	No
44-10	PR321902	304711	12107	GS025	9/25/2019 9:39	2177	2037	2720	No
44-10	PR321902	304711	12107	GS026	9/25/2019 9:44	2193	2037	2720	No
44-10	PR321902	304711	12107	GS026	9/25/2019 9:47	2207	2037	2720	No
44-10	PR321902	304711	12107	GS026	9/25/2019 9:49	2094	2037	2720	No
44-10	PR321902	304711	12107	GS027	9/25/2019 9:52	2159	2037	2720	No
44-10	PR321902	304711	12107	GS027	9/25/2019 9:55	2161	2037	2720	No
44-10	PR321902	304711	12107	GS027	9/25/2019 9:57	2261	2037	2720	No
44-10	PR321902	304711	12107	GS028	9/25/2019 10:01	2202	2037	2720	No
44-10	PR321902	304711	12107	GS028	9/25/2019 10:03	2130	2037	2720	No
44-10	PR321902	304711	12107	GS028	9/25/2019 10:05	2049	2037	2720	No
44-10	PR321902	304711	12107	GS029	9/25/2019 10:16	2177	2037	2720	No
44-10	PR321902	304711	12107	GS029	9/25/2019 10:18	2149	2037	2720	No
44-10	PR321902	304711	12107	GS029	9/25/2019 10:20	2191	2037	2720	No
44-10	PR321902	304711	12107	GS030	9/25/2019 10:24	2190	2037	2720	No
44-10	PR321902	304711	12107	GS030	9/25/2019 10:26	2174	2037	2720	No
44-10	PR321902	304711	12107	GS030	9/25/2019 10:28	2101	2037	2720	No
44-10	PR321902	304711	12107	GS031	9/25/2019 10:31	2108	2037	2720	No
44-10	PR321902	304711	12107	GS031	9/25/2019 10:33	2148	2037	2720	No
44-10	PR321902	304711	12107	GS031	9/25/2019 10:38	2209	2037	2720	No
44-10	PR321902	304711	12107	GS032	9/25/2019 12:26	2061	2037	2720	No
44-10	PR321902	304711	12107	GS032	9/25/2019 12:28	2129	2037	2720	No
44-10	PR321902	304711	12107	GS032	9/25/2019 12:31	2091	2037	2720	No
44-10	PR321902	304711	12107	GS033	9/25/2019 12:34	2147	2037	2720	No
44-10	PR321902	304711	12107	GS033	9/25/2019 12:36	2126	2037	2720	No
44-10	PR321902	304711	12107	GS033	9/25/2019 12:39	2167	2037	2720	No
44-10	PR321902	304711	12107	GS035	9/25/2019 12:52	2228	2037	2720	No
44-10	PR321902	304711	12107	GS035	9/25/2019 12:54	2100	2037	2720	No
44-10	PR321902	304711	12107	GS035	9/25/2019 12:56	2076	2037	2720	No
44-10	PR321902	304711	12107	GS036	9/25/2019 13:00	2120	2037	2720	No
44-10	PR321902	304711	12107	GS036	9/25/2019 13:03	2181	2037	2720	No
44-10	PR321902	304711	12107	GS036	9/25/2019 13:05	2144	2037	2720	No
44-10	PR321902	304711	12107	GS037	9/25/2019 13:09	2164	2037	2720	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR321902	304711	12107	GS037	9/25/2019 13:12	2104	2037	2720	No
44-10	PR321902	304711	12107	GS037	9/25/2019 13:14	2028	2037	2720	No
44-10	PR321902	304711	12107	GS034	9/30/2019 8:24	2387	2235	2949	No
44-10	PR321902	304711	12107	GS034	9/30/2019 8:26	2382	2235	2949	No
44-10	PR321902	304711	12107	GS034	9/30/2019 8:28	2291	2235	2949	No
44-10	PR372106	216166	12107	GS038	9/25/2019 12:30	2780	2224	2937	No
44-10	PR372106	216166	12107	GS038	9/25/2019 12:32	2604	2224	2937	No
44-10	PR372106	216166	12107	GS038	9/25/2019 12:34	2569	2224	2937	No
44-10	PR372106	216166	12107	GS039	9/25/2019 12:36	2653	2224	2937	No
44-10	PR372106	216166	12107	GS039	9/25/2019 12:38	2640	2224	2937	No
44-10	PR372106	216166	12107	GS039	9/25/2019 12:40	2552	2224	2937	No
44-10	PR372106	216166	12107	GS040	9/25/2019 12:42	2537	2224	2937	No
44-10	PR372106	216166	12107	GS040	9/25/2019 12:44	2688	2224	2937	No
44-10	PR372106	216166	12107	GS040	9/25/2019 12:46	2566	2224	2937	No
44-10	PR372106	216166	12107	GS041	9/25/2019 12:48	2659	2224	2937	No
44-10	PR372106	216166	12107	GS041	9/25/2019 12:50	2458	2224	2937	No
44-10	PR372106	216166	12107	GS041	9/25/2019 12:52	2414	2224	2937	No
44-10	PR372106	216166	12107	GS042	9/25/2019 12:54	2586	2224	2937	No
44-10	PR372106	216166	12107	GS042	9/25/2019 12:56	2596	2224	2937	No
44-10	PR372106	216166	12107	GS042	9/25/2019 12:58	2868	2224	2937	No
44-10	PR372106	216166	12107	GS043	9/25/2019 13:00	2769	2224	2937	No
44-10	PR372106	216166	12107	GS043	9/25/2019 13:02	2656	2224	2937	No
44-10	PR372106	216166	12107	GS043	9/25/2019 13:04	2418	2224	2937	No
44-10	PR372106	216166	12107	GS044	9/25/2019 13:06	2486	2224	2937	No
44-10	PR372106	216166	12107	GS044	9/25/2019 13:08	2671	2224	2937	No
44-10	PR372106	216166	12107	GS044	9/25/2019 13:10	2715	2224	2937	No
44-10	PR363452	304726	12107	GS045	9/25/2019 9:03	2547	2240	2955	No
44-10	PR363452	304726	12107	GS045	9/25/2019 9:06	2503	2240	2955	No
44-10	PR363452	304726	12107	GS045	9/25/2019 9:08	2441	2240	2955	No
44-10	PR363452	304726	12107	GS046	9/25/2019 9:10	2353	2240	2955	No
44-10	PR363452	304726	12107	GS046	9/25/2019 9:13	2866	2240	2955	No
44-10	PR363452	304726	12107	GS046	9/25/2019 9:16	2479	2240	2955	No
44-10	PR363452	304726	12107	GS047	9/25/2019 9:19	2734	2240	2955	No
44-10	PR363452	304726	12107	GS047	9/25/2019 9:21	2744	2240	2955	No
44-10	PR363452	304726	12107	GS047	9/25/2019 9:23	2498	2240	2955	No
44-10	PR363452	304726	12107	GS048	9/25/2019 9:25	2383	2240	2955	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR363452	304726	12107	GS048	9/25/2019 9:28	2803	2240	2955	No
44-10	PR363452	304726	12107	GS048	9/25/2019 9:30	2898	2240	2955	No
44-10	PR363452	304726	12107	GS049	9/25/2019 9:32	2954	2240	2955	No
44-10	PR363452	304726	12107	GS049	9/25/2019 9:35	2854	2240	2955	No
44-10	PR363452	304726	12107	GS049	9/25/2019 9:37	2362	2240	2955	No
44-10	PR363452	304726	12107	GS050	9/25/2019 9:42	2444	2240	2955	No
44-10	PR363452	304726	12107	GS050	9/25/2019 9:45	2803	2240	2955	No
44-10	PR363452	304726	12107	GS050	9/25/2019 9:47	2814	2240	2955	No
44-10	PR363452	304726	12107	GS051	9/25/2019 9:50	2825	2240	2955	No
44-10	PR363452	304726	12107	GS051	9/25/2019 9:53	2900	2240	2955	No
44-10	PR363452	304726	12107	GS051	9/25/2019 9:55	2331	2240	2955	No
44-10	PR363452	304726	12107	GS052	9/25/2019 9:58	2376	2240	2955	No
44-10	PR363452	304726	12107	GS052	9/25/2019 10:00	2935	2240	2955	No
44-10	PR363452	304726	12107	GS052	9/25/2019 10:02	2938	2240	2955	No
44-10	PR363452	304726	12107	GS053	9/25/2019 10:05	2839	2240	2955	No
44-10	PR363452	304726	12107	GS053	9/25/2019 10:07	2915	2240	2955	No
44-10	PR363452	304726	12107	GS053	9/25/2019 10:09	2441	2240	2955	No
44-10	PR363452	304726	12107	GS054	9/25/2019 10:12	2543	2240	2955	No
44-10	PR363452	304726	12107	GS054	9/25/2019 10:14	2781	2240	2955	No
44-10	PR363452	304726	12107	GS054	9/25/2019 10:17	2921	2240	2955	No
44-10	PR363452	304726	12107	GS055	9/25/2019 10:20	2947	2240	2955	No
44-10	PR363452	304726	12107	GS055	9/25/2019 10:23	2884	2240	2955	No
44-10	PR363452	304726	12107	GS055	9/25/2019 10:26	2629	2240	2955	No
44-10	PR363452	304726	12107	GS056	9/25/2019 10:28	2532	2240	2955	No
44-10	PR363452	304726	12107	GS056	9/25/2019 10:32	2786	2240	2955	No
44-10	PR363452	304726	12107	GS056	9/25/2019 10:34	2762	2240	2955	No
44-10	PR363452	304726	12107	GS057	9/25/2019 12:27	2817	2240	2955	No
44-10	PR363452	304726	12107	GS057	9/25/2019 12:29	2813	2240	2955	No
44-10	PR363452	304726	12107	GS057	9/25/2019 12:31	2503	2240	2955	No
44-10	PR363452	304726	12107	GS058	9/25/2019 12:35	2743	2240	2955	No
44-10	PR363452	304726	12107	GS058	9/25/2019 12:37	2736	2240	2955	No
44-10	PR363452	304726	12107	GS058	9/25/2019 12:40	2634	2240	2955	No
44-10	PR363452	304726	12107	GS059	9/25/2019 12:44	2657	2240	2955	No
44-10	PR363452	304726	12107	GS059	9/25/2019 12:47	2845	2240	2955	No
44-10	PR363452	304726	12107	GS059	9/25/2019 12:49	2952	2240	2955	No
44-10	PR363452	304726	12107	GS060	9/25/2019 12:52	2629	2240	2955	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR363452	304726	12107	GS060	9/25/2019 12:54	2704	2240	2955	No
44-10	PR363452	304726	12107	GS060	9/25/2019 12:56	2706	2240	2955	No
44-10	PR363452	304726	12107	GS061	9/25/2019 12:59	2591	2240	2955	No
44-10	PR363452	304726	12107	GS061	9/25/2019 13:01	2801	2240	2955	No
44-10	PR363452	304726	12107	GS061	9/25/2019 13:03	2558	2240	2955	No
44-10	PR363452	304726	12107	GS062	9/25/2019 13:06	2857	2240	2955	No
44-10	PR363452	304726	12107	GS062	9/25/2019 13:08	2768	2240	2955	No
44-10	PR363452	304726	12107	GS062	9/25/2019 13:10	2540	2240	2955	No
44-10	PR363452	304726	12107	GS063	9/25/2019 13:13	2452	2240	2955	No
44-10	PR363452	304726	12107	GS063	9/25/2019 13:15	2667	2240	2955	No
44-10	PR363452	304726	12107	GS063	9/25/2019 13:17	2748	2240	2955	No
44-10	PR363452	304726	12107	GS064	9/25/2019 13:20	2849	2240	2955	No
44-10	PR363452	304726	12107	GS064	9/25/2019 13:22	2898	2240	2955	No
44-10	PR363452	304726	12107	GS064	9/25/2019 13:24	2474	2240	2955	No
44-10	PR363452	304726	12107	GS065	9/25/2019 13:27	2374	2240	2955	No
44-10	PR363452	304726	12107	GS065	9/25/2019 13:29	2637	2240	2955	No
44-10	PR363452	304726	12107	GS065	9/25/2019 13:31	2392	2240	2955	No
44-10	ES0118	216173	12107	GS066	9/25/2019 9:04	2450	2336	3067	No
44-10	ES0118	216173	12107	GS066	9/25/2019 9:06	2725	2336	3067	No
44-10	ES0118	216173	12107	GS066	9/25/2019 9:07	2516	2336	3067	No
44-10	ES0118	216173	12107	GS067	9/25/2019 9:10	2635	2336	3067	No
44-10	ES0118	216173	12107	GS067	9/25/2019 9:12	2876	2336	3067	No
44-10	ES0118	216173	12107	GS067	9/25/2019 9:13	2452	2336	3067	No
44-10	ES0118	216173	12107	GS068	9/25/2019 9:16	2449	2336	3067	No
44-10	ES0118	216173	12107	GS068	9/25/2019 9:18	2844	2336	3067	No
44-10	ES0118	216173	12107	GS068	9/25/2019 9:20	2566	2336	3067	No
44-10	ES0118	216173	12107	GS069	9/25/2019 9:22	2594	2336	3067	No
44-10	ES0118	216173	12107	GS069	9/25/2019 9:24	2638	2336	3067	No
44-10	ES0118	216173	12107	GS069	9/25/2019 9:26	2402	2336	3067	No
44-10	ES0118	216173	12107	GS070	9/25/2019 9:28	2452	2336	3067	No
44-10	ES0118	216173	12107	GS070	9/25/2019 9:30	2670	2336	3067	No
44-10	ES0118	216173	12107	GS070	9/25/2019 9:31	2541	2336	3067	No
44-10	ES0118	216173	12107	GS071	9/25/2019 9:34	2626	2336	3067	No
44-10	ES0118	216173	12107	GS071	9/25/2019 9:36	2622	2336	3067	No
44-10	ES0118	216173	12107	GS071	9/25/2019 9:37	2400	2336	3067	No
44-10	ES0118	216173	12107	GS072	9/25/2019 9:40	2391	2336	3067	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	ES0118	216173	12107	GS072	9/25/2019 9:42	2529	2336	3067	No
44-10	ES0118	216173	12107	GS072	9/25/2019 9:44	2539	2336	3067	No
44-10	ES0118	216173	12107	GS073	9/25/2019 9:46	2593	2336	3067	No
44-10	ES0118	216173	12107	GS073	9/25/2019 9:48	2393	2336	3067	No
44-10	ES0118	216173	12107	GS073	9/25/2019 9:50	2360	2336	3067	No
44-10	ES0118	216173	12107	GS074	9/25/2019 9:52	2424	2336	3067	No
44-10	ES0118	216173	12107	GS074	9/25/2019 9:55	2431	2336	3067	No
44-10	ES0118	216173	12107	GS074	9/25/2019 9:56	2623	2336	3067	No
44-10	ES0118	216173	12107	GS075	9/25/2019 9:58	2605	2336	3067	No
44-10	ES0118	216173	12107	GS075	9/25/2019 10:01	2474	2336	3067	No
44-10	ES0118	216173	12107	GS075	9/25/2019 10:02	2412	2336	3067	No
44-10	ES0118	216173	12107	GS076	9/25/2019 10:06	2374	2336	3067	No
44-10	ES0118	216173	12107	GS076	9/25/2019 10:08	2373	2336	3067	No
44-10	ES0118	216173	12107	GS076	9/25/2019 10:09	2485	2336	3067	No
44-10	ES0118	216173	12107	GS077	9/25/2019 10:12	2519	2336	3067	No
44-10	ES0118	216173	12107	GS077	9/25/2019 10:14	2396	2336	3067	No
44-10	ES0118	216173	12107	GS077	9/25/2019 10:15	2386	2336	3067	No
44-10	ES0118	216173	12107	GS078	9/25/2019 10:18	2384	2336	3067	No
44-10	ES0118	216173	12107	GS078	9/25/2019 10:20	2457	2336	3067	No
44-10	ES0118	216173	12107	GS078	9/25/2019 10:21	2415	2336	3067	No
44-10	ES0118	216173	12107	GS079	9/25/2019 10:24	2573	2336	3067	No
44-10	ES0118	216173	12107	GS079	9/25/2019 10:26	2460	2336	3067	No
44-10	ES0118	216173	12107	GS079	9/25/2019 10:27	2509	2336	3067	No
44-10	ES0118	216173	12107	GS080	9/25/2019 10:30	2430	2336	3067	No
44-10	ES0118	216173	12107	GS080	9/25/2019 10:32	2380	2336	3067	No
44-10	ES0118	216173	12107	GS080	9/25/2019 10:34	2457	2336	3067	No
44-10	ES0118	216173	12107	GS081	9/25/2019 10:36	2438	2336	3067	No
44-10	ES0118	216173	12107	GS081	9/25/2019 10:38	2357	2336	3067	No
44-10	ES0118	216173	12107	GS081	9/25/2019 10:39	2403	2336	3067	No
44-10	ES0118	216173	12107	GS082	9/25/2019 12:23	2365	2336	3067	No
44-10	ES0118	216173	12107	GS082	9/25/2019 12:25	2419	2336	3067	No
44-10	ES0118	216173	12107	GS082	9/25/2019 12:26	2421	2336	3067	No
44-10	ES0118	216173	12107	GS083	9/25/2019 12:29	2365	2336	3067	No
44-10	ES0118	216173	12107	GS083	9/25/2019 12:31	2521	2336	3067	No
44-10	ES0118	216173	12107	GS083	9/25/2019 12:32	2492	2336	3067	No
44-10	ES0118	216173	12107	GS084	9/25/2019 12:35	2372	2336	3067	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	ES0118	216173	12107	GS084	9/25/2019 12:37	2356	2336	3067	No
44-10	ES0118	216173	12107	GS084	9/25/2019 12:39	2346	2336	3067	No
44-10	ES0118	216173	12107	GS085	9/25/2019 12:41	2384	2336	3067	No
44-10	ES0118	216173	12107	GS085	9/25/2019 12:43	2388	2336	3067	No
44-10	ES0118	216173	12107	GS085	9/25/2019 12:45	2399	2336	3067	No
44-10	ES0118	216173	12107	GS086	9/25/2019 12:47	2425	2336	3067	No
44-10	ES0118	216173	12107	GS086	9/25/2019 12:50	2423	2336	3067	No
44-10	ES0118	216173	12107	GS086	9/25/2019 12:51	2496	2336	3067	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
QC REPLICATE SCANS									
44-10	PR311750	266656	12107	GS001	10/10/2019 7:45	2211	2066	2753	No
44-10	PR311750	266656	12107	GS001	10/10/2019 7:47	2106	2066	2753	No
44-10	PR311750	266656	12107	GS001	10/10/2019 7:49	2137	2066	2753	No
44-10	PR311750	266656	12107	GS002	10/10/2019 7:51	2203	2066	2753	No
44-10	PR311750	266656	12107	GS002	10/10/2019 7:53	2174	2066	2753	No
44-10	PR311750	266656	12107	GS002	10/10/2019 7:55	2258	2066	2753	No
44-10	PR311750	266656	12107	GS003	10/10/2019 7:57	2370	2066	2753	No
44-10	PR311750	266656	12107	GS003	10/10/2019 7:59	2199	2066	2753	No
44-10	PR311750	266656	12107	GS003	10/10/2019 8:01	2115	2066	2753	No
44-10	PR311750	266656	12107	GS004	10/10/2019 8:03	2346	2066	2753	No
44-10	PR311750	266656	12107	GS004	10/10/2019 8:05	2375	2066	2753	No
44-10	PR311750	266656	12107	GS004	10/10/2019 8:07	2186	2066	2753	No
44-10	PR311750	266656	12107	GS005	10/10/2019 8:09	2253	2066	2753	No
44-10	PR311750	266656	12107	GS005	10/10/2019 8:11	2211	2066	2753	No
44-10	PR311750	266656	12107	GS005	10/10/2019 8:13	2160	2066	2753	No
44-10	PR311750	266656	12107	GS006	10/10/2019 8:15	2235	2066	2753	No
44-10	PR311750	266656	12107	GS006	10/10/2019 8:17	2196	2066	2753	No
44-10	PR311750	266656	12107	GS006	10/10/2019 8:19	2132	2066	2753	No
44-10	PR311750	266656	12107	GS007	10/10/2019 8:21	2239	2066	2753	No
44-10	PR311750	266656	12107	GS007	10/10/2019 8:23	2082	2066	2753	No
44-10	PR311750	266656	12107	GS007	10/10/2019 8:25	2281	2066	2753	No
44-10	PR311750	266656	12107	GS008	10/10/2019 8:27	2284	2066	2753	No
44-10	PR311750	266656	12107	GS008	10/10/2019 8:29	2272	2066	2753	No
44-10	PR311750	266656	12107	GS008	10/10/2019 8:31	2120	2066	2753	No
44-10	PR311750	266656	12107	GS009	10/10/2019 8:33	2159	2066	2753	No
44-10	PR311750	266656	12107	GS009	10/10/2019 8:35	2183	2066	2753	No
44-10	PR311750	266656	12107	GS009	10/10/2019 8:37	2177	2066	2753	No
44-10	PR311750	266656	12107	GS010	10/10/2019 8:39	2139	2066	2753	No
44-10	PR311750	266656	12107	GS010	10/10/2019 8:41	2323	2066	2753	No
44-10	PR311750	266656	12107	GS010	10/10/2019 8:43	2335	2066	2753	No
44-10	PR311750	266656	12107	GS011	10/10/2019 8:45	2280	2066	2753	No
44-10	PR311750	266656	12107	GS011	10/10/2019 8:47	2217	2066	2753	No
44-10	PR311750	266656	12107	GS011	10/10/2019 8:49	2200	2066	2753	No
44-10	PR311750	266656	12107	GS012	10/10/2019 8:51	2246	2066	2753	No
44-10	PR311750	266656	12107	GS012	10/10/2019 8:53	2244	2066	2753	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	12107	GS012	10/10/2019 8:55	2272	2066	2753	No
44-10	PR311750	266656	12107	GS013	10/10/2019 8:57	2202	2066	2753	No
44-10	PR311750	266656	12107	GS013	10/10/2019 8:59	2296	2066	2753	No
44-10	PR311750	266656	12107	GS013	10/10/2019 9:01	2207	2066	2753	No
44-10	PR311750	266656	12107	GS014	10/10/2019 9:03	2279	2066	2753	No
44-10	PR311750	266656	12107	GS014	10/10/2019 9:05	2230	2066	2753	No
44-10	PR311750	266656	12107	GS014	10/10/2019 9:07	2190	2066	2753	No
44-10	PR311750	266656	12107	GS015	10/10/2019 9:09	2349	2066	2753	No
44-10	PR311750	266656	12107	GS015	10/10/2019 9:11	2276	2066	2753	No
44-10	PR311750	266656	12107	GS015	10/10/2019 9:13	2317	2066	2753	No
44-10	PR311750	266656	12107	GS016	10/10/2019 9:15	2318	2066	2753	No
44-10	PR311750	266656	12107	GS016	10/10/2019 9:17	2257	2066	2753	No
44-10	PR311750	266656	12107	GS016	10/10/2019 9:19	2296	2066	2753	No
44-10	PR311750	266656	12107	GS017	10/10/2019 9:21	2266	2066	2753	No
44-10	PR311750	266656	12107	GS017	10/10/2019 9:23	2291	2066	2753	No
44-10	PR311750	266656	12107	GS017	10/10/2019 9:25	2231	2066	2753	No
44-10	PR311750	266656	12107	GS018	10/10/2019 9:27	2255	2066	2753	No
44-10	PR311750	266656	12107	GS018	10/10/2019 9:29	2319	2066	2753	No
44-10	PR311750	266656	12107	GS018	10/10/2019 9:31	2226	2066	2753	No
44-10	PR311750	266656	12107	GS019	10/10/2019 9:33	2321	2066	2753	No
44-10	PR311750	266656	12107	GS019	10/10/2019 9:35	2259	2066	2753	No
44-10	PR311750	266656	12107	GS019	10/10/2019 9:37	2274	2066	2753	No
44-10	PR311750	266656	12107	GS020	10/10/2019 9:39	2254	2066	2753	No
44-10	PR311750	266656	12107	GS020	10/10/2019 9:41	2307	2066	2753	No
44-10	PR311750	266656	12107	GS020	10/10/2019 9:43	2246	2066	2753	No
44-10	PR311750	266656	12107	GS021	10/10/2019 9:45	2427	2066	2753	No
44-10	PR311750	266656	12107	GS021	10/10/2019 9:47	2241	2066	2753	No
44-10	PR311750	266656	12107	GS021	10/10/2019 9:49	2246	2066	2753	No
44-10	PR311750	266656	12107	GS022	10/10/2019 9:51	2370	2066	2753	No
44-10	PR311750	266656	12107	GS022	10/10/2019 9:53	2237	2066	2753	No
44-10	PR311750	266656	12107	GS022	10/10/2019 9:57	2268	2066	2753	No
44-10	PR316938	293136	12107	GS023	10/10/2019 7:57	2249	2096	2788	No
44-10	PR316938	293136	12107	GS023	10/10/2019 7:59	2266	2096	2788	No
44-10	PR316938	293136	12107	GS023	10/10/2019 8:01	2332	2096	2788	No
44-10	PR316938	293136	12107	GS024	10/10/2019 8:03	2409	2096	2788	No
44-10	PR316938	293136	12107	GS024	10/10/2019 8:05	2198	2096	2788	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	PR316938	293136	12107	GS024	10/10/2019 8:07	2255	2096	2788	No
44-10	PR316938	293136	12107	GS025	10/10/2019 8:10	2285	2096	2788	No
44-10	PR316938	293136	12107	GS025	10/10/2019 8:12	2331	2096	2788	No
44-10	PR316938	293136	12107	GS025	10/10/2019 8:14	2402	2096	2788	No
44-10	PR316938	293136	12107	GS026	10/10/2019 8:16	2328	2096	2788	No
44-10	PR316938	293136	12107	GS026	10/10/2019 8:18	2312	2096	2788	No
44-10	PR316938	293136	12107	GS026	10/10/2019 8:20	2198	2096	2788	No
44-10	PR316938	293136	12107	GS027	10/10/2019 8:22	2382	2096	2788	No
44-10	PR316938	293136	12107	GS027	10/10/2019 8:24	2367	2096	2788	No
44-10	PR316938	293136	12107	GS027	10/10/2019 8:26	2329	2096	2788	No
44-10	PR316938	293136	12107	GS028	10/10/2019 8:28	2267	2096	2788	No
44-10	PR316938	293136	12107	GS028	10/10/2019 8:30	2380	2096	2788	No
44-10	PR316938	293136	12107	GS028	10/10/2019 8:32	2251	2096	2788	No
44-10	PR316938	293136	12107	GS029	10/10/2019 8:34	2481	2096	2788	No
44-10	PR316938	293136	12107	GS029	10/10/2019 8:36	2423	2096	2788	No
44-10	PR316938	293136	12107	GS029	10/10/2019 8:38	2361	2096	2788	No
44-10	PR316938	293136	12107	GS030	10/10/2019 8:40	2427	2096	2788	No
44-10	PR316938	293136	12107	GS030	10/10/2019 8:43	2221	2096	2788	No
44-10	PR316938	293136	12107	GS030	10/10/2019 8:45	2411	2096	2788	No
44-10	PR316938	293136	12107	GS031	10/10/2019 8:47	2377	2096	2788	No
44-10	PR316938	293136	12107	GS031	10/10/2019 8:49	2237	2096	2788	No
44-10	PR316938	293136	12107	GS031	10/10/2019 8:51	2359	2096	2788	No
44-10	PR316938	293136	12107	GS032	10/10/2019 8:53	2357	2096	2788	No
44-10	PR316938	293136	12107	GS032	10/10/2019 8:55	2323	2096	2788	No
44-10	PR316938	293136	12107	GS032	10/10/2019 8:57	2360	2096	2788	No
44-10	PR316938	293136	12107	GS033	10/10/2019 8:59	2402	2096	2788	No
44-10	PR316938	293136	12107	GS033	10/10/2019 9:01	2337	2096	2788	No
44-10	PR316938	293136	12107	GS033	10/10/2019 9:03	2350	2096	2788	No
44-10	PR316938	293136	12107	GS034	10/10/2019 9:05	2398	2096	2788	No
44-10	PR316938	293136	12107	GS034	10/10/2019 9:08	2368	2096	2788	No
44-10	PR316938	293136	12107	GS034	10/10/2019 9:10	2360	2096	2788	No
44-10	PR316938	293136	12107	GS035	10/10/2019 9:12	2382	2096	2788	No
44-10	PR316938	293136	12107	GS035	10/10/2019 9:14	2441	2096	2788	No
44-10	PR316938	293136	12107	GS035	10/10/2019 9:17	2379	2096	2788	No
44-10	PR316938	293136	12107	GS036	10/10/2019 9:19	2316	2096	2788	No
44-10	PR316938	293136	12107	GS036	10/10/2019 9:21	2414	2096	2788	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	PR316938	293136	12107	GS036	10/10/2019 9:23	2453	2096	2788	No
44-10	PR316938	293136	12107	GS037	10/10/2019 9:25	2451	2096	2788	No
44-10	PR316938	293136	12107	GS037	10/10/2019 9:27	2409	2096	2788	No
44-10	PR316938	293136	12107	GS037	10/10/2019 9:29	2328	2096	2788	No
44-10	PR316938	293136	12107	GS038	10/10/2019 9:31	2361	2096	2788	No
44-10	PR316938	293136	12107	GS038	10/10/2019 9:33	2366	2096	2788	No
44-10	PR316938	293136	12107	GS038	10/10/2019 9:35	2326	2096	2788	No
44-10	PR316938	293136	12107	GS039	10/10/2019 9:38	2515	2096	2788	No
44-10	PR316938	293136	12107	GS039	10/10/2019 9:40	2341	2096	2788	No
44-10	PR316938	293136	12107	GS039	10/10/2019 9:42	2378	2096	2788	No
44-10	PR316938	293136	12107	GS040	10/10/2019 9:44	2362	2096	2788	No
44-10	PR316938	293136	12107	GS040	10/10/2019 9:46	2559	2096	2788	No
44-10	PR316938	293136	12107	GS040	10/10/2019 9:48	2668	2096	2788	No
44-10	PR316938	293136	12107	GS041	10/10/2019 9:50	2610	2096	2788	No
44-10	PR316938	293136	12107	GS041	10/10/2019 9:53	2416	2096	2788	No
44-10	PR316938	293136	12107	GS041	10/10/2019 9:55	2370	2096	2788	No
44-10	PR316938	293136	12107	GS042	10/10/2019 9:57	2543	2096	2788	No
44-10	PR316938	293136	12107	GS042	10/10/2019 9:59	2485	2096	2788	No
44-10	PR316938	293136	12107	GS042	10/10/2019 10:01	2458	2096	2788	No
44-10	PR316938	293136	12107	GS043	10/10/2019 10:03	2483	2096	2788	No
44-10	PR316938	293136	12107	GS043	10/10/2019 10:05	2520	2096	2788	No
44-10	PR316938	293136	12107	GS043	10/10/2019 10:07	2688	2096	2788	No
44-10	PR316938	293136	12107	GS044	10/10/2019 10:09	2522	2096	2788	No
44-10	PR316938	293136	12107	GS044	10/10/2019 10:11	2576	2096	2788	No
44-10	PR316938	293136	12107	GS044	10/10/2019 10:13	2323	2096	2788	No
44-10	PR308037	266657	12107	GS045	10/10/2019 7:48	2264	2130	2828	No
44-10	PR308037	266657	12107	GS045	10/10/2019 7:50	2344	2130	2828	No
44-10	PR308037	266657	12107	GS045	10/10/2019 7:52	2280	2130	2828	No
44-10	PR308037	266657	12107	GS046	10/10/2019 7:56	2265	2130	2828	No
44-10	PR308037	266657	12107	GS046	10/10/2019 7:58	2335	2130	2828	No
44-10	PR308037	266657	12107	GS046	10/10/2019 8:00	2143	2130	2828	No
44-10	PR308037	266657	12107	GS047	10/10/2019 8:04	2229	2130	2828	No
44-10	PR308037	266657	12107	GS047	10/10/2019 8:06	2514	2130	2828	No
44-10	PR308037	266657	12107	GS047	10/10/2019 8:08	2412	2130	2828	No
44-10	PR308037	266657	12107	GS048	10/10/2019 8:12	2595	2130	2828	No
44-10	PR308037	266657	12107	GS048	10/10/2019 8:14	2677	2130	2828	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	PR308037	266657	12107	GS048	10/10/2019 8:16	2210	2130	2828	No
44-10	PR308037	266657	12107	GS049	10/10/2019 8:18	2152	2130	2828	No
44-10	PR308037	266657	12107	GS049	10/10/2019 8:21	2648	2130	2828	No
44-10	PR308037	266657	12107	GS049	10/10/2019 8:23	2468	2130	2828	No
44-10	PR308037	266657	12107	GS050	10/10/2019 8:26	2533	2130	2828	No
44-10	PR308037	266657	12107	GS050	10/10/2019 8:28	2771	2130	2828	No
44-10	PR308037	266657	12107	GS050	10/10/2019 8:30	2382	2130	2828	No
44-10	PR308037	266657	12107	GS051	10/10/2019 9:45	2961	2993	3820	No
44-10	PR308037	266657	12107	GS051	10/10/2019 9:48	2853	2993	3820	No
44-10	PR308037	266657	12107	GS051	10/10/2019 9:50	2291	2130	2828	No
44-10	PR308037	266657	12107	GS052	10/10/2019 9:53	2464	2130	2828	No
44-10	PR308037	266657	12107	GS052	10/10/2019 9:55	3052	2993	3820	No
44-10	PR308037	266657	12107	GS052	10/10/2019 9:58	2873	2993	3820	No
44-10	PR308037	266657	12107	GS053	10/10/2019 10:01	3042	2993	3820	No
44-10	PR308037	266657	12107	GS053	10/10/2019 10:04	3188	2993	3820	No
44-10	PR308037	266657	12107	GS053	10/10/2019 10:06	2243	2130	2828	No
44-10	PR308037	266657	12107	GS054	10/10/2019 10:11	3377	2993	3820	No
44-10	PR308037	266657	12107	GS054	10/10/2019 10:13	3194	2993	3820	No
44-10	PR308037	266657	12107	GS054	10/10/2019 10:15	2371	2130	2828	No
44-10	PR308037	266657	12107	GS055	10/10/2019 10:19	2716	2130	2828	No
44-10	PR308037	266657	12107	GS055	10/10/2019 10:21	2807	2130	2828	No
44-10	PR308037	266657	12107	GS055	10/10/2019 10:23	2433	2130	2828	No
44-10	PR308037	266657	12107	GS056	10/10/2019 10:26	2739	2130	2828	No
44-10	PR308037	266657	12107	GS056	10/10/2019 10:28	2520	2130	2828	No
44-10	PR308037	266657	12107	GS056	10/10/2019 10:30	2510	2130	2828	No
44-10	PR308037	266657	12107	GS057	10/10/2019 10:34	2409	2130	2828	No
44-10	PR308037	266657	12107	GS057	10/10/2019 10:36	2666	2130	2828	No
44-10	PR308037	266657	12107	GS057	10/10/2019 10:38	2708	2130	2828	No
44-10	PR308037	266657	12107	GS058	10/10/2019 10:41	2596	2130	2828	No
44-10	PR308037	266657	12107	GS058	10/10/2019 10:43	2423	2130	2828	No
44-10	PR308037	266657	12107	GS058	10/10/2019 10:45	2451	2130	2828	No
44-10	PR308037	266657	12107	GS059	10/10/2019 10:47	2641	2130	2828	No
44-10	PR308037	266657	12107	GS059	10/10/2019 10:50	2598	2130	2828	No
44-10	PR308037	266657	12107	GS059	10/10/2019 10:52	2663	2130	2828	No
44-10	PR308037	266657	12107	GS060	10/10/2019 10:55	2808	2130	2828	No
44-10	PR308037	266657	12107	GS060	10/10/2019 10:57	2658	2130	2828	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	PR308037	266657	12107	GS060	10/10/2019 10:59	2513	2130	2828	No
44-10	PR308037	266657	12107	GS061	10/10/2019 11:54	2577	2130	2828	No
44-10	PR308037	266657	12107	GS061	10/10/2019 11:56	2638	2130	2828	No
44-10	PR308037	266657	12107	GS061	10/10/2019 11:58	2534	2130	2828	No
44-10	PR308037	266657	12107	GS062	10/10/2019 12:01	2425	2130	2828	No
44-10	PR308037	266657	12107	GS062	10/10/2019 12:03	2556	2130	2828	No
44-10	PR308037	266657	12107	GS062	10/10/2019 12:05	2440	2130	2828	No
44-10	PR308037	266657	12107	GS063	10/10/2019 12:08	2594	2130	2828	No
44-10	PR308037	266657	12107	GS063	10/10/2019 12:10	2796	2130	2828	No
44-10	PR308037	266657	12107	GS063	10/10/2019 12:13	2460	2130	2828	No
44-10	PR308037	266657	12107	GS064	10/10/2019 12:15	2388	2130	2828	No
44-10	PR308037	266657	12107	GS064	10/10/2019 12:17	2813	2130	2828	No
44-10	PR308037	266657	12107	GS064	10/10/2019 12:20	2448	2130	2828	No
44-10	PR308037	266657	12107	GS065	10/10/2019 12:23	2342	2130	2828	No
44-10	PR308037	266657	12107	GS065	10/10/2019 12:25	2689	2130	2828	No
44-10	PR308037	266657	12107	GS065	10/10/2019 12:27	2565	2130	2828	No
44-10	PR375273	304730	12107	GS066	10/10/2019 8:03	2617	2255	2973	No
44-10	PR375273	304730	12107	GS066	10/10/2019 8:05	2881	2255	2973	No
44-10	PR375273	304730	12107	GS066	10/10/2019 8:07	2622	2255	2973	No
44-10	PR375273	304730	12107	GS067	10/10/2019 8:10	2731	2255	2973	No
44-10	PR375273	304730	12107	GS067	10/10/2019 8:12	2748	2255	2973	No
44-10	PR375273	304730	12107	GS067	10/10/2019 8:14	2521	2255	2973	No
44-10	PR375273	304730	12107	GS068	10/10/2019 8:17	2557	2255	2973	No
44-10	PR375273	304730	12107	GS068	10/10/2019 8:19	2961	2255	2973	No
44-10	PR375273	304730	12107	GS068	10/10/2019 8:21	2703	2255	2973	No
44-10	PR375273	304730	12107	GS069	10/10/2019 8:24	2805	2255	2973	No
44-10	PR375273	304730	12107	GS069	10/10/2019 8:44	2936	2255	2973	No
44-10	PR375273	304730	12107	GS069	10/10/2019 8:48	2610	2255	2973	No
44-10	PR375273	304730	12107	GS070	10/10/2019 8:50	2529	2255	2973	No
44-10	PR375273	304730	12107	GS070	10/10/2019 8:52	2709	2255	2973	No
44-10	PR375273	304730	12107	GS070	10/10/2019 8:54	2875	2255	2973	No
44-10	PR375273	304730	12107	GS071	10/10/2019 8:56	2687	2255	2973	No
44-10	PR375273	304730	12107	GS071	10/10/2019 8:58	2919	2255	2973	No
44-10	PR375273	304730	12107	GS071	10/10/2019 9:00	2613	2255	2973	No
44-10	PR375273	304730	12107	GS072	10/10/2019 9:03	2538	2255	2973	No
44-10	PR375273	304730	12107	GS072	10/10/2019 9:05	2798	2255	2973	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR375273	304730	12107	GS072	10/10/2019 9:09	2667	2255	2973	No
44-10	PR375273	304730	12107	GS073	10/10/2019 9:12	2631	2255	2973	No
44-10	PR375273	304730	12107	GS073	10/10/2019 9:14	2637	2255	2973	No
44-10	PR375273	304730	12107	GS073	10/10/2019 9:16	2531	2255	2973	No
44-10	PR375273	304730	12107	GS074	10/10/2019 9:19	2516	2255	2973	No
44-10	PR375273	304730	12107	GS074	10/10/2019 9:21	2631	2255	2973	No
44-10	PR375273	304730	12107	GS074	10/10/2019 9:24	2739	2255	2973	No
44-10	PR375273	304730	12107	GS075	10/10/2019 9:26	2682	2255	2973	No
44-10	PR375273	304730	12107	GS075	10/10/2019 9:28	2494	2255	2973	No
44-10	PR375273	304730	12107	GS075	10/10/2019 9:30	2593	2255	2973	No
44-10	PR375273	304730	12107	GS076	10/10/2019 9:33	2506	2255	2973	No
44-10	PR375273	304730	12107	GS076	10/10/2019 9:35	2472	2255	2973	No
44-10	PR375273	304730	12107	GS076	10/10/2019 9:37	2700	2255	2973	No
44-10	PR375273	304730	12107	GS077	10/10/2019 9:39	2572	2255	2973	No
44-10	PR375273	304730	12107	GS077	10/10/2019 9:41	2497	2255	2973	No
44-10	PR375273	304730	12107	GS077	10/10/2019 9:44	2635	2255	2973	No
44-10	PR375273	304730	12107	GS078	10/10/2019 9:46	2506	2255	2973	No
44-10	PR375273	304730	12107	GS078	10/10/2019 9:48	2536	2255	2973	No
44-10	PR375273	304730	12107	GS078	10/10/2019 9:50	2595	2255	2973	No
44-10	PR375273	304730	12107	GS079	10/10/2019 9:52	2625	2255	2973	No
44-10	PR375273	304730	12107	GS079	10/10/2019 9:54	2630	2255	2973	No
44-10	PR375273	304730	12107	GS079	10/10/2019 9:56	2472	2255	2973	No
44-10	PR375273	304730	12107	GS080	10/10/2019 9:59	2540	2255	2973	No
44-10	PR375273	304730	12107	GS080	10/10/2019 10:01	2592	2255	2973	No
44-10	PR375273	304730	12107	GS080	10/10/2019 10:03	2743	2255	2973	No
44-10	PR375273	304730	12107	GS081	10/10/2019 10:05	2550	2255	2973	No
44-10	PR375273	304730	12107	GS081	10/10/2019 10:08	2666	2255	2973	No
44-10	PR375273	304730	12107	GS081	10/10/2019 10:10	2625	2255	2973	No
44-10	PR375273	304730	12107	GS082	10/10/2019 10:13	2641	2255	2973	No
44-10	PR375273	304730	12107	GS082	10/10/2019 10:15	2713	2255	2973	No
44-10	PR375273	304730	12107	GS082	10/10/2019 10:17	2615	2255	2973	No
44-10	PR375273	304730	12107	GS083	10/10/2019 10:19	2462	2255	2973	No
44-10	PR375273	304730	12107	GS083	10/10/2019 10:22	2494	2255	2973	No
44-10	PR375273	304730	12107	GS083	10/10/2019 10:24	2548	2255	2973	No
44-10	PR375273	304730	12107	GS084	10/10/2019 10:26	2598	2255	2973	No
44-10	PR375273	304730	12107	GS084	10/10/2019 10:28	2696	2255	2973	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR375273	304730	12107	GS084	10/10/2019 10:30	2500	2255	2973	No
44-10	PR375273	304730	12107	GS085	10/10/2019 10:32	2566	2255	2973	No
44-10	PR375273	304730	12107	GS085	10/10/2019 10:34	2606	2255	2973	No
44-10	PR375273	304730	12107	GS085	10/10/2019 10:37	2527	2255	2973	No
44-10	PR375273	304730	12107	GS086	10/10/2019 10:40	2664	2255	2973	No
44-10	PR375273	304730	12107	GS086	10/10/2019 10:42	2503	2255	2973	No
44-10	PR375273	304730	12107	GS086	10/10/2019 10:45	2686	2255	2973	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. 12107 **Description:** South Half of Fuel & Auxiliary Building
Classification: 1 **Type I (α) Error:** 0.05 **Number of Samples:** 17

#	Fraction of the Release Criterion						Weighted Sum (W_s)	$1-W_s$	Sign
	Radionuclides of Concern					Activity or SOF (as applicable)			
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90				
1	4.10E-02	1.20E-02	7.38E-03	8.82E-03	1.73E-05	SOF	0.069	0.931	+
2	2.12E-02	9.81E-03	2.51E-03	4.56E-03	5.89E-06	SOF	0.038	0.962	+
3	1.81E-02	6.41E-03	0.00E+00	3.91E-03	0.00E+00	SOF	0.028	0.972	+
4	3.78E-02	8.66E-03	8.26E-03	8.13E-03	1.94E-05	SOF	0.063	0.937	+
5	4.93E-02	0.00E+00	1.12E-02	1.06E-02	2.63E-05	SOF	0.071	0.929	+
6	0.00E+00	1.02E-03	0.00E+00	0.00E+00	0.00E+00	SOF	0.001	0.999	+
7	2.70E-02	0.00E+00	2.84E-03	5.82E-03	6.66E-06	SOF	0.036	0.964	+
8	4.62E-03	4.78E-03	0.00E+00	9.95E-04	0.00E+00	SOF	0.010	0.990	+
9	6.06E-03	1.03E-02	6.86E-03	1.30E-03	1.61E-05	SOF	0.025	0.975	+
10	3.61E-03	4.90E-03	0.00E+00	7.77E-04	0.00E+00	SOF	0.009	0.991	+
11	3.78E-02	8.54E-03	0.00E+00	8.13E-03	0.00E+00	SOF	0.054	0.946	+
12	5.58E-02	8.19E-03	0.00E+00	1.20E-02	0.00E+00	SOF	0.076	0.924	+
13	4.13E-03	1.68E-03	5.70E-04	8.90E-04	1.34E-06	SOF	0.007	0.993	+
14	2.79E-02	1.50E-02	4.10E-03	6.00E-03	9.63E-06	SOF	0.053	0.947	+
15	1.61E-02	7.85E-03	4.35E-03	3.47E-03	1.02E-05	SOF	0.032	0.968	+
16	3.92E-02	1.65E-02	0.00E+00	8.45E-03	0.00E+00	SOF	0.064	0.936	+
17	6.71E-03	2.74E-04	6.25E-03	1.44E-03	1.47E-05	SOF	0.015	0.985	+

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

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

Prepared By (RE): J Graham (Print Name) / (Signature) 12/16/19 (Date)

Peer Reviewed By (RE): R.J. Mandis (Print Name) / (Signature) 12-16-19 (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #:	12000	Survey Unit #:	12107	Survey Unit Name:	South Half of Fuel & Auxiliary Buildings
Sample Plan#:	L1-12107A-F				

Sample Description: Comparison of split samples collected from systematic surface soil sample #9. The samples were analyzed using gamma spectroscopy by on-site HPGe system. The standard/comparison samples were L1-12107A-FSGS-009SS/L1-12107A-FQGS-009SS.

STANDARD					COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
K-40	9.06E+00	5.89E-01	15.40	0.6 - 1.66	9.06E+00	5.91E-01	1.0	Y

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

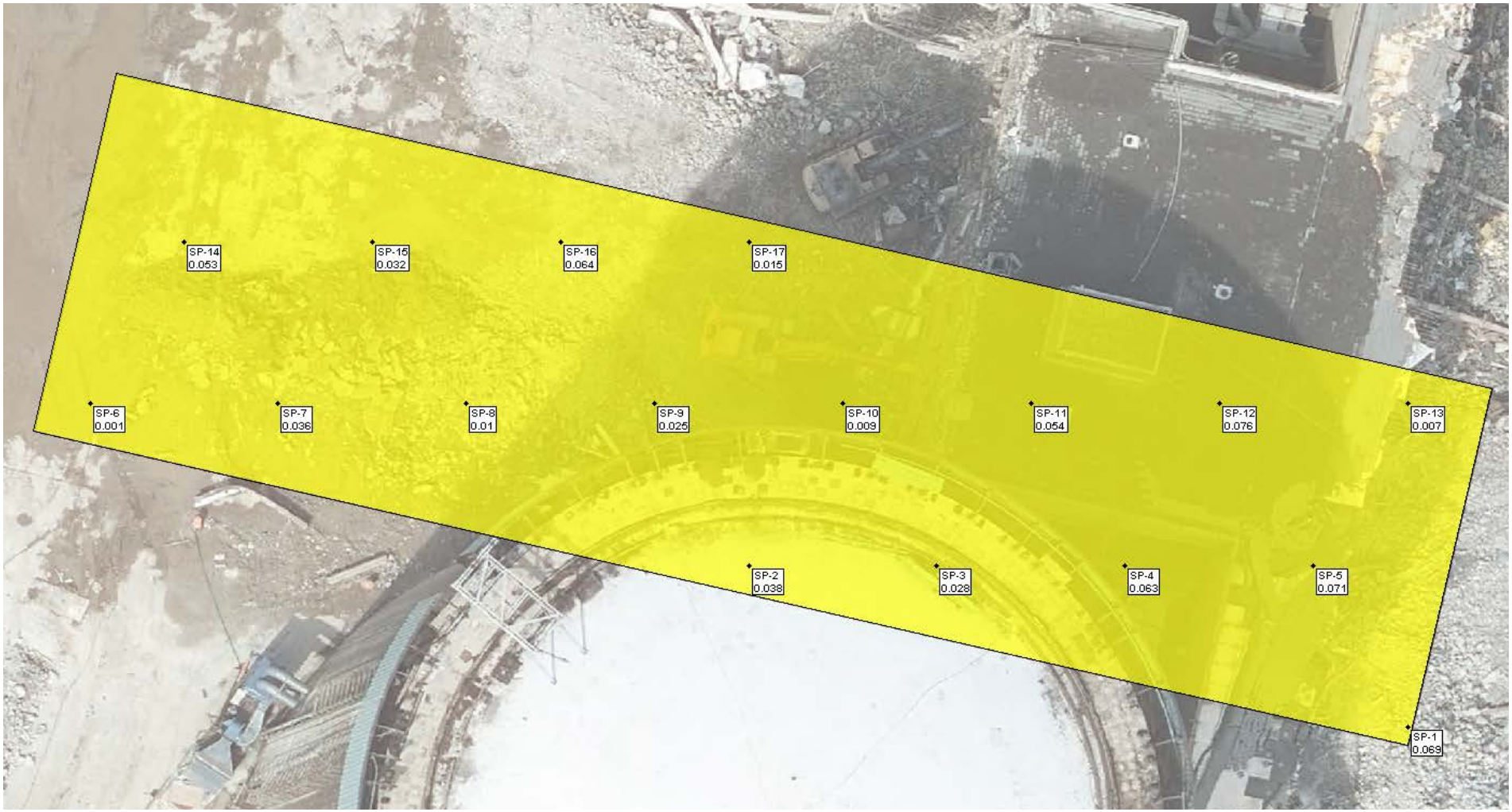
Table 4-1 from the QAPP is reproduced below to show acceptance criteria used to assess split samples.

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

Performed by:	Date:	Reveiwed by:	Date:
J Graham	12/16/19	R.S. Mundia	12-16-19

ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot

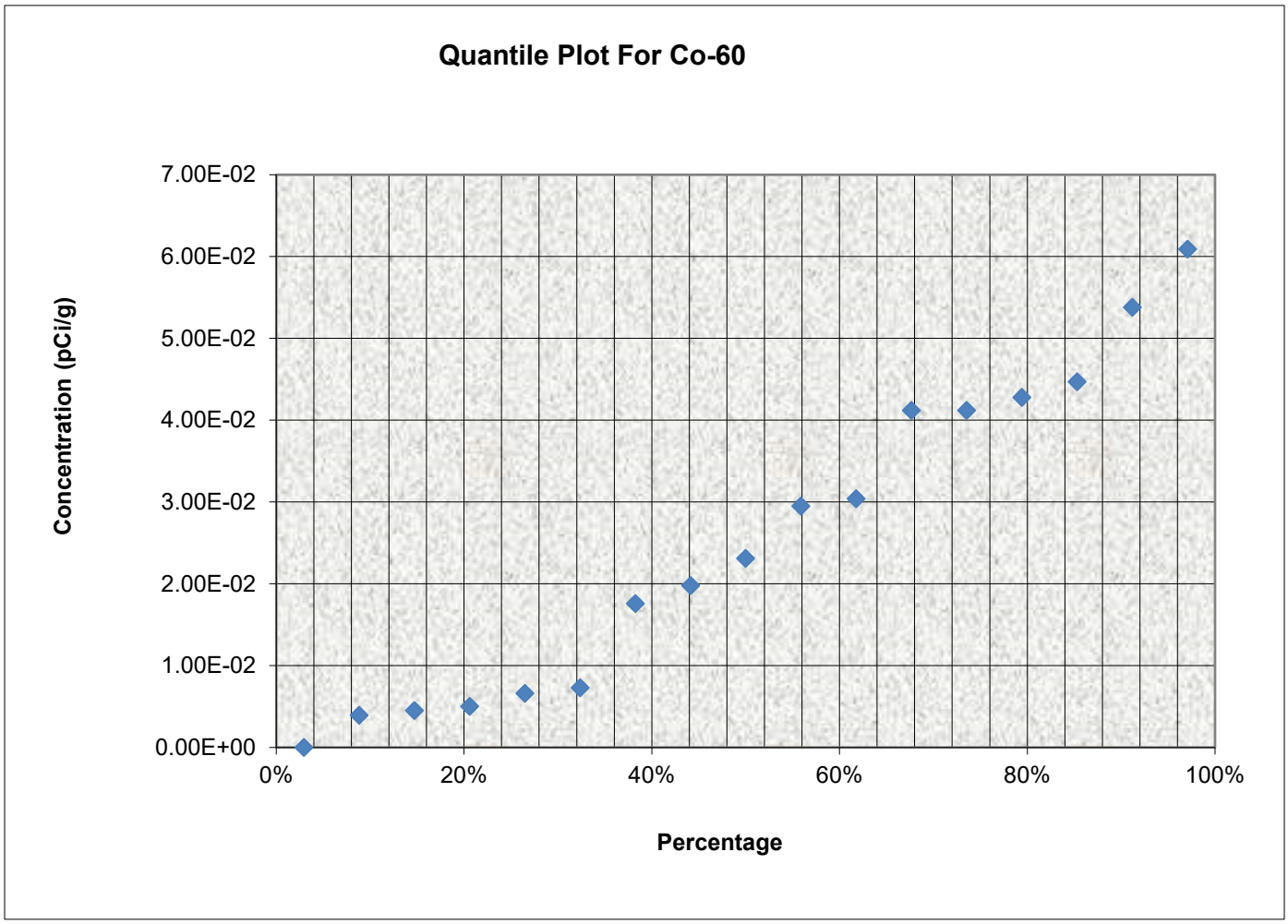


QUANTILE PLOT FOR Co-60

Survey Unit: 12107

Survey Unit Name: South Half of Fuel & Auxiliary Buildings

Mean: 2.54E-02 pCi/g

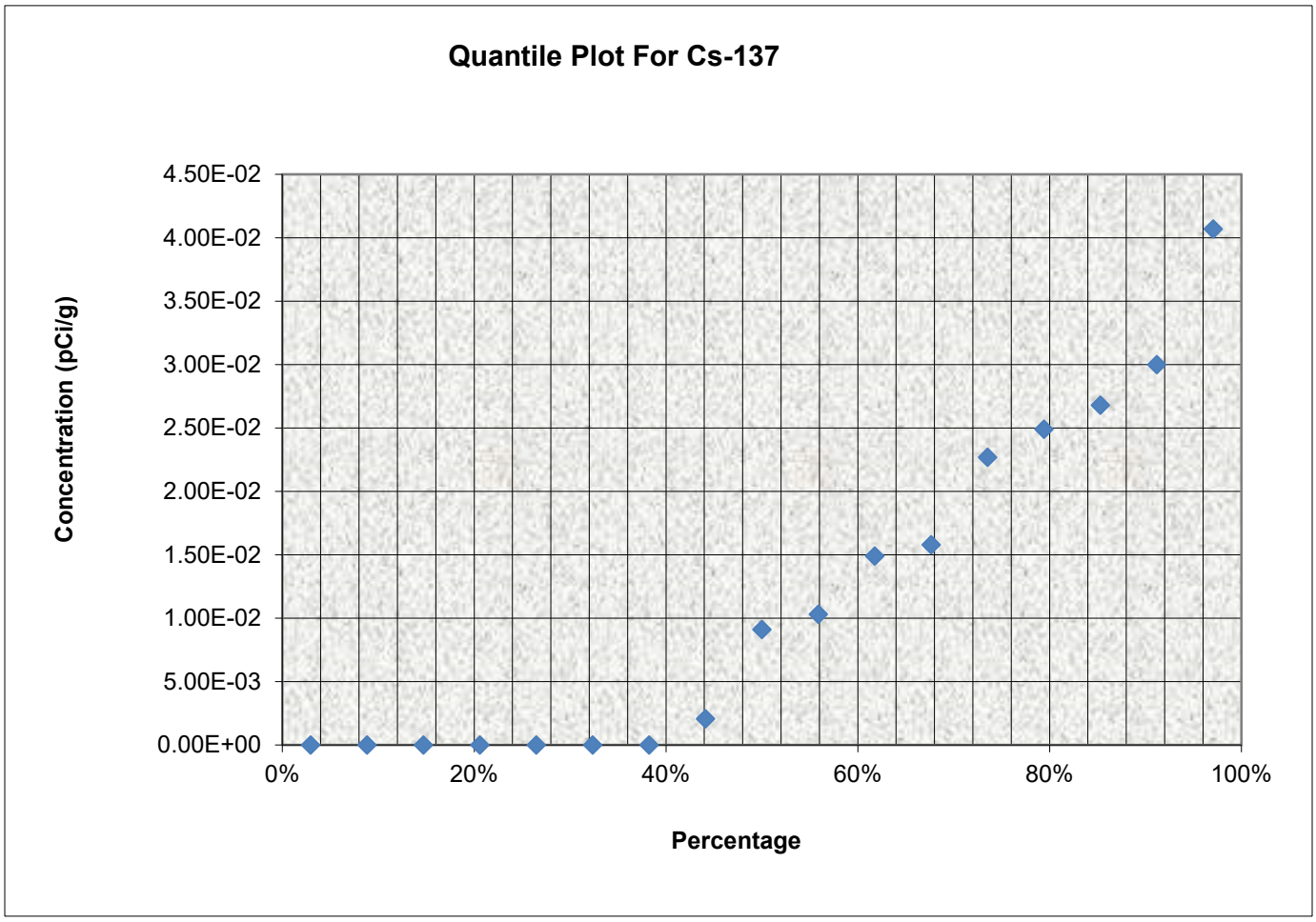


QUANTILE PLOT FOR Cs-137

Survey Unit: 12107

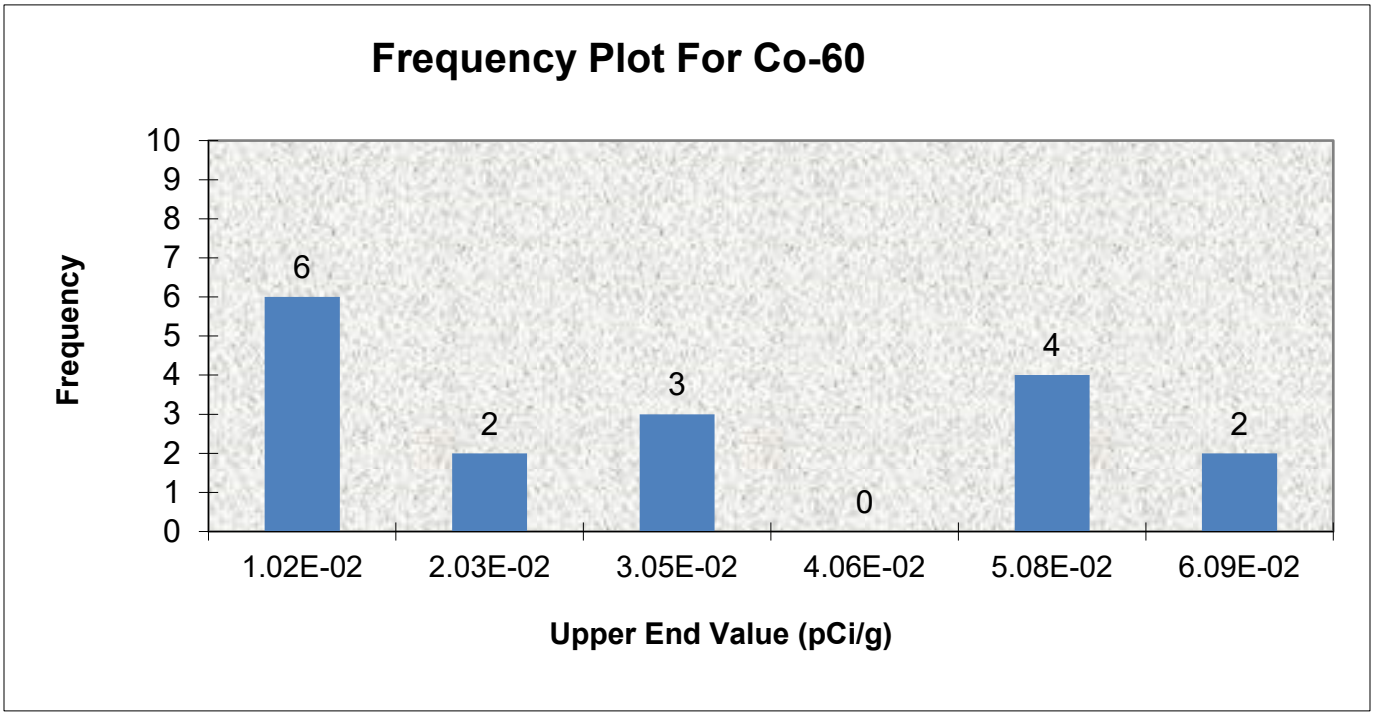
Survey Unit Name: South Half of Fuel & Auxiliary Buildings

Mean: 1.16E-02 pCi/g



HISTOGRAM FOR Co-60

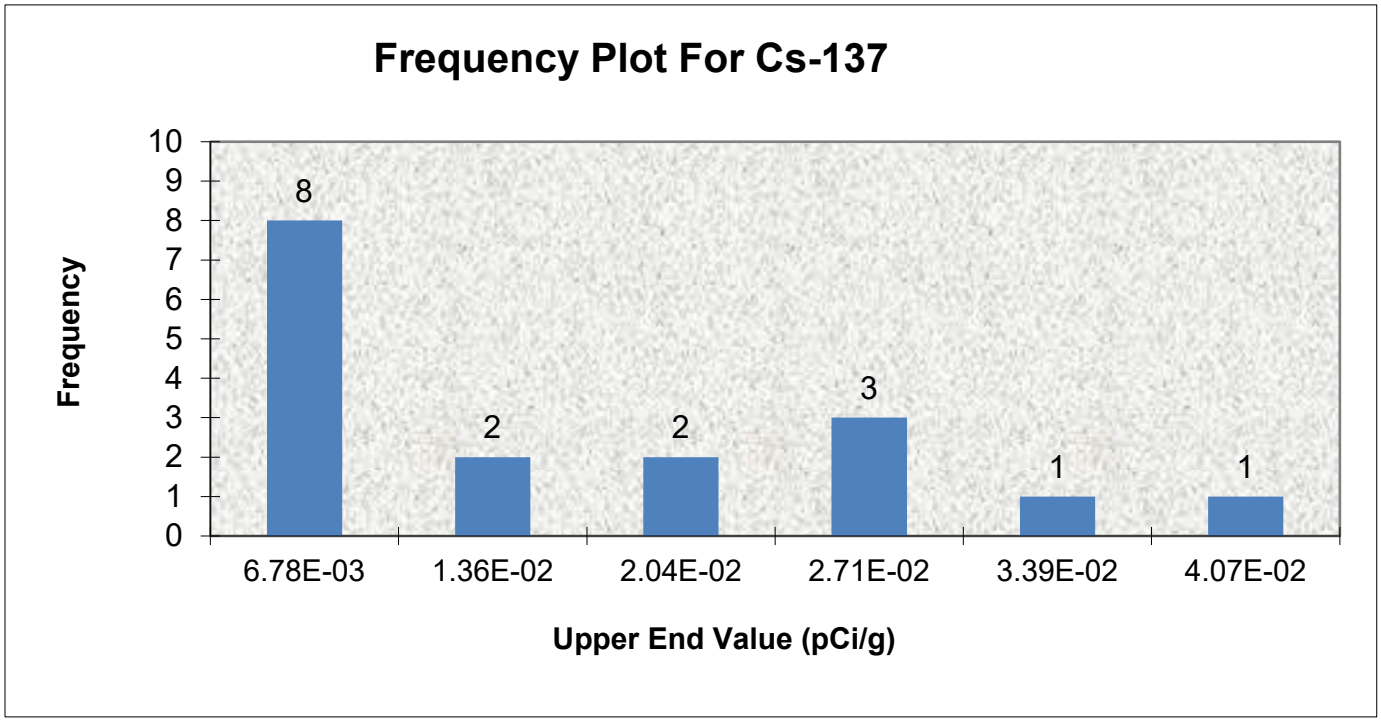
Survey Unit:	12107	
Survey Unit Name:	South Half of Fuel & Auxiliary Buildings	
Mean:	2.54E-02	pCi/g
Median:	2.31E-02	pCi/g
ST DEV:	0.019	
Skew:	0.296	



Upper Value	Observation Frequency	Observation %
1.02E-02	6	35%
2.03E-02	2	12%
3.05E-02	3	18%
4.06E-02	0	0%
5.08E-02	4	24%
6.09E-02	2	12%
TOTAL	17	100%

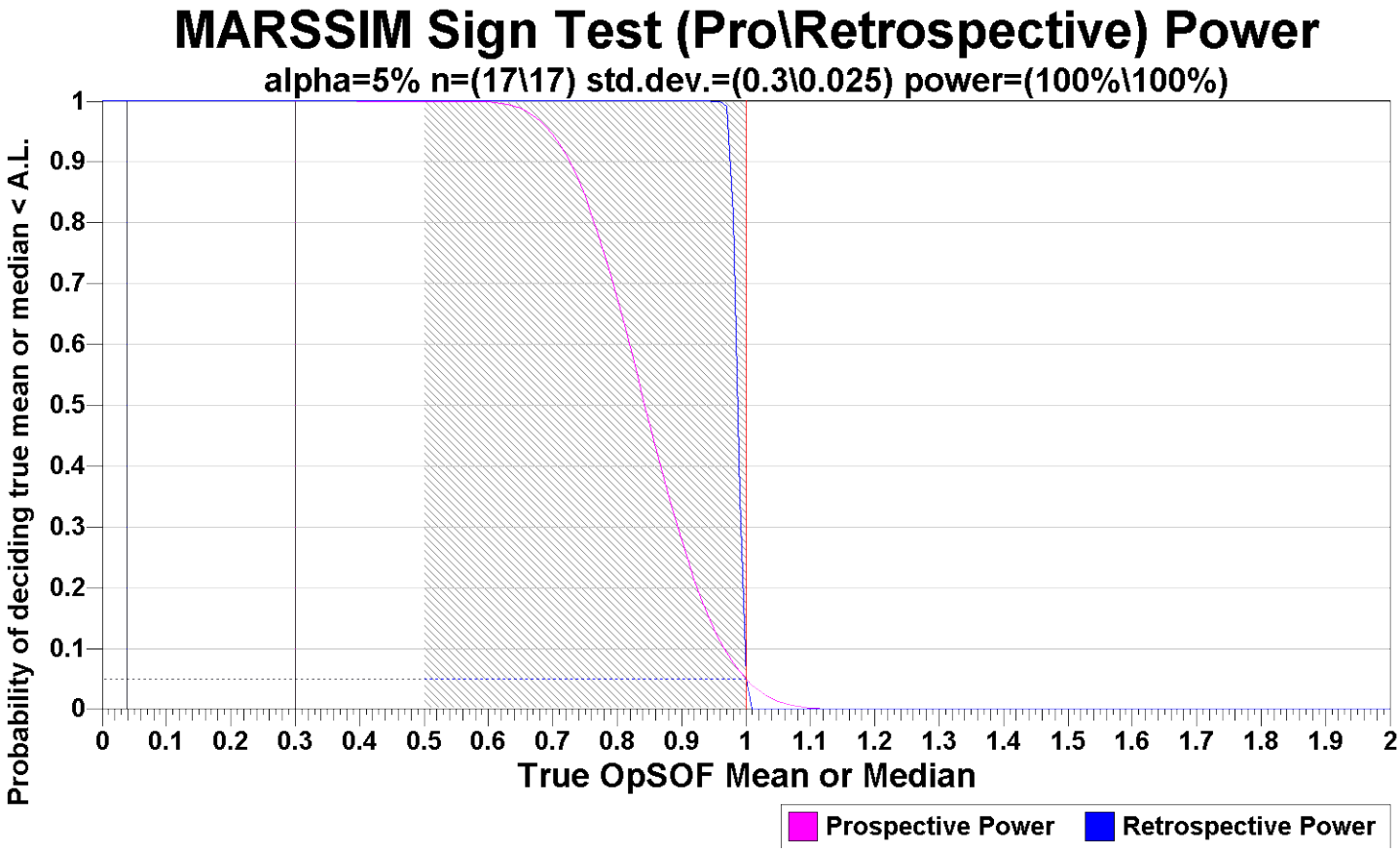
HISTOGRAM FOR Cs-137

Survey Unit:	12107	
Survey Unit Name:	South Half of Fuel & Auxiliary Buildings	
Mean:	1.16E-02	pCi/g
Median:	9.11E-03	pCi/g
ST DEV:	0.013	
Skew:	0.813	



Upper Value	Observation Frequency	Observation %
6.78E-03	8	47%
1.36E-02	2	12%
2.04E-02	2	12%
2.71E-02	3	18%
3.39E-02	1	6%
4.07E-02	1	6%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Unit 12107



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 30-Sep-19-10019

L1-12107A-FSGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10019
Sample Description	: L1-12107A-FSGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.604E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:00:00AM
Acquisition Started	: 9/30/2019 9:42:57AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80067
Fill Height	: 1603.87 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 9:58:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/1/19 - 0700

J Graham

Analysis Report for 30-Sep-19-10019

L1-12107A-FSGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.55	947 -	959	954.65	1.02E+02	14.40	4.02E+01	0.82
2	351.96	1401 -	1415	1407.85	8.06E+01	12.62	2.74E+01	1.20
3	609.17	2428 -	2444	2435.96	7.26E+01	9.95	8.42E+00	1.08
4	911.33	3639 -	3650	3644.36	2.64E+01	7.81	1.36E+01	0.41
5	1460.69	5830 -	5855	5843.12	4.27E+02	21.64	9.65E+00	2.08

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	8.83E+00	5.89E-01
Bi-211	0.88	351.07	*	13.02	5.32E-01	9.36E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.58E-01	2.58E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.98E-01	2.96E-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 30-Sep-19-10019

L1-12107A-FSGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.94E-01	3.42E-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	1.65E-01	4.93E-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 30-Sep-19-10019

L1-12107A-FSGS-001SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	8.83E+00	5.89E-01	
?	Bi-211	0.880	5.32E-01	9.36E-02	
	Pb-212	0.999	1.58E-01	2.58E-02	
	Bi-214	0.999	1.98E-01	2.96E-02	
?	Pb-214	1.000	1.94E-01	3.42E-02	
	Ac-228	0.999	1.65E-01	4.93E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10019

L1-12107A-FSGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 9:58:00AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.31E-02	5.74E-02	5.74E-02
	BE-7	477.60		10.44	-2.40E-02	3.89E-01	3.89E-01
+	K-40	1460.82	*	10.66	8.83E+00	5.07E-01	5.07E-01
	Mn-54	834.85		99.98	8.36E-03	4.80E-02	4.80E-02
	Co-60	1173.23		99.85	4.47E-02	5.64E-02	7.06E-02
		1332.49		99.98	2.42E-02		5.64E-02
	Nb-94	702.65		99.81	1.97E-02	4.28E-02	4.37E-02
		871.09		99.89	-3.62E-02		4.28E-02
	Ag-108m	79.13		6.60	6.65E-01	3.91E-02	1.52E+00
		433.94		90.50	-1.60E-02		3.91E-02
		614.28		89.80	-1.25E-02		6.91E-02
		722.94		90.80	1.30E-02		4.95E-02
	Sb-125	176.31		6.84	9.08E-02	1.16E-01	4.82E-01
		380.45		1.52	-2.40E+00		2.16E+00
		427.87		29.60	1.92E-02		1.16E-01
		463.36		10.49	9.28E-02		3.53E-01
		600.60		17.65	1.96E-01		2.52E-01
		606.71		4.98	1.49E+00		1.31E+00
		635.95		11.22	2.23E-01		3.87E-01

Analysis Report for 30-Sep-19-10019

L1-12107A-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.34E+00	1.16E-01	2.15E+00
Ba-133	79.61	2.65	1.24E+00	7.61E-02	3.59E+00
	81.00	32.90	-3.14E-01		2.43E-01
	276.40	7.16	3.08E-01		4.96E-01
	302.85	18.34	5.70E-02		1.90E-01
	356.01	62.05	-1.49E-02		7.61E-02
	383.85	8.94	1.74E-01		3.89E-01
Cs-134	475.36	1.48	3.45E+00	5.55E-02	2.70E+00
	563.25	8.34	1.91E-01		4.37E-01
	569.33	15.37	-1.59E-01		2.54E-01
	604.72	97.62	-3.14E-03		6.23E-02
	795.86	85.46	2.08E-02		5.55E-02
	801.95	8.69	-2.91E-01		4.99E-01
	1038.61	0.99	-2.76E+00		5.26E+00
	1167.97	1.79	1.04E+00		3.97E+00
	1365.19	3.02	5.91E-01		1.62E+00
Cs-137	661.66	85.10	2.68E-02	5.05E-02	5.05E-02
Eu-152	121.78	28.67	-1.58E-02	1.26E-01	1.35E-01
	244.70	7.61	2.99E-01		4.75E-01
	295.94	0.45	2.99E+00		9.18E+00
	344.28	26.60	-5.08E-02		1.26E-01
	367.79	0.86	-1.51E+00		4.24E+00
	411.12	2.24	-2.82E-01		1.59E+00
	443.96	2.83	7.14E-01		1.28E+00
	488.68	0.42	-1.92E+00		7.97E+00
	563.99	0.49	-9.95E-01		7.20E+00
	586.26	0.46	1.13E+01		1.18E+01
	678.62	0.47	-9.67E+00		8.21E+00
	688.67	0.86	-7.23E-01		4.42E+00
	719.35	0.28	1.30E+00		1.42E+01
	778.90	12.96	-1.46E-01		3.73E-01
	810.45	0.32	2.44E-01		1.54E+01
	867.37	4.26	-6.71E-01		9.83E-01
	919.33	0.43	-4.59E+00		1.26E+01
	964.08	14.65	3.59E-01		4.09E-01
	1085.87	10.24	2.25E-01		4.82E-01
	1089.74	1.73	2.55E-01		3.05E+00
	1112.07	13.69	-1.03E-01		4.19E-01
	1212.95	1.43	1.12E+00		5.00E+00
	1249.94	0.19	-1.58E+01		3.22E+01
	1299.14	1.63	8.08E-03		3.47E+00
	1408.01	21.07	-2.00E-02		1.67E-01
	1457.64	0.50	1.86E+02		4.55E+01
	1528.10	0.28	4.85E+00		1.18E+01
Eu-154	123.07	40.40	5.04E-02	9.65E-02	9.65E-02
	247.93	6.89	1.42E-01		4.72E-01
	591.76	4.95	6.80E-02		7.97E-01
	692.42	1.78	-3.14E-01		2.07E+00
	723.30	20.06	-4.67E-04		2.22E-01
	756.80	4.52	2.37E-02		8.17E-01
	873.18	12.08	1.71E-01		3.89E-01

Analysis Report for 30-Sep-19-10019

L1-12107A-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	7.36E-02	9.65E-02	5.48E-01
	1004.76	18.01	1.27E-01		3.14E-01
	1274.43	34.80	-6.24E-02		1.52E-01
	1596.48	1.80	3.82E-02		1.92E+00
Eu-155	45.30	1.31	7.22E+00	2.13E-01	1.94E+01
	60.01	1.22	-1.79E+00		2.09E+01
	86.55	30.70	3.05E-01		2.28E-01
	105.31	21.10	-8.16E-02		2.13E-01
Ra-226	186.21	3.64	7.38E-01	1.01E+00	1.01E+00
Pa-231	27.36	10.30	1.59E+00	1.43E+00	2.29E+00
	283.69	1.70	-7.82E-01		1.81E+00
	300.07	2.47	-2.59E+00		1.43E+00
	302.65	2.20	1.32E+00		1.60E+00
	330.06	1.40	2.89E+00		2.76E+00
U-235	143.76	10.96	-1.67E-01	6.47E-02	3.29E-01
	163.33	5.08	-4.36E-01		6.64E-01
	185.71	57.20	6.16E-02		6.47E-02
	202.11	1.08	-7.09E-01		3.08E+00
	205.31	5.01	1.97E-01		6.84E-01
Am-241	59.54	35.90	-1.25E-01	7.17E-01	7.17E-01

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

Apex-Gamma

Analysis Report for 30-Sep-19-10020

L1-12107A-FSGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10020
Sample Description	: L1-12107A-FSGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.699E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:02:00AM
Acquisition Started	: 9/30/2019 10:01:17AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80068
Fill Height	: 1699.37 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:16:20AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 10/1/19 - 0700

J Graham

Analysis Report for 30-Sep-19-10020

L1-12107A-FSGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.71	473 -	482	477.60	1.44E+02	20.26	1.15E+02	1.02
2	295.21	585 -	595	590.47	6.00E+01	14.39	6.10E+01	1.16
3	351.98	699 -	708	703.91	7.14E+01	13.87	5.36E+01	1.14
4	583.13	1160 -	1171	1165.85	7.64E+01	11.20	1.96E+01	1.08
5	609.25	1212 -	1223	1218.07	8.36E+01	10.82	1.34E+01	1.10
6	1460.66	2915 -	2928	2921.38	5.12E+02	22.80	3.10E+00	2.10

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.37E+00	5.83E-01
Tl-208	0.99	583.19	*	85.00	9.65E-02	1.53E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.98E-01	3.22E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.03E-01	2.89E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 30-Sep-19-10020

L1-12107A-FSGS-002SS

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	2.21E-01	5.58E-02
		351.93	*	35.60	1.54E-01	3.23E-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	0.996	9.37E+00	5.83E-01	
	Tl-208	0.999	9.65E-02	1.53E-02	
X	Bi-211	0.875			
	Pb-212	0.999	1.98E-01	3.22E-02	
	Bi-214	1.000	2.03E-01	2.89E-02	
	Pb-214	1.000	1.70E-01	2.79E-02	

Analysis Report for 30-Sep-19-10020

L1-12107A-FSGS-002SS

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10020

L1-12107A-FSGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:16:20AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.21E-02	4.94E-02	4.94E-02
	BE-7	477.60		10.44	-6.18E-02	3.36E-01	3.36E-01
+	K-40	1460.82	*	10.66	9.37E+00	2.27E-01	2.27E-01
	Mn-54	834.85		99.98	-4.34E-03	4.27E-02	4.27E-02
	Co-60	1173.23		99.85	-1.98E-02	4.91E-02	5.47E-02
		1332.49		99.98	2.31E-02		4.91E-02
	Nb-94	702.65		99.81	-4.04E-03	4.25E-02	4.25E-02
		871.09		99.89	3.73E-02		4.41E-02
	Ag-108m	79.13		6.60	3.54E-01	3.55E-02	1.15E+00
		433.94		90.50	7.56E-03		3.55E-02
		614.28		89.80	-1.02E-02		4.75E-02
		722.94		90.80	-9.15E-03		4.41E-02
	Sb-125	176.31		6.84	1.64E-01	1.07E-01	5.10E-01
		380.45		1.52	-8.45E-01		2.04E+00
		427.87		29.60	-3.45E-02		1.07E-01
		463.36		10.49	6.43E-02		3.02E-01
		600.60		17.65	-1.92E-02		1.81E-01
		606.71		4.98	3.16E-02		1.19E+00
		635.95		11.22	2.46E-02		3.33E-01

Analysis Report for 30-Sep-19-10020

L1-12107A-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-5.27E-02	1.07E-01	1.77E+00
Ba-133	79.61	2.65	1.12E+00	6.73E-02	2.78E+00
	81.00	32.90	-1.77E-01		1.83E-01
	276.40	7.16	-1.04E-01		4.42E-01
	302.85	18.34	4.89E-02		1.62E-01
	356.01	62.05	-2.93E-02		6.73E-02
	383.85	8.94	-8.80E-02		3.50E-01
Cs-134	475.36	1.48	2.06E+00	4.42E-02	2.41E+00
	563.25	8.34	2.46E-01		4.42E-01
	569.33	15.37	-1.82E-01		1.98E-01
	604.72	97.62	5.28E-03		5.46E-02
	795.86	85.46	1.70E-02		4.42E-02
	801.95	8.69	-2.22E-01		4.16E-01
	1038.61	0.99	-5.56E-01		5.00E+00
	1167.97	1.79	-1.86E-01		3.16E+00
	1365.19	3.02	3.55E-01		1.20E+00
Cs-137	661.66	85.10	9.11E-03	4.90E-02	4.90E-02
Eu-152	121.78	28.67	1.09E-02	1.12E-01	1.12E-01
	244.70	7.61	-1.47E-01		4.63E-01
	295.94	0.45	-1.63E-01		8.85E+00
	344.28	26.60	-5.66E-02		1.26E-01
	367.79	0.86	-1.03E+00		3.43E+00
	411.12	2.24	-7.19E-01		1.40E+00
	443.96	2.83	9.50E-02		1.14E+00
	488.68	0.42	8.50E-01		7.64E+00
	563.99	0.49	4.15E+00		7.50E+00
	586.26	0.46	5.38E-01		1.29E+01
	678.62	0.47	-3.74E+00		6.74E+00
	688.67	0.86	-4.50E+00		3.87E+00
	719.35	0.28	-5.25E-02		1.10E+01
	778.90	12.96	5.74E-02		3.12E-01
	810.45	0.32	3.38E+00		1.28E+01
	867.37	4.26	-7.42E-01		9.49E-01
	919.33	0.43	-3.66E+00		8.73E+00
	964.08	14.65	-8.28E-02		3.25E-01
	1085.87	10.24	-1.10E-01		5.14E-01
	1089.74	1.73	-1.24E-01		3.05E+00
	1112.07	13.69	4.16E-02		3.85E-01
	1212.95	1.43	-2.23E+00		4.43E+00
	1249.94	0.19	1.13E+01		3.21E+01
	1299.14	1.63	1.67E+00		3.54E+00
	1408.01	21.07	1.62E-01		2.42E-01
	1457.64	0.50	-1.72E+01		4.34E+01
	1528.10	0.28	2.55E+00		1.18E+01
Eu-154	123.07	40.40	-1.11E-02	7.82E-02	7.82E-02
	247.93	6.89	7.27E-02		4.64E-01
	591.76	4.95	5.02E-01		8.06E-01
	692.42	1.78	-2.98E-01		2.24E+00
	723.30	20.06	-4.00E-03		2.04E-01
	756.80	4.52	-7.82E-02		7.28E-01
	873.18	12.08	3.79E-02		3.65E-01

Analysis Report for 30-Sep-19-10020

L1-12107A-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.69E-01	7.82E-02	3.75E-01
	1004.76	18.01	-1.35E-01		2.24E-01
	1274.43	34.80	3.36E-03		1.67E-01
	1596.48	1.80	-2.90E-02		1.70E+00
Eu-155	45.30	1.31	-8.68E-02	1.61E-01	1.15E+01
	60.01	1.22	-2.52E+00		1.15E+01
	86.55	30.70	-6.34E-02		1.61E-01
	105.31	21.10	2.09E-02		1.88E-01
Ra-226	186.21	3.64	1.05E+00	1.08E+00	1.08E+00
Pa-231	27.36	10.30	7.16E-01	1.18E+00	1.18E+00
	283.69	1.70	1.72E-01		1.91E+00
	300.07	2.47	2.11E-01		1.28E+00
	302.65	2.20	4.07E-01		1.35E+00
	330.06	1.40	6.92E-01		2.41E+00
U-235	143.76	10.96	-4.05E-02	6.85E-02	2.70E-01
	163.33	5.08	-2.09E-01		6.25E-01
	185.71	57.20	7.13E-02		6.85E-02
	202.11	1.08	-9.22E-01		3.05E+00
	205.31	5.01	6.58E-02		6.75E-01
Am-241	59.54	35.90	-1.94E-01	3.93E-01	3.93E-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 30-Sep-19-10021
L1-12107A-FSGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10021
Sample Description	: L1-12107A-FSGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.526E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:04:00AM
Acquisition Started	: 9/30/2019 10:01:25AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80069
Fill Height	: 1525.83 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:16:28AM

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

DATA VALIDATED 10/1/19 - 0700
J Graham

Analysis Report for 30-Sep-19-10021

L1-12107A-FSGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.59	949 -	959	954.46	9.11E+01	14.86	5.39E+01	1.01
2	351.82	1385 -	1413	1407.00	5.48E+01	19.18	6.53E+01	1.11
3	582.99	2327 -	2338	2331.17	3.85E+01	7.72	8.49E+00	0.72
4	910.82	3637 -	3648	3642.23	3.08E+01	7.18	8.15E+00	0.89
5	1460.13	5829 -	5851	5840.33	3.89E+02	20.02	2.99E+00	1.65

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.92	1460.82	*	10.66	9.70E+00	6.53E-01
Tl-208	0.99	583.19	*	85.00	6.43E-02	1.35E-02
Bi-211	0.91	351.07	*	13.02	4.19E-01	1.51E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.63E-01	2.97E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.53E-01	5.51E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		

Analysis Report for 30-Sep-19-10021

L1-12107A-FSGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Ac-228	0.99	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	5.45E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.925	9.70E+00	6.53E-01	
	Tl-208	0.994	6.43E-02	1.35E-02	
?	Bi-211	0.914	4.19E-01	1.51E-01	
	Pb-212	1.000	1.63E-01	2.97E-02	
?	Pb-214	0.999	1.53E-01	5.51E-02	
	Ac-228	0.993	2.30E-01	5.45E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10021

L1-12107A-FSGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:16:28AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.42E-02	6.11E-02	6.11E-02
	BE-7	477.60		10.44	1.95E-01	4.42E-01	4.42E-01
+	K-40	1460.82	*	10.66	9.70E+00	3.64E-01	3.64E-01
	Mn-54	834.85		99.98	2.33E-02	4.73E-02	4.73E-02
	Co-60	1173.23		99.85	-1.00E-01	5.91E-02	7.41E-02
		1332.49		99.98	1.98E-02		5.91E-02
	Nb-94	702.65		99.81	9.54E-03	4.91E-02	4.91E-02
		871.09		99.89	-2.47E-02		5.10E-02
	Ag-108m	79.13		6.60	-5.16E-01	4.79E-02	1.79E+00
		433.94		90.50	2.77E-02		4.79E-02
		614.28		89.80	-1.04E-01		5.69E-02
		722.94		90.80	2.70E-02		6.01E-02
	Sb-125	176.31		6.84	2.65E-01	1.21E-01	6.04E-01
		380.45		1.52	7.31E-02		2.86E+00
		427.87		29.60	-1.19E-01		1.21E-01
		463.36		10.49	1.42E-01		3.97E-01
		600.60		17.65	-2.82E-01		2.54E-01
		606.71		4.98	1.13E+00		1.42E+00
		635.95		11.22	1.01E-01		3.74E-01

Analysis Report for 30-Sep-19-10021

L1-12107A-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.68E+00	1.21E-01	2.22E+00
Ba-133	79.61	2.65	-1.33E+00	7.55E-02	4.30E+00
	81.00	32.90	1.63E-02		3.08E-01
	276.40	7.16	1.95E-01		5.63E-01
	302.85	18.34	1.80E-01		2.28E-01
	356.01	62.05	7.97E-03		7.55E-02
	383.85	8.94	2.67E-01		4.94E-01
Cs-134	475.36	1.48	1.25E+00	5.01E-02	2.84E+00
	563.25	8.34	-3.23E-01		4.72E-01
	569.33	15.37	-8.43E-02		2.92E-01
	604.72	97.62	1.11E-02		6.81E-02
	795.86	85.46	-4.44E-02		5.01E-02
	801.95	8.69	2.01E-01		5.37E-01
	1038.61	0.99	1.67E+00		5.92E+00
	1167.97	1.79	-3.44E+00		3.98E+00
	1365.19	3.02	2.54E-01		1.45E+00
Cs-137	661.66	85.10	-7.28E-04	5.30E-02	5.30E-02
Eu-152	121.78	28.67	1.16E-01	1.59E-01	1.70E-01
	244.70	7.61	2.61E-01		6.15E-01
	295.94	0.45	7.68E+00		9.40E+00
	344.28	26.60	-5.20E-02		1.59E-01
	367.79	0.86	6.67E-01		4.27E+00
	411.12	2.24	1.46E+00		1.83E+00
	443.96	2.83	7.37E-01		1.44E+00
	488.68	0.42	-1.09E+00		9.47E+00
	563.99	0.49	-5.60E-01		7.73E+00
	586.26	0.46	1.30E+01		1.32E+01
	678.62	0.47	9.03E+00		1.13E+01
	688.67	0.86	-1.17E+00		5.23E+00
	719.35	0.28	1.79E+00		1.69E+01
	778.90	12.96	5.56E-03		3.71E-01
	810.45	0.32	-1.52E+00		1.56E+01
	867.37	4.26	-9.87E-01		1.13E+00
	919.33	0.43	2.77E+00		1.17E+01
	964.08	14.65	4.09E-01		5.02E-01
	1085.87	10.24	-5.44E-01		6.43E-01
	1089.74	1.73	-2.60E+00		4.07E+00
	1112.07	13.69	-2.80E-01		4.89E-01
	1212.95	1.43	1.93E+00		5.90E+00
	1249.94	0.19	-3.87E+01		3.83E+01
	1299.14	1.63	-1.39E+00		4.31E+00
	1408.01	21.07	3.99E-02		2.71E-01
	1457.64	0.50	2.09E+02		5.19E+01
	1528.10	0.28	-1.06E+01		1.69E+01
Eu-154	123.07	40.40	-8.68E-02	1.16E-01	1.16E-01
	247.93	6.89	3.01E-01		5.96E-01
	591.76	4.95	-7.64E-01		9.85E-01
	692.42	1.78	2.05E+00		2.74E+00
	723.30	20.06	1.71E-01		2.75E-01
	756.80	4.52	1.84E-01		1.17E+00
	873.18	12.08	-2.29E-01		4.15E-01

Analysis Report for 30-Sep-19-10021

L1-12107A-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.87E-01	1.16E-01	5.24E-01
	1004.76	18.01	-9.05E-02		3.01E-01
	1274.43	34.80	-1.16E-01		2.08E-01
	1596.48	1.80	9.52E-01		2.32E+00
Eu-155	45.30	1.31	-7.29E-01	2.67E-01	3.17E+01
	60.01	1.22	-1.39E+01		3.04E+01
	86.55	30.70	1.97E-02		2.71E-01
	105.31	21.10	-6.22E-02		2.67E-01
Ra-226	186.21	3.64	6.42E-01	1.04E+00	1.04E+00
Pa-231	27.36	10.30	7.05E-01	1.57E+00	3.50E+00
	283.69	1.70	-6.12E-01		2.27E+00
	300.07	2.47	-1.56E+00		1.57E+00
	302.65	2.20	1.53E+00		1.90E+00
	330.06	1.40	5.58E-01		3.02E+00
U-235	143.76	10.96	2.85E-01	6.66E-02	4.17E-01
	163.33	5.08	4.91E-01		8.34E-01
	185.71	57.20	6.49E-02		6.66E-02
	202.11	1.08	-8.68E-01		3.34E+00
	205.31	5.01	-4.96E-01		6.62E-01
Am-241	59.54	35.90	-2.80E-01	1.13E+00	1.13E+00

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

Apex-Gamma

Analysis Report for 30-Sep-19-10022

L1-12107A-FSGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10022
Sample Description	: L1-12107A-FSGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.525E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:06:00AM
Acquisition Started	: 9/30/2019 10:01:32AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80070
Fill Height	: 1525.41 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:16:42AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/1/19 - 0700

J Graham

Analysis Report for 30-Sep-19-10022

L1-12107A-FSGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.83	949 -	960	954.89	1.07E+02	16.45	6.38E+01	1.25
2	338.27	1347 -	1356	1352.17	1.48E+01	8.59	2.62E+01	1.03
3	352.07	1400 -	1413	1407.30	8.60E+01	11.16	1.40E+01	1.13
4	583.24	2326 -	2337	2331.09	2.27E+01	7.49	1.33E+01	0.76
5	911.16	3636 -	3648	3642.10	2.57E+01	7.09	9.34E+00	0.83
6	968.39	3866 -	3877	3870.99	2.42E+01	6.66	7.81E+00	0.86
7	1460.24	5826 -	5851	5838.92	4.24E+02	21.22	6.33E+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	0.94	1460.82	*	10.66	9.51E+00	6.30E-01
Tl-208	0.99	583.19	*	85.00	3.42E-02	1.15E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.70E-01	2.95E-02
		300.09		3.30		
Pb-214	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.17E-01	3.30E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		

Analysis Report for 30-Sep-19-10022

L1-12107A-FSGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Ac-228	0.99	209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.14E-01	6.70E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.73E-01	4.82E-02
		964.77		4.99		
		968.97	*	15.80	2.77E-01	7.72E-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

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.948	9.51E+00	6.30E-01	
Tl-208	0.999	3.42E-02	1.15E-02	
Pb-212	0.994	1.70E-01	2.95E-02	
Pb-214	0.511	2.17E-01	3.30E-02	
Ac-228	0.990	1.78E-01	3.49E-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 30-Sep-19-10022

L1-12107A-FSGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:16:42AM
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	5.56E-02	5.77E-02	5.77E-02
	BE-7	477.60		10.44	-1.19E-01	4.03E-01	4.03E-01
+	K-40	1460.82	*	10.66	9.51E+00	4.56E-01	4.56E-01
	Mn-54	834.85		99.98	1.03E-03	4.50E-02	4.50E-02
	Co-60	1173.23		99.85	-1.53E-02	6.00E-02	6.43E-02
		1332.49		99.98	4.12E-02		6.00E-02
	Nb-94	702.65		99.81	-9.10E-03	3.77E-02	3.77E-02
		871.09		99.89	-4.55E-03		4.35E-02
	Ag-108m	79.13		6.60	1.25E-01	4.08E-02	1.11E+00
		433.94		90.50	-7.52E-03		4.08E-02
		614.28		89.80	-5.71E-02		5.13E-02
		722.94		90.80	-1.01E-02		4.97E-02
	Sb-125	176.31		6.84	3.59E-02	1.21E-01	4.25E-01
		380.45		1.52	-9.93E-01		2.11E+00
		427.87		29.60	-1.47E-02		1.21E-01
		463.36		10.49	1.13E-01		3.69E-01
		600.60		17.65	-1.10E-01		2.10E-01
		606.71		4.98	9.13E-01		1.09E+00
		635.95		11.22	-3.94E-01		3.02E-01

Analysis Report for 30-Sep-19-10022

L1-12107A-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	8.72E-01	1.21E-01	2.62E+00
Ba-133	79.61	2.65	4.18E-01	6.36E-02	2.68E+00
	81.00	32.90	-3.04E-01		1.81E-01
	276.40	7.16	-3.67E-02		4.46E-01
	302.85	18.34	9.31E-02		1.91E-01
	356.01	62.05	-2.45E-03		6.36E-02
	383.85	8.94	-2.11E-01		3.47E-01
Cs-134	475.36	1.48	1.23E+00	4.83E-02	2.80E+00
	563.25	8.34	-4.95E-01		5.16E-01
	569.33	15.37	6.90E-02		2.76E-01
	604.72	97.62	-4.91E-02		4.83E-02
	795.86	85.46	1.50E-02		5.33E-02
	801.95	8.69	2.88E-01		5.81E-01
	1038.61	0.99	-1.03E+00		5.07E+00
	1167.97	1.79	2.55E+00		3.85E+00
	1365.19	3.02	-6.30E-03		1.76E+00
Cs-137	661.66	85.10	3.00E-02	4.92E-02	4.92E-02
Eu-152	121.78	28.67	-1.01E-01	1.09E-01	1.09E-01
	244.70	7.61	-8.01E-02		4.84E-01
	295.94	0.45	3.25E+00		8.80E+00
	344.28	26.60	-2.78E-02		1.20E-01
	367.79	0.86	1.41E+00		3.61E+00
	411.12	2.24	2.51E-01		1.62E+00
	443.96	2.83	2.88E-01		1.26E+00
	488.68	0.42	1.49E+00		8.85E+00
	563.99	0.49	-8.53E+00		8.47E+00
	586.26	0.46	9.13E+00		1.13E+01
	678.62	0.47	-2.42E+00		8.23E+00
	688.67	0.86	-2.20E-01		5.42E+00
	719.35	0.28	-6.45E+00		1.45E+01
	778.90	12.96	3.66E-02		3.45E-01
	810.45	0.32	2.05E+00		1.39E+01
	867.37	4.26	-1.63E-01		9.98E-01
	919.33	0.43	2.15E-01		1.15E+01
	964.08	14.65	-3.95E-01		4.81E-01
	1085.87	10.24	1.23E-01		4.93E-01
	1089.74	1.73	-2.55E+00		2.69E+00
	1112.07	13.69	2.87E-02		4.28E-01
	1212.95	1.43	1.23E+00		4.77E+00
	1249.94	0.19	-1.18E+00		3.45E+01
	1299.14	1.63	1.45E+00		3.56E+00
	1408.01	21.07	1.11E-01		1.99E-01
	1457.64	0.50	2.08E+02		4.91E+01
	1528.10	0.28	8.80E-01		6.75E+00
Eu-154	123.07	40.40	-8.23E-03	7.98E-02	7.98E-02
	247.93	6.89	-1.00E-01		4.35E-01
	591.76	4.95	-3.98E-01		7.85E-01
	692.42	1.78	1.49E+00		2.47E+00
	723.30	20.06	-5.38E-02		2.22E-01
	756.80	4.52	-8.21E-01		9.41E-01
	873.18	12.08	-1.18E-01		3.74E-01

Analysis Report for 30-Sep-19-10022

L1-12107A-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.09E-01	7.98E-02	5.43E-01
	1004.76	18.01	8.86E-02		3.22E-01
	1274.43	34.80	-7.84E-02		1.61E-01
	1596.48	1.80	1.29E+00		2.47E+00
Eu-155	45.30	1.31	-2.49E+00	1.85E-01	1.06E+01
	60.01	1.22	-1.09E+00		1.29E+01
	86.55	30.70	1.31E-01		1.89E-01
	105.31	21.10	-8.85E-03		1.85E-01
Ra-226	186.21	3.64	7.14E-01	9.40E-01	9.40E-01
Pa-231	27.36	10.30	7.13E-01	1.32E+00	1.32E+00
	283.69	1.70	4.43E-01		2.03E+00
	300.07	2.47	-1.97E+00		1.32E+00
	302.65	2.20	-2.72E-01		1.54E+00
	330.06	1.40	1.06E-03		2.41E+00
U-235	143.76	10.96	-3.16E-01	6.02E-02	2.96E-01
	163.33	5.08	-2.73E-01		6.33E-01
	185.71	57.20	4.07E-02		6.02E-02
	202.11	1.08	-3.06E-01		2.80E+00
	205.31	5.01	-4.76E-01		5.78E-01
Am-241	59.54	35.90	-4.46E-02	4.49E-01	4.49E-01

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

Apex-Gamma

Analysis Report for 30-Sep-19-10023

L1-12107A-FSGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10023
Sample Description	: L1-12107A-FSGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.646E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:08:00AM
Acquisition Started	: 9/30/2019 10:01:41AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80071
Fill Height	: 1646.26 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:16:46AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/1/19 - 0700
T Graham

Analysis Report for 30-Sep-19-10023

L1-12107A-FSGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	950 -	961	955.08	1.06E+02	16.00	5.91E+01	0.86
2	295.26	1175 -	1187	1181.25	4.65E+01	9.92	1.95E+01	0.59
3	351.89	1400 -	1415	1407.55	6.36E+01	11.77	2.44E+01	0.93
4	583.23	2326 -	2338	2332.23	3.29E+01	6.99	6.13E+00	0.49
5	609.36	2431 -	2444	2436.73	5.15E+01	8.98	1.05E+01	0.80
6	911.03	3636 -	3650	3643.18	3.60E+01	7.40	5.96E+00	0.77
7	1460.81	5831 -	5855	5843.60	4.73E+02	22.32	6.18E+00	1.72

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	9.71E+00	6.23E-01
Tl-208	1.00	583.19	*	85.00	4.63E-02	1.02E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.64E-01	2.81E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.39E-01	2.57E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 30-Sep-19-10023

L1-12107A-FSGS-005SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.91E-01	4.35E-02
		351.93	*	35.60	1.53E-01	3.08E-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	2.24E-01	4.70E-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 30-Sep-19-10023

L1-12107A-FSGS-005SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	9.71E+00	6.23E-01	
	Tl-208	1.000	4.63E-02	1.02E-02	
X	Bi-211	0.898			
	Pb-212	1.000	1.64E-01	2.81E-02	
	Bi-214	1.000	1.39E-01	2.57E-02	
	Pb-214	1.000	1.65E-01	2.51E-02	
	Ac-228	0.999	2.24E-01	4.70E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10023

L1-12107A-FSGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:16:46AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.84E-02	5.54E-02	5.54E-02
	BE-7	477.60		10.44	7.04E-02	4.01E-01	4.01E-01
+	K-40	1460.82	*	10.66	9.71E+00	4.10E-01	4.10E-01
	Mn-54	834.85		99.98	1.28E-02	5.13E-02	5.13E-02
	Co-60	1173.23		99.85	5.38E-02	5.20E-02	7.33E-02
		1332.49		99.98	9.31E-05		5.20E-02
	Nb-94	702.65		99.81	2.03E-02	4.25E-02	4.60E-02
		871.09		99.89	-8.13E-03		4.25E-02
	Ag-108m	79.13		6.60	1.87E-02	3.45E-02	1.40E+00
		433.94		90.50	-1.46E-02		3.45E-02
		614.28		89.80	-3.17E-02		6.60E-02
		722.94		90.80	-1.79E-02		5.32E-02
	Sb-125	176.31		6.84	5.66E-01	1.12E-01	5.02E-01
		380.45		1.52	9.76E-02		2.42E+00
		427.87		29.60	-2.09E-02		1.12E-01
		463.36		10.49	2.53E-01		3.78E-01
		600.60		17.65	1.38E-01		2.46E-01
		606.71		4.98	1.53E+00		1.20E+00
		635.95		11.22	-1.78E-01		2.99E-01

Analysis Report for 30-Sep-19-10023

L1-12107A-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	3.31E-01	1.12E-01	2.04E+00
Ba-133	79.61	2.65	1.22E+00	6.97E-02	3.38E+00
	81.00	32.90	-3.18E-01		2.39E-01
	276.40	7.16	-2.79E-02		4.91E-01
	302.85	18.34	-1.20E-01		1.83E-01
	356.01	62.05	1.51E-02		6.97E-02
	383.85	8.94	1.48E-01		4.19E-01
Cs-134	475.36	1.48	-2.57E+00	5.31E-02	2.41E+00
	563.25	8.34	-1.20E-01		4.63E-01
	569.33	15.37	-4.31E-03		2.73E-01
	604.72	97.62	-2.59E-02		5.63E-02
	795.86	85.46	-1.13E-02		5.31E-02
	801.95	8.69	-2.18E-01		4.88E-01
	1038.61	0.99	-5.16E-01		5.00E+00
	1167.97	1.79	-7.27E-01		4.08E+00
	1365.19	3.02	-7.94E-01		1.30E+00
Cs-137	661.66	85.10	4.07E-02	5.25E-02	5.25E-02
Eu-152	121.78	28.67	-3.26E-02	1.18E-01	1.35E-01
	244.70	7.61	-8.90E-02		4.72E-01
	295.94	0.45	7.28E+00		9.12E+00
	344.28	26.60	-9.27E-02		1.18E-01
	367.79	0.86	1.65E+00		3.80E+00
	411.12	2.24	4.83E-02		1.69E+00
	443.96	2.83	-4.96E-01		1.30E+00
	488.68	0.42	9.63E-01		9.34E+00
	563.99	0.49	-4.55E+00		7.75E+00
	586.26	0.46	9.81E+00		1.03E+01
	678.62	0.47	9.33E-01		7.53E+00
	688.67	0.86	3.87E+00		5.28E+00
	719.35	0.28	-9.51E+00		1.62E+01
	778.90	12.96	-1.90E-01		3.25E-01
	810.45	0.32	5.91E+00		1.46E+01
	867.37	4.26	-1.99E+00		1.01E+00
	919.33	0.43	-1.75E+01		1.10E+01
	964.08	14.65	2.62E-01		3.98E-01
	1085.87	10.24	-4.32E-01		5.76E-01
	1089.74	1.73	3.00E-01		3.29E+00
	1112.07	13.69	4.66E-02		3.88E-01
	1212.95	1.43	4.39E+00		4.43E+00
	1249.94	0.19	2.18E+01		2.89E+01
	1299.14	1.63	3.80E+00		4.02E+00
	1408.01	21.07	8.39E-02		2.23E-01
	1457.64	0.50	2.11E+02		4.72E+01
	1528.10	0.28	-3.76E+00		1.00E+01
Eu-154	123.07	40.40	8.42E-02	9.62E-02	9.62E-02
	247.93	6.89	4.58E-01		4.87E-01
	591.76	4.95	-9.49E-02		7.54E-01
	692.42	1.78	7.57E-01		2.62E+00
	723.30	20.06	9.80E-02		2.48E-01
	756.80	4.52	-4.98E-01		9.16E-01
	873.18	12.08	8.08E-02		3.64E-01

Analysis Report for 30-Sep-19-10023

L1-12107A-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	3.05E-01	9.62E-02	5.14E-01
	1004.76	18.01	2.21E-01		3.01E-01
	1274.43	34.80	-6.82E-02		1.51E-01
	1596.48	1.80	-5.75E-01		1.91E+00
Eu-155	45.30	1.31	-3.71E-01	2.14E-01	1.99E+01
	60.01	1.22	-3.41E+00		2.19E+01
	86.55	30.70	1.25E-01		2.28E-01
	105.31	21.10	-1.38E-01		2.14E-01
Ra-226	186.21	3.64	1.81E-01	1.01E+00	1.01E+00
Pa-231	27.36	10.30	2.98E+00	1.47E+00	2.54E+00
	283.69	1.70	-2.42E-01		2.01E+00
	300.07	2.47	-6.76E-01		1.47E+00
	302.65	2.20	-1.44E+00		1.50E+00
	330.06	1.40	-1.45E+00		2.37E+00
U-235	143.76	10.96	4.54E-02	6.42E-02	3.28E-01
	163.33	5.08	2.08E-01		6.75E-01
	185.71	57.20	1.93E-02		6.42E-02
	202.11	1.08	-5.65E-01		3.03E+00
	205.31	5.01	-5.24E-01		6.44E-01
Am-241	59.54	35.90	1.05E-01	7.74E-01	7.74E-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 30-Sep-19-10024

L1-12107A-FSGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10024
Sample Description	: L1-12107A-FSGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.518E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:10:00AM
Acquisition Started	: 9/30/2019 10:20:50AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80072
Fill Height	: 1517.97 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:35:53AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 10/1/19 - 0700
J Graham

Analysis Report for 30-Sep-19-10024

L1-12107A-FSGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.20	151 -	158	155.00	4.78E+01	17.21	1.23E+02	0.52
2	238.62	473 -	480	477.42	1.11E+02	18.12	1.08E+02	1.07
3	351.80	698 -	708	703.55	8.91E+01	14.20	4.69E+01	1.15
4	583.12	1163 -	1171	1165.84	3.55E+01	8.72	1.85E+01	1.28
5	609.29	1213 -	1222	1218.16	5.60E+01	10.60	2.50E+01	1.41
6	1377.52	2751 -	2759	2754.93	1.35E+01	4.61	3.50E+00	1.58
7	1460.65	2913 -	2928	2921.35	5.05E+02	22.73	3.86E+00	2.20

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.52E+00	5.95E-01
Tl-208	0.99	583.19	*	85.00	4.58E-02	1.16E-02
Bi-211	0.91	351.07	*	13.02	5.35E-01	9.55E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.56E-01	2.84E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.13E-01	1.17E-01
		87.35		3.97		
		89.78		1.46		

Analysis Report for 30-Sep-19-10024

L1-12107A-FSGS-006SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	609.32	*	45.49	1.39E-01	2.76E-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	6.51E-01	2.24E-01
		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	1.96E-01	3.49E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	5.51E-01	2.08E-01
		87.35		2.24		
		89.78		0.82		

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

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.995	9.52E+00	5.95E-01	

Analysis Report for 30-Sep-19-10024

L1-12107A-FSGS-006SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	Tl-208	0.999	4.58E-02	1.16E-02	
?	Bi-211	0.918	5.35E-01	9.55E-02	
	Pb-212	1.000	1.56E-01	2.84E-02	
?	Pb212-XR	0.999	3.13E-01	1.17E-01	
	Bi-214	1.000	1.47E-01	2.74E-02	
?	Pb-214	0.998	1.96E-01	3.49E-02	
?	Pb214-XR	0.999	5.51E-01	2.08E-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 30-Sep-19-10024

L1-12107A-FSGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:35:53AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.09E-02	5.57E-02	5.57E-02
	BE-7	477.60		10.44	1.70E-01	3.30E-01	3.30E-01
+	K-40	1460.82	*	10.66	9.52E+00	2.69E-01	2.69E-01
	Mn-54	834.85		99.98	-1.59E-04	3.55E-02	3.55E-02
	Co-60	1173.23		99.85	-2.49E-02	4.86E-02	5.42E-02
		1332.49		99.98	-4.15E-03		4.86E-02
	Nb-94	702.65		99.81	2.80E-02	4.29E-02	4.53E-02
		871.09		99.89	2.47E-02		4.29E-02
	Ag-108m	79.13		6.60	-9.02E-02	3.63E-02	1.06E+00
		433.94		90.50	2.55E-02		3.63E-02
		614.28		89.80	-3.95E-02		5.22E-02
		722.94		90.80	1.55E-03		4.18E-02
	Sb-125	176.31		6.84	2.20E-01	1.05E-01	5.21E-01
		380.45		1.52	5.88E-01		2.18E+00
		427.87		29.60	-1.12E-02		1.05E-01
		463.36		10.49	-6.58E-02		3.22E-01
		600.60		17.65	1.63E-01		2.23E-01
		606.71		4.98	-8.27E-02		1.15E+00
		635.95		11.22	5.45E-02		3.75E-01

Analysis Report for 30-Sep-19-10024

L1-12107A-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	8.64E-02	1.05E-01	2.02E+00
Ba-133	79.61	2.65	-4.35E-01	6.87E-02	2.55E+00
	81.00	32.90	-1.31E-01		1.70E-01
	276.40	7.16	3.76E-02		4.54E-01
	302.85	18.34	9.83E-02		1.87E-01
	356.01	62.05	-1.76E-02		6.87E-02
	383.85	8.94	-3.83E-02		3.45E-01
Cs-134	475.36	1.48	-2.36E-01	5.00E-02	2.11E+00
	563.25	8.34	1.58E-01		4.53E-01
	569.33	15.37	-7.72E-03		2.26E-01
	604.72	97.62	-1.73E-03		5.23E-02
	795.86	85.46	1.76E-03		5.00E-02
	801.95	8.69	-6.37E-02		4.48E-01
	1038.61	0.99	2.93E+00		4.87E+00
	1167.97	1.79	-2.23E+00		3.17E+00
	1365.19	3.02	-2.81E-01		7.11E-01
Cs-137	661.66	85.10	-4.78E-03	4.33E-02	4.33E-02
Eu-152	121.78	28.67	9.90E-03	1.17E-01	1.17E-01
	244.70	7.61	9.43E-02		4.59E-01
	295.94	0.45	2.68E+00		8.29E+00
	344.28	26.60	-7.10E-02		1.21E-01
	367.79	0.86	3.84E-01		3.74E+00
	411.12	2.24	3.39E-01		1.43E+00
	443.96	2.83	-4.88E-01		9.98E-01
	488.68	0.42	3.49E+00		8.48E+00
	563.99	0.49	4.79E-02		7.27E+00
	586.26	0.46	-4.61E+00		1.00E+01
	678.62	0.47	-2.35E+00		6.26E+00
	688.67	0.86	-1.48E+00		4.46E+00
	719.35	0.28	-3.91E+00		1.26E+01
	778.90	12.96	-2.08E-01		2.75E-01
	810.45	0.32	7.13E+00		1.20E+01
	867.37	4.26	-4.86E-01		8.65E-01
	919.33	0.43	-1.56E+00		1.04E+01
	964.08	14.65	4.91E-02		3.76E-01
	1085.87	10.24	-3.90E-02		3.91E-01
	1089.74	1.73	-6.28E-01		2.32E+00
	1112.07	13.69	2.83E-01		4.10E-01
	1212.95	1.43	7.80E-01		4.76E+00
	1249.94	0.19	-2.68E+01		2.98E+01
	1299.14	1.63	1.99E-01		3.00E+00
	1408.01	21.07	-7.74E-04		1.60E-01
	1457.64	0.50	-3.29E+00		4.44E+01
	1528.10	0.28	-1.84E-01		1.08E+01
Eu-154	123.07	40.40	-2.17E-02	8.10E-02	8.10E-02
	247.93	6.89	-1.07E-01		4.57E-01
	591.76	4.95	-1.57E-01		6.63E-01
	692.42	1.78	-1.04E+00		2.16E+00
	723.30	20.06	1.37E-02		1.92E-01
	756.80	4.52	-7.18E-02		8.15E-01
	873.18	12.08	2.24E-01		3.55E-01

Analysis Report for 30-Sep-19-10024

L1-12107A-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.92E-02	8.10E-02	4.34E-01
	1004.76	18.01	-3.03E-02		2.58E-01
	1274.43	34.80	-2.29E-02		1.46E-01
	1596.48	1.80	-8.00E-01		2.06E+00
Eu-155	45.30	1.31	-1.38E+00	1.67E-01	1.12E+01
	60.01	1.22	-1.70E+00		1.22E+01
	86.55	30.70	1.73E-02		1.67E-01
	105.31	21.10	-4.77E-02		1.81E-01
Ra-226	186.21	3.64	6.18E-01	9.57E-01	9.57E-01
Pa-231	27.36	10.30	8.20E-01	1.19E+00	1.19E+00
	283.69	1.70	-7.99E-01		1.81E+00
	300.07	2.47	-1.77E+00		1.30E+00
	302.65	2.20	8.19E-01		1.55E+00
	330.06	1.40	1.23E+00		2.62E+00
U-235	143.76	10.96	8.49E-02	6.15E-02	2.94E-01
	163.33	5.08	-1.93E-01		6.84E-01
	185.71	57.20	4.55E-02		6.15E-02
	202.11	1.08	2.24E+00		3.22E+00
	205.31	5.01	-1.88E-01		6.75E-01
Am-241	59.54	35.90	-7.58E-02	4.28E-01	4.28E-01

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

Apex-Gamma

Analysis Report for 30-Sep-19-10025

L1-12107A-FSGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10025
Sample Description	: L1-12107A-FSGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.762E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:12:00AM
Acquisition Started	: 9/30/2019 10:20:58AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80073
Fill Height	: 1761.65 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:36:03AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/1/19 - 0700

J Graham

Analysis Report for 30-Sep-19-10025

L1-12107A-FSGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.53	948 -	959	954.22	8.44E+01	15.49	6.16E+01	0.87
2	294.98	1171 -	1186	1179.82	5.09E+01	12.23	3.21E+01	1.01
3	338.34	1348 -	1357	1353.14	3.91E+01	9.08	1.89E+01	0.73
4	351.78	1399 -	1412	1406.85	1.05E+02	12.88	2.19E+01	1.05
5	608.93	2430 -	2441	2434.88	3.45E+01	7.72	9.47E+00	0.57
6	1460.01	5828 -	5851	5839.86	3.40E+02	19.08	6.00E+00	1.87

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.89	1460.82	*	10.66	8.16E+00	5.79E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.48E-01	2.96E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.08E-01	2.49E-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 30-Sep-19-10025

L1-12107A-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	2.37E-01	5.99E-02
		351.93	*	35.60	2.87E-01	4.20E-02
		785.96		1.06		
Ac-228	0.57	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.27E-01	8.06E-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 30-Sep-19-10025

L1-12107A-FSGS-007SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.899	8.16E+00	5.79E-01	
X	Bi-211	0.923			
	Pb-212	0.999	1.48E-01	2.96E-02	
	Bi-214	0.990	1.08E-01	2.49E-02	
	Pb-214	0.995	2.70E-01	3.44E-02	
	Ac-228	0.573	3.27E-01	8.06E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10025

L1-12107A-FSGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:36:03AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.71E-02	5.82E-02	5.82E-02
	BE-7	477.60		10.44	3.64E-01	4.86E-01	4.86E-01
+	K-40	1460.82	*	10.66	8.16E+00	4.69E-01	4.69E-01
	Mn-54	834.85		99.98	-2.65E-02	4.83E-02	4.83E-02
	Co-60	1173.23		99.85	2.95E-02	4.32E-02	7.72E-02
		1332.49		99.98	6.34E-03		4.32E-02
	Nb-94	702.65		99.81	1.86E-02	5.14E-02	5.14E-02
		871.09		99.89	2.49E-02		5.33E-02
	Ag-108m	79.13		6.60	4.10E-01	4.66E-02	1.92E+00
		433.94		90.50	2.69E-02		4.66E-02
		614.28		89.80	-7.94E-03		5.79E-02
		722.94		90.80	5.66E-02		6.14E-02
	Sb-125	176.31		6.84	-2.52E-01	1.32E-01	5.69E-01
		380.45		1.52	1.26E+00		2.88E+00
		427.87		29.60	4.72E-03		1.32E-01
		463.36		10.49	3.04E-01		4.57E-01
		600.60		17.65	3.93E-02		2.62E-01
		606.71		4.98	1.14E+00		1.24E+00
		635.95		11.22	-8.89E-02		3.24E-01

Analysis Report for 30-Sep-19-10025

L1-12107A-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.02E+00	1.32E-01	2.69E+00
Ba-133	79.61	2.65	-7.11E-01	7.56E-02	4.57E+00
	81.00	32.90	-1.83E-01		3.26E-01
	276.40	7.16	1.21E-01		5.38E-01
	302.85	18.34	-2.34E-02		2.05E-01
	356.01	62.05	-5.66E-02		7.56E-02
	383.85	8.94	1.35E-01		4.84E-01
Cs-134	475.36	1.48	2.52E+00	5.72E-02	3.41E+00
	563.25	8.34	3.32E-01		5.32E-01
	569.33	15.37	-3.11E-02		2.66E-01
	604.72	97.62	-1.60E-02		6.07E-02
	795.86	85.46	-2.27E-02		5.72E-02
	801.95	8.69	1.72E-01		4.68E-01
	1038.61	0.99	-2.77E+00		6.00E+00
	1167.97	1.79	1.54E-01		3.99E+00
	1365.19	3.02	1.05E+00		1.63E+00
Cs-137	661.66	85.10	1.03E-02	5.22E-02	5.22E-02
Eu-152	121.78	28.67	8.56E-03	1.55E-01	1.65E-01
	244.70	7.61	-1.32E-01		5.63E-01
	295.94	0.45	4.29E-01		1.02E+01
	344.28	26.60	6.63E-02		1.55E-01
	367.79	0.86	-2.35E+00		4.12E+00
	411.12	2.24	9.12E-01		1.90E+00
	443.96	2.83	-3.50E-01		1.46E+00
	488.68	0.42	-7.43E-01		8.08E+00
	563.99	0.49	2.94E+00		8.69E+00
	586.26	0.46	1.12E+01		1.26E+01
	678.62	0.47	2.43E-01		9.43E+00
	688.67	0.86	1.84E+00		4.37E+00
	719.35	0.28	5.56E+00		1.61E+01
	778.90	12.96	6.80E-02		3.53E-01
	810.45	0.32	-6.83E+00		1.08E+01
	867.37	4.26	-8.44E-01		1.13E+00
	919.33	0.43	1.38E+00		1.20E+01
	964.08	14.65	4.66E-02		4.76E-01
	1085.87	10.24	-3.63E-01		5.48E-01
	1089.74	1.73	-8.21E-01		3.37E+00
	1112.07	13.69	-1.90E-02		3.93E-01
	1212.95	1.43	-3.11E+00		4.92E+00
	1249.94	0.19	-2.71E+01		4.12E+01
	1299.14	1.63	-4.03E+00		3.19E+00
	1408.01	21.07	-1.48E-02		2.13E-01
	1457.64	0.50	1.79E+02		4.72E+01
	1528.10	0.28	7.52E+00		1.55E+01
Eu-154	123.07	40.40	3.47E-02	1.17E-01	1.17E-01
	247.93	6.89	-3.37E-01		5.36E-01
	591.76	4.95	-3.30E-01		9.02E-01
	692.42	1.78	-2.56E-01		2.30E+00
	723.30	20.06	2.14E-01		2.81E-01
	756.80	4.52	8.98E-01		1.21E+00
	873.18	12.08	1.92E-02		4.29E-01

Analysis Report for 30-Sep-19-10025

L1-12107A-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.11E-01	1.17E-01	4.88E-01
	1004.76	18.01	1.94E-01		3.17E-01
	1274.43	34.80	1.74E-01		2.22E-01
	1596.48	1.80	1.53E+00		2.76E+00
Eu-155	45.30	1.31	-4.87E-01	2.72E-01	3.08E+01
	60.01	1.22	4.76E+00		3.28E+01
	86.55	30.70	4.37E-03		2.82E-01
	105.31	21.10	-1.12E-01		2.72E-01
Ra-226	186.21	3.64	1.29E-01	1.11E+00	1.11E+00
Pa-231	27.36	10.30	3.13E+00	1.49E+00	3.53E+00
	283.69	1.70	-2.47E-01		2.28E+00
	300.07	2.47	4.98E-02		1.49E+00
	302.65	2.20	-2.54E-01		1.68E+00
	330.06	1.40	1.14E+00		2.96E+00
U-235	143.76	10.96	1.16E-01	7.06E-02	4.23E-01
	163.33	5.08	-2.96E-01		7.14E-01
	185.71	57.20	-3.02E-04		7.06E-02
	202.11	1.08	-2.92E-02		3.47E+00
	205.31	5.01	-5.11E-01		7.82E-01
Am-241	59.54	35.90	6.71E-01	1.19E+00	1.19E+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 30-Sep-19-10026

L1-12107A-FSGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10026
Sample Description	: L1-12107A-FSGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.628E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:14:00AM
Acquisition Started	: 9/30/2019 10:21:06AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80074
Fill Height	: 1628.20 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:36:27AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/1/19 - 0700
T Graham

Analysis Report for 30-Sep-19-10026

L1-12107A-FSGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.86	948 -	961	955.02	1.14E+02	17.29	6.50E+01	1.02
2	295.41	1174 -	1188	1180.92	6.93E+01	11.36	2.07E+01	1.02
3	352.15	1401 -	1414	1407.62	6.63E+01	11.22	2.17E+01	1.22
4	583.08	2325 -	2337	2330.42	3.61E+01	8.82	1.59E+01	0.34
5	609.30	2427 -	2442	2435.26	6.10E+01	11.00	2.00E+01	1.04
6	911.01	3634 -	3648	3641.49	3.56E+01	7.92	9.37E+00	1.35
7	1460.23	5826 -	5853	5838.85	4.54E+02	21.31	0.00E+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	0.94	1460.82	*	10.66	1.00E+01	6.40E-01
Tl-208	0.99	583.19	*	85.00	5.36E-02	1.35E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.79E-01	3.08E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.74E-01	3.31E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 30-Sep-19-10026

L1-12107A-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	2.93E-01	5.34E-02
		351.93	*	35.60	1.65E-01	3.09E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.36E-01	5.33E-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 30-Sep-19-10026

L1-12107A-FSGS-008SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.945	1.00E+01	6.40E-01	
Tl-208	0.998	5.36E-02	1.35E-02	
Pb-212	0.992	1.79E-01	3.08E-02	
Bi-214	1.000	1.74E-01	3.31E-02	
Pb-214	0.994	1.97E-01	2.67E-02	
Ac-228	0.998	2.36E-01	5.33E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10026

L1-12107A-FSGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:36:27AM
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	5.75E-02	5.78E-02	5.78E-02
	BE-7	477.60		10.44	9.71E-02	3.47E-01	3.47E-01
+	K-40	1460.82	*	10.66	1.00E+01	6.34E-02	6.34E-02
	Mn-54	834.85		99.98	3.18E-03	4.94E-02	4.94E-02
	Co-60	1173.23		99.85	-1.05E-02	5.46E-02	6.32E-02
		1332.49		99.98	5.04E-03		5.46E-02
	Nb-94	702.65		99.81	1.96E-02	4.12E-02	4.12E-02
		871.09		99.89	-1.75E-02		4.44E-02
	Ag-108m	79.13		6.60	3.81E-01	4.06E-02	1.23E+00
		433.94		90.50	-1.14E-02		4.06E-02
		614.28		89.80	-4.91E-02		6.13E-02
		722.94		90.80	2.01E-02		4.89E-02
	Sb-125	176.31		6.84	1.91E-01	1.12E-01	4.65E-01
		380.45		1.52	-2.31E-01		2.19E+00
		427.87		29.60	-1.78E-02		1.12E-01
		463.36		10.49	1.63E-01		3.68E-01
		600.60		17.65	-3.72E-02		2.31E-01
		606.71		4.98	1.13E+00		1.38E+00
		635.95		11.22	6.69E-02		3.21E-01

Analysis Report for 30-Sep-19-10026

L1-12107A-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	6.62E-01	1.12E-01	2.23E+00
Ba-133	79.61	2.65	9.86E-01	6.07E-02	2.96E+00
	81.00	32.90	-1.94E-01		1.99E-01
	276.40	7.16	-7.15E-02		4.79E-01
	302.85	18.34	7.05E-02		1.87E-01
	356.01	62.05	4.75E-03		6.07E-02
	383.85	8.94	2.53E-01		4.13E-01
Cs-134	475.36	1.48	2.66E-01	5.48E-02	2.29E+00
	563.25	8.34	-5.16E-01		4.57E-01
	569.33	15.37	1.25E-01		2.33E-01
	604.72	97.62	8.28E-03		6.12E-02
	795.86	85.46	-4.19E-02		5.48E-02
	801.95	8.69	6.70E-01		6.77E-01
	1038.61	0.99	-2.94E-01		5.16E+00
	1167.97	1.79	1.22E+00		3.48E+00
	1365.19	3.02	4.69E-01		1.50E+00
Cs-137	661.66	85.10	-1.58E-03	4.92E-02	4.92E-02
Eu-152	121.78	28.67	3.74E-02	1.15E-01	1.20E-01
	244.70	7.61	1.51E-01		5.18E-01
	295.94	0.45	5.50E+00		9.57E+00
	344.28	26.60	-6.38E-02		1.15E-01
	367.79	0.86	-3.10E+00		3.76E+00
	411.12	2.24	-4.54E-01		1.31E+00
	443.96	2.83	-7.11E-01		1.25E+00
	488.68	0.42	3.69E-02		8.42E+00
	563.99	0.49	-5.50E+00		7.75E+00
	586.26	0.46	-4.07E+00		1.19E+01
	678.62	0.47	7.19E+00		9.15E+00
	688.67	0.86	-4.32E+00		4.57E+00
	719.35	0.28	-3.52E+00		1.38E+01
	778.90	12.96	7.47E-02		3.55E-01
	810.45	0.32	4.95E+00		1.57E+01
	867.37	4.26	-1.50E-01		1.02E+00
	919.33	0.43	1.31E+00		1.17E+01
	964.08	14.65	3.66E-01		4.92E-01
	1085.87	10.24	5.62E-03		5.46E-01
	1089.74	1.73	-1.88E+00		3.24E+00
	1112.07	13.69	-2.27E-01		4.33E-01
	1212.95	1.43	-5.42E-01		4.40E+00
	1249.94	0.19	-2.26E+01		3.39E+01
	1299.14	1.63	2.90E+00		4.20E+00
	1408.01	21.07	-2.35E-02		1.87E-01
	1457.64	0.50	-3.47E+00		4.93E+01
	1528.10	0.28	8.94E-01		1.34E+01
Eu-154	123.07	40.40	2.85E-02	8.70E-02	8.70E-02
	247.93	6.89	-4.99E-01		4.66E-01
	591.76	4.95	2.82E-01		7.95E-01
	692.42	1.78	-1.03E+00		2.14E+00
	723.30	20.06	2.70E-02		2.22E-01
	756.80	4.52	1.88E-01		1.00E+00
	873.18	12.08	-9.26E-02		3.81E-01

Analysis Report for 30-Sep-19-10026

L1-12107A-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.13E-01	8.70E-02	4.97E-01
	1004.76	18.01	2.91E-01		3.36E-01
	1274.43	34.80	-8.30E-02		1.67E-01
	1596.48	1.80	2.56E-01		2.53E+00
Eu-155	45.30	1.31	-3.82E+00	1.85E-01	1.05E+01
	60.01	1.22	-1.74E+00		1.19E+01
	86.55	30.70	1.23E-02		1.85E-01
	105.31	21.10	3.50E-03		2.03E-01
Ra-226	186.21	3.64	4.89E-01	9.69E-01	9.69E-01
Pa-231	27.36	10.30	5.81E-01	1.21E+00	1.21E+00
	283.69	1.70	1.11E+00		1.98E+00
	300.07	2.47	-7.37E-01		1.33E+00
	302.65	2.20	7.16E-01		1.56E+00
	330.06	1.40	1.44E+00		2.87E+00
U-235	143.76	10.96	6.64E-02	6.05E-02	3.03E-01
	163.33	5.08	-8.43E-02		6.24E-01
	185.71	57.20	1.18E-02		6.05E-02
	202.11	1.08	-1.06E+00		2.93E+00
	205.31	5.01	-4.11E-01		6.60E-01
Am-241	59.54	35.90	2.03E-01	4.32E-01	4.32E-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 30-Sep-19-10027

L1-12107A-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10027
Sample Description	: L1-12107A-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.612E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:16:00AM
Acquisition Started	: 9/30/2019 10:21:14AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80075
Fill Height	: 1612.01 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:36:21AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/1/19 - 0700
T Graham

Analysis Report for 30-Sep-19-10027

L1-12107A-FSGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.66	950 -	961	955.09	9.79E+01	15.26	5.21E+01	0.98
2	282.68	1127 -	1135	1130.98	1.18E+01	5.99	1.13E+01	0.50
3	295.20	1176 -	1187	1181.01	3.43E+01	10.39	2.87E+01	1.01
4	352.02	1401 -	1415	1408.07	8.12E+01	12.47	2.58E+01	0.85
5	477.36	1902 -	1916	1909.01	4.26E+01	8.36	9.43E+00	0.41
6	510.83	2037 -	2048	2042.83	2.87E+01	10.38	3.13E+01	0.61
7	583.59	2324 -	2340	2333.69	4.63E+01	9.28	1.28E+01	0.66
8	609.31	2429 -	2444	2436.49	5.60E+01	8.95	8.00E+00	0.83
9	1460.69	5831 -	5854	5843.12	4.39E+02	21.23	2.97E+00	1.81

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	3.35E-02	1.23E-02
BE-7	0.99	477.60	*	10.44	4.54E-01	9.49E-02
K-40	0.99	1460.82	*	10.66	9.06E+00	5.89E-01
Tl-208	0.97	583.19	*	85.00	6.54E-02	1.37E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.52E-01	2.67E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.52E-01	2.60E-02

Analysis Report for 30-Sep-19-10027

L1-12107A-FSGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.41E-01	4.43E-02
		351.93	*	35.60	1.96E-01	3.39E-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
	An Pk	0.996	3.35E-02	1.23E-02	
	BE-7	0.990	4.54E-01	9.49E-02	
	K-40	0.997	9.06E+00	5.89E-01	
	Tl-208	0.974	6.54E-02	1.37E-02	
X	Bi-211	0.866			
	Pb-212	1.000	1.52E-01	2.67E-02	

Analysis Report for 30-Sep-19-10027

L1-12107A-FSGS-009SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
Bi-214	1.000	1.52E-01	2.60E-02	
Pb-214	0.999	1.76E-01	2.69E-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 30-Sep-19-10027

L1-12107A-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:36:21AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
2	282.68	1.30556E-02	50.97		

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	3.35E-02	3.85E-02	3.85E-02
+	BE-7	477.60	*	10.44	4.54E-01	2.20E-01	2.20E-01
+	K-40	1460.82	*	10.66	9.06E+00	3.00E-01	3.00E-01
	Mn-54	834.85		99.98	-1.19E-02	4.53E-02	4.53E-02
	Co-60	1173.23		99.85	-8.67E-02	4.90E-02	6.59E-02
		1332.49		99.98	6.61E-03		4.90E-02
	Nb-94	702.65		99.81	3.56E-02	4.96E-02	4.96E-02
		871.09		99.89	1.17E-02		5.01E-02
	Ag-108m	79.13		6.60	2.39E-01	3.68E-02	1.53E+00
		433.94		90.50	-1.39E-02		3.68E-02
		614.28		89.80	1.30E-02		6.63E-02
		722.94		90.80	9.39E-03		4.82E-02
	Sb-125	176.31		6.84	2.04E-01	1.07E-01	5.27E-01
		380.45		1.52	-8.14E-02		2.38E+00
		427.87		29.60	-2.30E-02		1.07E-01
		463.36		10.49	-7.51E-02		3.67E-01
		600.60		17.65	-1.53E-02		2.23E-01
		606.71		4.98	3.35E-01		1.14E+00

Analysis Report for 30-Sep-19-10027

L1-12107A-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	635.95	11.22	-5.93E-02	1.07E-01	3.73E-01
	671.44	1.79	1.04E+00		2.15E+00
Ba-133	79.61	2.65	3.43E+00	7.54E-02	3.79E+00
	81.00	32.90	-1.72E-01		2.63E-01
	276.40	7.16	1.10E-01		4.65E-01
	302.85	18.34	1.73E-01		1.93E-01
	356.01	62.05	1.77E-02		7.54E-02
	383.85	8.94	2.01E-01		3.95E-01
Cs-134	475.36	1.48	2.26E+00	5.62E-02	3.08E+00
	563.25	8.34	1.53E-01		3.87E-01
	569.33	15.37	1.93E-03		2.29E-01
	604.72	97.62	-2.41E-02		5.62E-02
	795.86	85.46	1.79E-02		5.68E-02
	801.95	8.69	-6.92E-01		5.06E-01
	1038.61	0.99	-2.79E+00		5.10E+00
	1167.97	1.79	-6.15E+00		3.63E+00
	1365.19	3.02	4.97E-02		1.73E+00
Cs-137	661.66	85.10	2.49E-02	4.67E-02	4.67E-02
Eu-152	121.78	28.67	8.48E-03	1.26E-01	1.40E-01
	244.70	7.61	3.68E-01		5.00E-01
	295.94	0.45	1.04E+01		9.49E+00
	344.28	26.60	-4.79E-02		1.26E-01
	367.79	0.86	-1.51E+00		3.78E+00
	411.12	2.24	-7.42E-01		1.51E+00
	443.96	2.83	7.60E-01		1.40E+00
	488.68	0.42	-4.28E+00		8.86E+00
	563.99	0.49	5.44E+00		6.78E+00
	586.26	0.46	-1.02E+00		1.22E+01
	678.62	0.47	4.94E+00		9.87E+00
	688.67	0.86	-7.44E-01		5.13E+00
	719.35	0.28	3.60E+00		1.53E+01
	778.90	12.96	5.25E-02		3.93E-01
	810.45	0.32	-1.54E+00		1.45E+01
	867.37	4.26	-6.35E-01		1.11E+00
	919.33	0.43	3.39E+00		1.17E+01
	964.08	14.65	2.15E-01		4.28E-01
	1085.87	10.24	1.42E-01		4.90E-01
	1089.74	1.73	-1.19E+00		3.00E+00
	1112.07	13.69	-3.56E-02		4.49E-01
	1212.95	1.43	-4.44E+00		4.76E+00
	1249.94	0.19	-1.38E+01		3.09E+01
	1299.14	1.63	-1.60E+00		3.57E+00
	1408.01	21.07	1.42E-01		2.12E-01
	1457.64	0.50	1.96E+02		4.56E+01
	1528.10	0.28	4.04E+00		1.10E+01
Eu-154	123.07	40.40	5.06E-02	1.00E-01	1.00E-01
	247.93	6.89	-1.91E-01		4.90E-01
	591.76	4.95	4.78E-02		7.96E-01
	692.42	1.78	5.89E-01		2.40E+00
	723.30	20.06	3.51E-02		2.21E-01
	756.80	4.52	-3.01E-01		9.33E-01

Analysis Report for 30-Sep-19-10027

L1-12107A-FSGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	1.29E-01	1.00E-01	4.30E-01
	996.29	10.48	3.60E-02		5.03E-01
	1004.76	18.01	5.25E-02		2.82E-01
	1274.43	34.80	-2.95E-02		1.70E-01
	1596.48	1.80	-7.20E-01		1.78E+00
Eu-155	45.30	1.31	1.17E+01	2.12E-01	2.24E+01
	60.01	1.22	-1.35E+00		2.19E+01
	86.55	30.70	-1.79E-01		2.20E-01
	105.31	21.10	-7.29E-02		2.12E-01
Ra-226	186.21	3.64	8.49E-01	1.10E+00	1.10E+00
Pa-231	27.36	10.30	1.79E+00	1.46E+00	2.38E+00
	283.69	1.70	2.93E-01		1.96E+00
	300.07	2.47	1.30E-01		1.46E+00
	302.65	2.20	9.30E-01		1.60E+00
	330.06	1.40	-6.45E-01		2.33E+00
U-235	143.76	10.96	-2.26E-01	6.91E-02	3.26E-01
	163.33	5.08	-4.03E-02		6.66E-01
	185.71	57.20	2.70E-02		6.91E-02
	202.11	1.08	2.36E+00		3.39E+00
	205.31	5.01	-5.99E-01		7.11E-01
Am-241	59.54	35.90	-1.10E-01	7.67E-01	7.67E-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 30-Sep-19-10028
L1-12107A-FQGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10028
Sample Description	: L1-12107A-FQGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.784E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:16:00AM
Acquisition Started	: 9/30/2019 10:39:10AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80076
Fill Height	: 1784.16 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:54:12AM

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

DATA VALIDATED 10/1/19 - 0700
J Graham

Analysis Report for 30-Sep-19-10028

L1-12107A-FQGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.72	945 -	960	955.36	1.51E+02	18.25	6.00E+01	1.22
2	295.42	1174 -	1188	1181.88	5.11E+01	11.71	2.99E+01	0.42
3	338.22	1348 -	1359	1352.91	2.80E+01	9.91	2.80E+01	0.61
4	351.88	1401 -	1416	1407.50	7.68E+01	12.82	2.92E+01	1.10
5	477.69	1905 -	1917	1910.34	3.13E+01	7.56	9.75E+00	1.01
6	583.17	2327 -	2337	2331.99	2.49E+01	9.74	2.91E+01	0.36
7	609.39	2428 -	2445	2436.83	5.63E+01	12.23	2.87E+01	0.90
8	911.23	3637 -	3651	3643.96	3.20E+01	7.99	1.10E+01	0.36
9	1460.81	5830 -	5856	5843.60	4.49E+02	21.88	6.75E+00	1.90

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	3.28E-01	8.28E-02
K-40	1.00	1460.82	*	10.66	9.06E+00	5.91E-01
Tl-208	1.00	583.19	*	85.00	3.46E-02	1.37E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.31E-01	3.36E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.50E-01	3.39E-02
		768.36		4.89		

Analysis Report for 30-Sep-19-10028

L1-12107A-FQGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.08E-01	5.04E-02
		351.93	*	35.60	1.82E-01	3.37E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.04E-01	7.42E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.95E-01	4.96E-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 30-Sep-19-10028

L1-12107A-FQGS-009SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.999	3.28E-01	8.28E-02	
	K-40	1.000	9.06E+00	5.91E-01	
	Tl-208	1.000	3.46E-02	1.37E-02	
X	Bi-211	0.901			
	Pb-212	0.999	2.31E-01	3.36E-02	
	Bi-214	1.000	1.50E-01	3.39E-02	
	Pb-214	0.998	1.90E-01	2.80E-02	
	Ac-228	1.000	1.98E-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 30-Sep-19-10028

L1-12107A-FQGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:54:12AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.29E-02	5.65E-02	5.65E-02
+	BE-7	477.60	*	10.44	3.28E-01	2.12E-01	2.12E-01
+	K-40	1460.82	*	10.66	9.06E+00	4.30E-01	4.30E-01
	Mn-54	834.85		99.98	1.98E-02	4.75E-02	4.75E-02
	Co-60	1173.23		99.85	-4.10E-02	5.69E-02	6.24E-02
		1332.49		99.98	2.77E-02		5.69E-02
	Nb-94	702.65		99.81	4.09E-03	4.53E-02	4.53E-02
		871.09		99.89	2.27E-02		4.66E-02
	Ag-108m	79.13		6.60	4.59E-01	3.85E-02	1.57E+00
		433.94		90.50	3.98E-03		3.85E-02
		614.28		89.80	9.91E-04		6.61E-02
		722.94		90.80	3.96E-03		5.13E-02
	Sb-125	176.31		6.84	2.54E-01	1.21E-01	5.28E-01
		380.45		1.52	-3.31E-02		2.36E+00
		427.87		29.60	-4.00E-02		1.21E-01
		463.36		10.49	-1.60E-02		4.07E-01
		600.60		17.65	1.38E-01		2.67E-01
		606.71		4.98	1.48E+00		1.34E+00
		635.95		11.22	2.06E-01		3.75E-01

Analysis Report for 30-Sep-19-10028

L1-12107A-FQGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.08E+00	1.21E-01	2.29E+00
Ba-133	79.61	2.65	1.55E+00	7.55E-02	3.74E+00
	81.00	32.90	-4.63E-01		2.46E-01
	276.40	7.16	-1.86E-01		5.13E-01
	302.85	18.34	1.60E-01		1.89E-01
	356.01	62.05	-1.04E-02		7.55E-02
	383.85	8.94	8.54E-02		3.66E-01
Cs-134	475.36	1.48	3.34E+00	6.12E-02	2.97E+00
	563.25	8.34	2.66E-01		4.87E-01
	569.33	15.37	-7.63E-02		2.37E-01
	604.72	97.62	5.53E-03		6.44E-02
	795.86	85.46	3.16E-02		6.12E-02
	801.95	8.69	-4.52E-01		5.24E-01
	1038.61	0.99	-4.83E+00		5.51E+00
	1167.97	1.79	-1.94E-02		3.74E+00
	1365.19	3.02	7.70E-01		1.62E+00
Cs-137	661.66	85.10	3.16E-02	5.54E-02	5.54E-02
Eu-152	121.78	28.67	-9.19E-02	1.36E-01	1.42E-01
	244.70	7.61	-1.31E-01		5.07E-01
	295.94	0.45	7.93E+00		9.49E+00
	344.28	26.60	-1.19E-01		1.36E-01
	367.79	0.86	7.63E-01		4.43E+00
	411.12	2.24	4.24E-01		1.73E+00
	443.96	2.83	2.54E-01		1.36E+00
	488.68	0.42	1.88E-01		9.41E+00
	563.99	0.49	2.36E-01		8.00E+00
	586.26	0.46	1.52E+01		1.23E+01
	678.62	0.47	9.28E+00		9.07E+00
	688.67	0.86	-2.11E-01		4.60E+00
	719.35	0.28	-1.71E+00		1.52E+01
	778.90	12.96	2.03E-02		3.52E-01
	810.45	0.32	1.25E+01		1.48E+01
	867.37	4.26	-6.63E-01		1.03E+00
	919.33	0.43	-1.26E+01		1.06E+01
	964.08	14.65	6.84E-01		4.81E-01
	1085.87	10.24	-1.82E-01		4.95E-01
	1089.74	1.73	-7.59E-01		3.20E+00
	1112.07	13.69	-2.88E-01		4.25E-01
	1212.95	1.43	-5.34E+00		5.15E+00
	1249.94	0.19	-4.57E+01		3.31E+01
	1299.14	1.63	4.26E-01		3.65E+00
	1408.01	21.07	1.74E-02		2.19E-01
	1457.64	0.50	1.98E+02		4.53E+01
	1528.10	0.28	1.68E+00		1.30E+01
Eu-154	123.07	40.40	-3.75E-02	1.03E-01	1.03E-01
	247.93	6.89	-4.39E-02		5.29E-01
	591.76	4.95	1.70E-01		7.63E-01
	692.42	1.78	6.53E-01		2.41E+00
	723.30	20.06	-9.77E-02		2.30E-01
	756.80	4.52	5.51E-01		1.10E+00
	873.18	12.08	1.08E-01		3.86E-01

Analysis Report for 30-Sep-19-10028

L1-12107A-FQGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.21E-01	1.03E-01	4.92E-01
	1004.76	18.01	6.61E-02		2.92E-01
	1274.43	34.80	-1.07E-01		1.69E-01
	1596.48	1.80	-6.79E-02		2.10E+00
Eu-155	45.30	1.31	7.26E+00	2.26E-01	2.09E+01
	60.01	1.22	-1.60E+01		2.17E+01
	86.55	30.70	1.41E-01		2.35E-01
	105.31	21.10	-7.25E-02		2.26E-01
Ra-226	186.21	3.64	1.18E+00	1.16E+00	1.16E+00
Pa-231	27.36	10.30	1.65E+00	1.52E+00	2.37E+00
	283.69	1.70	5.03E-01		2.13E+00
	300.07	2.47	2.73E-02		1.52E+00
	302.65	2.20	1.11E+00		1.57E+00
	330.06	1.40	2.22E+00		2.82E+00
U-235	143.76	10.96	-5.02E-02	7.45E-02	3.38E-01
	163.33	5.08	-3.67E-02		7.15E-01
	185.71	57.20	7.87E-02		7.45E-02
	202.11	1.08	-3.19E-01		3.37E+00
	205.31	5.01	-6.81E-02		7.39E-01
Am-241	59.54	35.90	-6.16E-01	7.80E-01	7.80E-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 30-Sep-19-10029

L1-12107A-FSGS-010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10029
Sample Description	: L1-12107A-FSGS-010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.768E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:18:00AM
Acquisition Started	: 9/30/2019 10:39:16AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80077
Fill Height	: 1768.29 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:54:18AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 10/1/19 - 0700

J Graham

Analysis Report for 30-Sep-19-10029

L1-12107A-FSGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.54	473 -	481	477.27	9.15E+01	19.30	1.30E+02	1.15
2	295.10	586 -	594	590.26	3.93E+01	12.94	5.97E+01	1.22
3	351.86	699 -	708	703.67	1.02E+02	14.12	4.28E+01	1.38
4	583.26	1160 -	1171	1166.12	7.44E+01	11.11	1.96E+01	1.76
5	609.38	1212 -	1222	1218.34	6.18E+01	10.83	2.32E+01	1.22
6	911.21	1817 -	1827	1821.87	3.57E+01	8.63	1.63E+01	1.52
7	1119.74	2236 -	2243	2239.04	1.30E+01	6.44	1.40E+01	0.62
8	1460.70	2913 -	2927	2921.45	5.04E+02	22.70	3.75E+00	2.11

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.14E+00	5.72E-01
Tl-208	0.99	583.19	*	85.00	9.33E-02	1.50E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.26E-01	2.83E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.49E-01	2.76E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 30-Sep-19-10029

L1-12107A-FSGS-010SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29	*	14.92	1.41E-01	7.02E-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	1.44E-01	4.87E-02
		351.93	*	35.60	2.18E-01	3.49E-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	1.97E-01	4.83E-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 30-Sep-19-10029

L1-12107A-FSGS-010SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	9.14E+00	5.72E-01	
	Tl-208	0.999	9.33E-02	1.50E-02	
X	Bi-211	0.904			
	Pb-212	0.999	1.26E-01	2.83E-02	
	Bi-214	0.993	1.48E-01	2.57E-02	
	Pb-214	0.999	1.93E-01	2.83E-02	
	Ac-228	1.000	1.97E-01	4.83E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10029

L1-12107A-FSGS-010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:54:18AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.60E-02	5.53E-02	5.53E-02
	BE-7	477.60		10.44	9.97E-02	3.57E-01	3.57E-01
+	K-40	1460.82	*	10.66	9.14E+00	2.55E-01	2.55E-01
	Mn-54	834.85		99.98	2.31E-03	4.23E-02	4.23E-02
	Co-60	1173.23		99.85	-5.42E-03	4.77E-02	5.55E-02
		1332.49		99.98	3.94E-03		4.77E-02
	Nb-94	702.65		99.81	1.78E-02	3.77E-02	3.91E-02
		871.09		99.89	9.66E-03		3.77E-02
	Ag-108m	79.13		6.60	5.80E-01	3.29E-02	1.08E+00
		433.94		90.50	-3.11E-03		3.29E-02
		614.28		89.80	-2.48E-02		5.48E-02
		722.94		90.80	-1.37E-02		4.37E-02
	Sb-125	176.31		6.84	-8.10E-02	1.05E-01	4.49E-01
		380.45		1.52	1.25E+00		2.39E+00
		427.87		29.60	-1.30E-02		1.05E-01
		463.36		10.49	1.30E-01		3.22E-01
		600.60		17.65	8.37E-03		1.98E-01
		606.71		4.98	-1.39E-01		1.11E+00
		635.95		11.22	-3.23E-02		3.06E-01

Analysis Report for 30-Sep-19-10029

L1-12107A-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-5.32E-01	1.05E-01	1.99E+00
Ba-133	79.61	2.65	9.34E-01	6.49E-02	2.56E+00
	81.00	32.90	-2.02E-01		1.75E-01
	276.40	7.16	2.71E-01		4.76E-01
	302.85	18.34	8.69E-02		1.84E-01
	356.01	62.05	-4.57E-02		6.49E-02
	383.85	8.94	-1.41E-01		3.56E-01
Cs-134	475.36	1.48	6.89E-01	5.02E-02	2.45E+00
	563.25	8.34	-1.80E-01		3.65E-01
	569.33	15.37	-2.91E-02		2.40E-01
	604.72	97.62	4.35E-03		5.13E-02
	795.86	85.46	8.49E-03		5.02E-02
	801.95	8.69	-1.44E-01		4.53E-01
	1038.61	0.99	-1.94E+00		4.36E+00
	1167.97	1.79	-2.71E+00		2.99E+00
	1365.19	3.02	5.20E-01		1.52E+00
Cs-137	661.66	85.10	-1.16E-03	4.25E-02	4.25E-02
Eu-152	121.78	28.67	6.46E-02	1.16E-01	1.24E-01
	244.70	7.61	2.28E-02		4.64E-01
	295.94	0.45	5.60E+00		8.55E+00
	344.28	26.60	-7.94E-02		1.16E-01
	367.79	0.86	-7.62E-02		3.73E+00
	411.12	2.24	-5.84E-01		1.34E+00
	443.96	2.83	3.45E-01		1.20E+00
	488.68	0.42	9.79E+00		9.18E+00
	563.99	0.49	-3.56E+00		6.19E+00
	586.26	0.46	-4.42E+00		1.20E+01
	678.62	0.47	-3.01E+00		7.15E+00
	688.67	0.86	1.58E-01		4.89E+00
	719.35	0.28	-3.79E+00		1.31E+01
	778.90	12.96	-1.24E-02		2.97E-01
	810.45	0.32	1.60E+00		1.25E+01
	867.37	4.26	-2.78E-02		8.98E-01
	919.33	0.43	-5.35E+00		9.14E+00
	964.08	14.65	1.33E-01		3.70E-01
	1085.87	10.24	5.31E-02		4.53E-01
	1089.74	1.73	-1.01E+00		2.38E+00
	1112.07	13.69	-2.65E-02		3.83E-01
	1212.95	1.43	-1.02E+00		4.05E+00
	1249.94	0.19	-2.25E+01		2.79E+01
	1299.14	1.63	9.16E-01		3.47E+00
	1408.01	21.07	2.12E-02		1.74E-01
	1457.64	0.50	-3.26E+00		4.26E+01
	1528.10	0.28	-1.54E+00		1.10E+01
Eu-154	123.07	40.40	5.10E-02	8.54E-02	8.54E-02
	247.93	6.89	5.62E-02		4.56E-01
	591.76	4.95	-4.80E-02		7.30E-01
	692.42	1.78	3.75E-01		2.25E+00
	723.30	20.06	-7.42E-02		1.98E-01
	756.80	4.52	2.88E-01		8.61E-01
	873.18	12.08	-1.52E-01		2.96E-01

Analysis Report for 30-Sep-19-10029

L1-12107A-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.62E-01	8.54E-02	4.61E-01
	1004.76	18.01	-8.80E-02		2.41E-01
	1274.43	34.80	8.20E-02		1.82E-01
	1596.48	1.80	-1.33E+00		1.43E+00
Eu-155	45.30	1.31	3.98E+00	1.71E-01	1.17E+01
	60.01	1.22	5.16E-01		1.29E+01
	86.55	30.70	-1.12E-02		1.71E-01
	105.31	21.10	-1.65E-02		1.76E-01
Ra-226	186.21	3.64	3.44E-01	9.58E-01	9.58E-01
Pa-231	27.36	10.30	5.40E-01	1.17E+00	1.17E+00
	283.69	1.70	4.35E-01		1.71E+00
	300.07	2.47	-6.86E-01		1.31E+00
	302.65	2.20	7.24E-01		1.53E+00
	330.06	1.40	3.90E-02		2.27E+00
U-235	143.76	10.96	8.70E-02	6.22E-02	2.88E-01
	163.33	5.08	4.51E-01		7.20E-01
	185.71	57.20	4.14E-02		6.22E-02
	202.11	1.08	-9.16E-01		2.99E+00
	205.31	5.01	-4.30E-01		6.30E-01
Am-241	59.54	35.90	-1.60E-01	4.40E-01	4.40E-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 30-Sep-19-10030

L1-12107A-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10030
Sample Description	: L1-12107A-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.687E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:20:00AM
Acquisition Started	: 9/30/2019 10:39:22AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80078
Fill Height	: 1687.44 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:54:36AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/1/19 - 0700
J Graham

Analysis Report for 30-Sep-19-10030

L1-12107A-FSGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.59	948 -	961	954.44	9.63E+01	16.23	5.77E+01	0.84
2	295.14	1177 -	1185	1180.45	2.86E+01	8.92	2.34E+01	0.45
3	351.69	1401 -	1413	1406.48	6.00E+01	11.91	3.10E+01	1.04
4	582.90	2325 -	2337	2330.80	3.44E+01	8.22	1.26E+01	1.24
5	1460.04	5830 -	5852	5839.98	3.66E+02	20.51	1.52E+01	2.06

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.90	1460.82	*	10.66	8.88E+00	6.29E-01
Tl-208	0.98	583.19	*	85.00	5.61E-02	1.38E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.69E-01	3.16E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.34E-01	4.31E-02
		351.93	*	35.60	1.65E-01	3.53E-02
		785.96		1.06		

Analysis Report for 30-Sep-19-10030

L1-12107A-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
	K-40	0.906	8.88E+00	6.29E-01	
	Tl-208	0.987	5.61E-02	1.38E-02	
X	Bi-211	0.941			
	Pb-212	1.000	1.69E-01	3.16E-02	
	Pb-214	0.994	1.53E-01	2.73E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10030

L1-12107A-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:54:36AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.37E-02	5.98E-02	5.98E-02
	BE-7	477.60		10.44	-1.76E-01	4.02E-01	4.02E-01
+	K-40	1460.82	*	10.66	8.88E+00	6.80E-01	6.80E-01
	Mn-54	834.85		99.98	-4.89E-02	4.79E-02	4.79E-02
	Co-60	1173.23		99.85	4.12E-02	6.13E-02	7.64E-02
		1332.49		99.98	7.44E-03		6.13E-02
	Nb-94	702.65		99.81	-1.45E-02	4.71E-02	4.87E-02
		871.09		99.89	-1.48E-02		4.71E-02
	Ag-108m	79.13		6.60	3.61E-01	4.77E-02	1.95E+00
		433.94		90.50	-9.50E-03		4.77E-02
		614.28		89.80	-1.16E-01		6.06E-02
		722.94		90.80	-1.25E-02		5.15E-02
	Sb-125	176.31		6.84	3.68E-01	1.32E-01	6.07E-01
		380.45		1.52	1.22E+00		2.63E+00
		427.87		29.60	-9.76E-02		1.32E-01
		463.36		10.49	2.33E-01		4.05E-01
		600.60		17.65	6.17E-02		2.79E-01
		606.71		4.98	2.05E+00		1.35E+00
		635.95		11.22	-1.81E-01		3.06E-01

Analysis Report for 30-Sep-19-10030

L1-12107A-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.03E+00	1.32E-01	2.38E+00
Ba-133	79.61	2.65	7.49E-01	7.37E-02	4.70E+00
	81.00	32.90	-1.24E-01		3.20E-01
	276.40	7.16	9.73E-02		5.41E-01
	302.85	18.34	4.38E-02		2.17E-01
	356.01	62.05	-4.15E-02		7.37E-02
	383.85	8.94	-2.33E-02		4.48E-01
Cs-134	475.36	1.48	-1.99E-01	5.86E-02	2.66E+00
	563.25	8.34	8.53E-02		4.97E-01
	569.33	15.37	-1.95E-02		2.68E-01
	604.72	97.62	-8.45E-03		6.42E-02
	795.86	85.46	1.48E-02		5.86E-02
	801.95	8.69	-5.79E-02		5.14E-01
	1038.61	0.99	-3.70E+00		5.38E+00
	1167.97	1.79	3.53E-01		4.12E+00
	1365.19	3.02	4.80E-01		1.70E+00
Cs-137	661.66	85.10	-6.77E-03	5.63E-02	5.63E-02
Eu-152	121.78	28.67	1.10E-01	1.56E-01	1.71E-01
	244.70	7.61	4.18E-01		6.05E-01
	295.94	0.45	-2.91E+00		9.77E+00
	344.28	26.60	8.66E-02		1.56E-01
	367.79	0.86	-4.98E-01		4.31E+00
	411.12	2.24	-1.28E+00		1.76E+00
	443.96	2.83	-1.14E+00		1.34E+00
	488.68	0.42	-8.02E+00		9.27E+00
	563.99	0.49	9.11E-01		8.42E+00
	586.26	0.46	-6.29E+00		1.22E+01
	678.62	0.47	-3.59E+00		9.22E+00
	688.67	0.86	1.68E+00		5.51E+00
	719.35	0.28	-5.02E+00		1.46E+01
	778.90	12.96	-2.83E-01		3.85E-01
	810.45	0.32	-4.76E+00		1.50E+01
	867.37	4.26	-5.85E-01		1.04E+00
	919.33	0.43	-6.96E+00		1.19E+01
	964.08	14.65	3.89E-01		5.37E-01
	1085.87	10.24	1.81E-01		5.73E-01
	1089.74	1.73	-2.12E+00		3.67E+00
	1112.07	13.69	-2.10E-01		4.28E-01
	1212.95	1.43	-2.39E+00		5.40E+00
	1249.94	0.19	2.17E+01		4.02E+01
	1299.14	1.63	-1.41E+00		4.26E+00
	1408.01	21.07	4.78E-02		2.24E-01
	1457.64	0.50	1.94E+02		5.02E+01
	1528.10	0.28	7.60E+00		1.56E+01
Eu-154	123.07	40.40	5.72E-03	1.21E-01	1.21E-01
	247.93	6.89	-1.35E-01		5.73E-01
	591.76	4.95	3.08E-02		8.51E-01
	692.42	1.78	-1.86E+00		2.48E+00
	723.30	20.06	-8.01E-02		2.37E-01
	756.80	4.52	-1.49E-01		9.30E-01
	873.18	12.08	-4.15E-02		4.46E-01

Analysis Report for 30-Sep-19-10030

L1-12107A-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.17E-01	1.21E-01	4.93E-01
	1004.76	18.01	1.80E-01		3.39E-01
	1274.43	34.80	-2.89E-01		1.53E-01
	1596.48	1.80	2.75E-01		2.54E+00
Eu-155	45.30	1.31	-1.82E+01	2.61E-01	3.04E+01
	60.01	1.22	1.05E+01		3.20E+01
	86.55	30.70	6.88E-03		2.61E-01
	105.31	21.10	-8.46E-02		2.65E-01
Ra-226	186.21	3.64	6.72E-01	1.24E+00	1.24E+00
Pa-231	27.36	10.30	2.95E+00	1.60E+00	3.58E+00
	283.69	1.70	-5.87E-01		2.22E+00
	300.07	2.47	-9.71E-01		1.60E+00
	302.65	2.20	7.58E-01		1.79E+00
	330.06	1.40	4.56E-01		2.96E+00
U-235	143.76	10.96	2.51E-01	7.84E-02	3.83E-01
	163.33	5.08	-2.96E-01		7.54E-01
	185.71	57.20	-1.36E-02		7.84E-02
	202.11	1.08	8.56E-01		3.64E+00
	205.31	5.01	-3.15E-01		7.83E-01
Am-241	59.54	35.90	1.41E-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 30-Sep-19-10031

L1-12107A-FSGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10031
Sample Description	: L1-12107A-FSGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.602E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:22:00AM
Acquisition Started	: 9/30/2019 10:39:30AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80079
Fill Height	: 1601.75 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 10:54:35AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/1/19 - 0700

J Graham

Analysis Report for 30-Sep-19-10031

L1-12107A-FSGS-012SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.67	950 -	960	954.28	1.01E+02	16.01	6.35E+01	1.06
2	338.68	1349 -	1358	1353.80	2.60E+01	8.71	2.20E+01	0.32
3	352.03	1400 -	1414	1407.13	7.31E+01	11.31	1.89E+01	1.31
4	583.27	2325 -	2338	2331.20	3.99E+01	8.56	1.21E+01	0.95
5	609.42	2428 -	2443	2435.71	5.84E+01	9.34	9.61E+00	0.74
6	1460.23	5827 -	5851	5838.84	4.40E+02	21.84	9.16E+00	1.47

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.94	1460.82	*	10.66	9.74E+00	6.43E-01
Tl-208	0.99	583.19	*	85.00	5.94E-02	1.32E-02
Bi-211	0.86	351.07	*	13.02	4.99E-01	8.70E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.58E-01	2.83E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.67E-01	2.86E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 30-Sep-19-10031

L1-12107A-FSGS-012SS

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	1.82E-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	1.99E-01	6.87E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 30-Sep-19-10031

L1-12107A-FSGS-012SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.945	9.74E+00	6.43E-01	
	Tl-208	0.999	5.94E-02	1.32E-02	
?	Bi-211	0.863	4.99E-01	8.70E-02	
	Pb-212	1.000	1.58E-01	2.83E-02	
	Bi-214	0.999	1.67E-01	2.86E-02	
?	Pb-214	0.999	1.82E-01	3.18E-02	
	Ac-228	0.997	1.99E-01	6.87E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10031

L1-12107A-FSGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 10:54:35AM
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	7.17E-02	5.61E-02	5.61E-02
	BE-7	477.60		10.44	3.38E-02	3.44E-01	3.44E-01
+	K-40	1460.82	*	10.66	9.74E+00	5.22E-01	5.22E-01
	Mn-54	834.85		99.98	-2.38E-02	4.53E-02	4.53E-02
	Co-60	1173.23		99.85	6.09E-02	5.48E-02	7.33E-02
		1332.49		99.98	3.41E-02		5.48E-02
	Nb-94	702.65		99.81	-5.56E-02	3.66E-02	3.87E-02
		871.09		99.89	-1.15E-02		3.66E-02
	Ag-108m	79.13		6.60	5.10E-01	4.07E-02	1.14E+00
		433.94		90.50	1.45E-02		4.07E-02
		614.28		89.80	-4.83E-03		5.76E-02
		722.94		90.80	-5.88E-03		5.60E-02
	Sb-125	176.31		6.84	2.35E-01	1.30E-01	4.56E-01
		380.45		1.52	-1.05E+00		2.13E+00
		427.87		29.60	2.58E-02		1.30E-01
		463.36		10.49	1.92E-03		3.39E-01
		600.60		17.65	3.67E-02		2.49E-01
		606.71		4.98	2.75E-02		1.34E+00
		635.95		11.22	-2.66E-01		3.39E-01

Analysis Report for 30-Sep-19-10031

L1-12107A-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.72E+00	1.30E-01	2.34E+00
Ba-133	79.61	2.65	1.64E+00	6.41E-02	2.79E+00
	81.00	32.90	-2.52E-01		1.82E-01
	276.40	7.16	2.00E-01		4.69E-01
	302.85	18.34	5.38E-02		1.74E-01
	356.01	62.05	-2.17E-02		6.41E-02
	383.85	8.94	1.83E-01		3.71E-01
Cs-134	475.36	1.48	1.16E+00	4.26E-02	2.42E+00
	563.25	8.34	-1.93E-01		5.00E-01
	569.33	15.37	7.77E-02		2.76E-01
	604.72	97.62	8.79E-03		5.89E-02
	795.86	85.46	1.42E-02		4.26E-02
	801.95	8.69	9.07E-03		4.51E-01
	1038.61	0.99	-4.98E-01		5.69E+00
	1167.97	1.79	3.67E-01		3.63E+00
	1365.19	3.02	7.69E-01		1.69E+00
Cs-137	661.66	85.10	-3.05E-03	4.87E-02	4.87E-02
Eu-152	121.78	28.67	1.03E-02	1.14E-01	1.14E-01
	244.70	7.61	1.67E-01		4.64E-01
	295.94	0.45	4.63E+00		9.18E+00
	344.28	26.60	3.04E-02		1.19E-01
	367.79	0.86	-1.14E+00		3.33E+00
	411.12	2.24	6.85E-03		1.59E+00
	443.96	2.83	1.46E-01		1.22E+00
	488.68	0.42	7.61E-01		8.23E+00
	563.99	0.49	-1.01E+01		7.88E+00
	586.26	0.46	-2.48E+00		1.20E+01
	678.62	0.47	1.30E-01		9.30E+00
	688.67	0.86	1.12E+00		4.88E+00
	719.35	0.28	-1.74E+01		1.53E+01
	778.90	12.96	-9.82E-02		3.46E-01
	810.45	0.32	1.11E+01		1.39E+01
	867.37	4.26	1.07E-01		7.84E-01
	919.33	0.43	3.88E-02		1.10E+01
	964.08	14.65	-3.28E-01		4.26E-01
	1085.87	10.24	-6.49E-01		5.88E-01
	1089.74	1.73	-2.37E+00		3.35E+00
	1112.07	13.69	-2.04E-01		4.29E-01
	1212.95	1.43	-4.64E-01		5.49E+00
	1249.94	0.19	2.21E+01		3.35E+01
	1299.14	1.63	1.37E+00		3.94E+00
	1408.01	21.07	1.26E-01		2.53E-01
	1457.64	0.50	2.06E+02		4.93E+01
	1528.10	0.28	4.34E+00		1.18E+01
Eu-154	123.07	40.40	3.64E-02	7.96E-02	7.96E-02
	247.93	6.89	-2.72E-01		4.00E-01
	591.76	4.95	-2.48E-01		7.31E-01
	692.42	1.78	1.23E+00		2.47E+00
	723.30	20.06	1.38E-01		2.59E-01
	756.80	4.52	-5.75E-01		9.60E-01
	873.18	12.08	-2.07E-02		3.42E-01

Analysis Report for 30-Sep-19-10031

L1-12107A-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.47E-01	7.96E-02	5.29E-01
	1004.76	18.01	1.57E-01		3.18E-01
	1274.43	34.80	1.87E-02		1.74E-01
	1596.48	1.80	1.41E+00		2.54E+00
Eu-155	45.30	1.31	3.68E+00	1.73E-01	1.10E+01
	60.01	1.22	3.45E+00		1.34E+01
	86.55	30.70	5.12E-02		1.73E-01
	105.31	21.10	7.53E-02		2.03E-01
Ra-226	186.21	3.64	4.67E-01	9.26E-01	9.26E-01
Pa-231	27.36	10.30	1.38E+00	1.35E+00	1.35E+00
	283.69	1.70	-1.68E+00		1.80E+00
	300.07	2.47	-1.29E+00		1.36E+00
	302.65	2.20	4.94E-01		1.44E+00
	330.06	1.40	1.24E+00		2.31E+00
U-235	143.76	10.96	8.09E-03	6.00E-02	3.04E-01
	163.33	5.08	-5.66E-02		5.95E-01
	185.71	57.20	4.81E-02		6.00E-02
	202.11	1.08	-3.98E-01		2.81E+00
	205.31	5.01	-2.22E-01		5.97E-01
Am-241	59.54	35.90	1.65E-01	4.66E-01	4.66E-01

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

Apex-Gamma

Analysis Report for 30-Sep-19-10032

L1-12107A-FSGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10032
Sample Description	: L1-12107A-FSGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.798E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:24:00AM
Acquisition Started	: 9/30/2019 10:58:07AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80080
Fill Height	: 1798.16 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 11:13:10AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 10/1/19 - 0700

J Graham

Analysis Report for 30-Sep-19-10032

L1-12107A-FSGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.71	473 -	482	477.60	9.26E+01	19.49	1.23E+02	1.00
2	351.99	699 -	708	703.93	9.12E+01	13.62	4.18E+01	1.24
3	583.35	1162 -	1171	1166.30	3.62E+01	9.83	2.58E+01	1.18
4	609.29	1213 -	1223	1218.16	7.54E+01	12.10	2.96E+01	1.53
5	911.18	1817 -	1826	1821.80	3.12E+01	8.02	1.38E+01	1.27
6	1460.71	2913 -	2928	2921.47	4.96E+02	22.52	3.81E+00	1.81

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	8.96E+00	5.63E-01
Tl-208	0.99	583.19	*	85.00	4.52E-02	1.26E-02
Bi-211	0.87	351.07	*	13.02	5.32E-01	9.02E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.27E-01	2.86E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.81E-01	3.10E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 30-Sep-19-10032

L1-12107A-FSGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.94E-01	3.30E-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	1.72E-01	4.47E-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 30-Sep-19-10032

L1-12107A-FSGS-013SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	8.96E+00	5.63E-01	
	Tl-208	0.996	4.52E-02	1.26E-02	
?	Bi-211	0.872	5.32E-01	9.02E-02	
	Pb-212	0.999	1.27E-01	2.86E-02	
	Bi-214	1.000	1.81E-01	3.10E-02	
?	Pb-214	0.513	1.94E-01	3.30E-02	
	Ac-228	1.000	1.72E-01	4.47E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10032

L1-12107A-FSGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 11:13:10AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.52E-02	5.15E-02	5.15E-02
	BE-7	477.60		10.44	-1.74E-02	2.83E-01	2.83E-01
+	K-40	1460.82	*	10.66	8.96E+00	2.56E-01	2.56E-01
	Mn-54	834.85		99.98	2.11E-03	4.05E-02	4.05E-02
	Co-60	1173.23		99.85	-5.83E-03	4.39E-02	5.40E-02
		1332.49		99.98	4.51E-03		4.39E-02
	Nb-94	702.65		99.81	-8.91E-03	3.39E-02	3.39E-02
		871.09		99.89	-1.05E-02		3.63E-02
	Ag-108m	79.13		6.60	3.63E-01	3.42E-02	1.14E+00
		433.94		90.50	-6.23E-03		3.42E-02
		614.28		89.80	-3.37E-02		5.26E-02
		722.94		90.80	-7.42E-03		4.20E-02
	Sb-125	176.31		6.84	1.00E-01	1.01E-01	4.72E-01
		380.45		1.52	-8.56E-01		1.91E+00
		427.87		29.60	-1.52E-02		1.01E-01
		463.36		10.49	6.54E-03		2.96E-01
		600.60		17.65	2.15E-02		2.28E-01
		606.71		4.98	5.10E-02		1.27E+00
		635.95		11.22	8.40E-02		3.22E-01

Analysis Report for 30-Sep-19-10032

L1-12107A-FSGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.13E-01	1.01E-01	2.06E+00
Ba-133	79.61	2.65	-6.35E-01	6.56E-02	2.64E+00
	81.00	32.90	-1.99E-01		1.86E-01
	276.40	7.16	-1.71E-02		4.69E-01
	302.85	18.34	5.26E-02		1.79E-01
	356.01	62.05	-3.17E-02		6.56E-02
	383.85	8.94	3.22E-02		3.26E-01
Cs-134	475.36	1.48	-4.93E-01	4.82E-02	1.89E+00
	563.25	8.34	3.49E-02		4.29E-01
	569.33	15.37	1.25E-01		2.37E-01
	604.72	97.62	-1.53E-03		5.44E-02
	795.86	85.46	2.92E-03		4.82E-02
	801.95	8.69	-8.12E-02		4.58E-01
	1038.61	0.99	1.41E+00		4.88E+00
	1167.97	1.79	1.61E+00		3.32E+00
	1365.19	3.02	8.80E-01		1.61E+00
Cs-137	661.66	85.10	2.07E-03	4.34E-02	4.34E-02
Eu-152	121.78	28.67	-3.88E-03	1.13E-01	1.13E-01
	244.70	7.61	-1.61E-01		4.47E-01
	295.94	0.45	1.99E+00		7.85E+00
	344.28	26.60	-6.65E-02		1.16E-01
	367.79	0.86	7.02E-01		3.52E+00
	411.12	2.24	1.20E-01		1.53E+00
	443.96	2.83	-1.57E-01		1.04E+00
	488.68	0.42	3.58E-01		7.65E+00
	563.99	0.49	-3.68E-01		7.11E+00
	586.26	0.46	2.94E-01		1.10E+01
	678.62	0.47	4.51E+00		8.34E+00
	688.67	0.86	-1.52E+00		3.83E+00
	719.35	0.28	-5.28E-01		1.29E+01
	778.90	12.96	1.53E-03		3.36E-01
	810.45	0.32	-1.97E+00		1.19E+01
	867.37	4.26	-4.64E-02		8.65E-01
	919.33	0.43	-5.81E+00		1.01E+01
	964.08	14.65	-4.02E-01		3.52E-01
	1085.87	10.24	1.36E-01		5.48E-01
	1089.74	1.73	2.18E+00		3.28E+00
	1112.07	13.69	-1.41E-01		3.52E-01
	1212.95	1.43	2.12E-01		4.42E+00
	1249.94	0.19	1.81E+01		3.34E+01
	1299.14	1.63	-9.00E-01		2.82E+00
	1408.01	21.07	7.65E-02		1.96E-01
	1457.64	0.50	-3.19E-01		4.22E+01
	1528.10	0.28	-7.15E+00		1.03E+01
Eu-154	123.07	40.40	5.62E-03	8.18E-02	8.18E-02
	247.93	6.89	-1.09E-01		4.68E-01
	591.76	4.95	-3.36E-01		7.36E-01
	692.42	1.78	-1.85E-01		2.03E+00
	723.30	20.06	-4.08E-02		1.88E-01
	756.80	4.52	3.65E-02		8.47E-01
	873.18	12.08	-1.81E-02		3.17E-01

Analysis Report for 30-Sep-19-10032

L1-12107A-FSGS-013SS

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	8.18E-02	3.92E-01
	1004.76	18.01	-7.96E-02		2.44E-01
	1274.43	34.80	-2.39E-02		1.65E-01
	1596.48	1.80	-7.16E-01		1.43E+00
Eu-155	45.30	1.31	-2.09E+00	1.80E-01	1.04E+01
	60.01	1.22	-1.95E+00		1.19E+01
	86.55	30.70	3.83E-02		1.80E-01
	105.31	21.10	5.44E-02		1.94E-01
Ra-226	186.21	3.64	9.35E-02	9.35E-01	9.35E-01
Pa-231	27.36	10.30	5.60E-01	1.09E+00	1.09E+00
	283.69	1.70	7.04E-01		1.97E+00
	300.07	2.47	-1.51E+00		1.24E+00
	302.65	2.20	4.38E-01		1.49E+00
	330.06	1.40	4.36E-01		2.36E+00
U-235	143.76	10.96	-3.23E-02	5.87E-02	2.83E-01
	163.33	5.08	4.92E-02		6.99E-01
	185.71	57.20	1.20E-03		5.87E-02
	202.11	1.08	5.17E-01		2.99E+00
	205.31	5.01	-1.67E-02		6.55E-01
Am-241	59.54	35.90	-1.26E-02	4.23E-01	4.23E-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 30-Sep-19-10033

L1-12107A-FSGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10033
Sample Description	: L1-12107A-FSGS-014SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.576E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:26:00AM
Acquisition Started	: 9/30/2019 10:58:14AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80081
Fill Height	: 1576.29 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 11:13:17AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/1/19 - 0700

J Graham

Analysis Report for 30-Sep-19-10033

L1-12107A-FSGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	946 -	960	954.70	9.56E+01	16.58	6.04E+01	0.66
2	338.21	1348 -	1357	1352.60	2.50E+01	8.29	1.90E+01	0.86
3	351.87	1400 -	1411	1407.20	6.44E+01	11.29	2.46E+01	0.37
4	583.02	2325 -	2338	2331.28	5.26E+01	8.24	5.43E+00	0.88
5	609.06	2429 -	2442	2435.43	5.65E+01	8.13	3.50E+00	1.47
6	1460.12	5829 -	5852	5840.31	3.97E+02	20.79	8.82E+00	1.42

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.92	1460.82	*	10.66	9.81E+00	6.67E-01
Tl-208	0.99	583.19	*	85.00	8.71E-02	1.46E-02
Bi-211	0.90	351.07	*	13.02	4.90E-01	9.45E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.70E-01	3.25E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.80E-01	2.81E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 30-Sep-19-10033

L1-12107A-FSGS-014SS

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	1.79E-01	3.45E-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	2.13E-01	7.29E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 30-Sep-19-10033

L1-12107A-FSGS-014SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.924	9.81E+00	6.67E-01	
	Tl-208	0.995	8.71E-02	1.46E-02	
?	Bi-211	0.903	4.90E-01	9.45E-02	
	Pb-212	1.000	1.70E-01	3.25E-02	
	Bi-214	0.996	1.80E-01	2.81E-02	
?	Pb-214	1.000	1.79E-01	3.45E-02	
	Ac-228	1.000	2.13E-01	7.29E-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 30-Sep-19-10033

L1-12107A-FSGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 11:13:17AM
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	8.86E-02	6.46E-02	6.46E-02
	BE-7	477.60		10.44	1.46E-01	4.03E-01	4.03E-01
+	K-40	1460.82	*	10.66	9.81E+00	5.66E-01	5.66E-01
	Mn-54	834.85		99.98	-1.02E-02	5.28E-02	5.28E-02
	Co-60	1173.23		99.85	3.04E-02	4.96E-02	6.08E-02
		1332.49		99.98	-2.88E-02		4.96E-02
	Nb-94	702.65		99.81	3.52E-02	4.53E-02	4.53E-02
		871.09		99.89	-1.09E-02		4.78E-02
	Ag-108m	79.13		6.60	3.65E-01	3.97E-02	1.85E+00
		433.94		90.50	-4.02E-02		3.97E-02
		614.28		89.80	-1.23E-03		5.87E-02
		722.94		90.80	-1.09E-03		5.31E-02
	Sb-125	176.31		6.84	-3.26E-01	1.29E-01	5.56E-01
		380.45		1.52	1.70E+00		2.69E+00
		427.87		29.60	2.31E-02		1.29E-01
		463.36		10.49	1.24E-01		4.23E-01
		600.60		17.65	5.82E-03		2.52E-01
		606.71		4.98	6.36E-01		1.33E+00
		635.95		11.22	-1.76E-01		3.71E-01

Analysis Report for 30-Sep-19-10033

L1-12107A-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.73E+00	1.29E-01	2.71E+00
Ba-133	79.61	2.65	-2.53E+00	7.38E-02	4.31E+00
	81.00	32.90	-1.64E-01		3.01E-01
	276.40	7.16	2.93E-01		5.50E-01
	302.85	18.34	3.14E-02		2.27E-01
	356.01	62.05	-1.02E-01		7.38E-02
	383.85	8.94	1.77E-01		4.69E-01
Cs-134	475.36	1.48	1.61E+00	5.28E-02	2.76E+00
	563.25	8.34	2.02E-01		4.53E-01
	569.33	15.37	6.72E-02		2.68E-01
	604.72	97.62	2.54E-03		6.76E-02
	795.86	85.46	2.60E-02		5.28E-02
	801.95	8.69	-7.78E-01		5.42E-01
	1038.61	0.99	2.50E+00		6.16E+00
	1167.97	1.79	-9.46E-01		2.86E+00
	1365.19	3.02	2.43E-01		1.68E+00
Cs-137	661.66	85.10	1.49E-02	5.79E-02	5.79E-02
Eu-152	121.78	28.67	1.73E-02	1.39E-01	1.55E-01
	244.70	7.61	-4.32E-01		5.41E-01
	295.94	0.45	7.57E+00		1.13E+01
	344.28	26.60	-1.05E-01		1.39E-01
	367.79	0.86	-1.21E+00		4.24E+00
	411.12	2.24	3.71E-01		1.84E+00
	443.96	2.83	-1.64E+00		1.27E+00
	488.68	0.42	2.47E+00		1.05E+01
	563.99	0.49	-3.66E+00		7.54E+00
	586.26	0.46	2.20E-01		1.41E+01
	678.62	0.47	9.69E-01		1.07E+01
	688.67	0.86	9.56E-01		4.94E+00
	719.35	0.28	-2.00E+00		1.39E+01
	778.90	12.96	-2.35E-02		3.55E-01
	810.45	0.32	5.21E+00		1.60E+01
	867.37	4.26	-4.32E-01		1.14E+00
	919.33	0.43	-7.18E+00		1.29E+01
	964.08	14.65	5.00E-01		4.98E-01
	1085.87	10.24	-5.96E-03		6.02E-01
	1089.74	1.73	2.52E+00		3.73E+00
	1112.07	13.69	3.07E-01		4.71E-01
	1212.95	1.43	3.70E-01		5.44E+00
	1249.94	0.19	9.21E+00		4.09E+01
	1299.14	1.63	1.87E+00		3.99E+00
	1408.01	21.07	2.07E-01		2.76E-01
	1457.64	0.50	2.17E+02		5.26E+01
	1528.10	0.28	3.87E+00		1.21E+01
Eu-154	123.07	40.40	-3.61E-02	1.10E-01	1.10E-01
	247.93	6.89	-2.03E-01		5.55E-01
	591.76	4.95	1.05E+00		1.02E+00
	692.42	1.78	-1.33E+00		2.17E+00
	723.30	20.06	1.35E-01		2.51E-01
	756.80	4.52	3.27E-01		1.15E+00
	873.18	12.08	2.51E-01		3.89E-01

Analysis Report for 30-Sep-19-10033

L1-12107A-FSGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.14E-01	1.10E-01	5.01E-01
	1004.76	18.01	-9.91E-02		3.04E-01
	1274.43	34.80	3.42E-02		1.74E-01
	1596.48	1.80	-9.04E-01		2.59E+00
Eu-155	45.30	1.31	8.51E+00	2.64E-01	3.24E+01
	60.01	1.22	-4.64E+00		2.93E+01
	86.55	30.70	-1.10E-01		2.64E-01
	105.31	21.10	7.59E-03		2.94E-01
Ra-226	186.21	3.64	-3.45E-01	1.05E+00	1.05E+00
Pa-231	27.36	10.30	5.07E+00	1.79E+00	3.91E+00
	283.69	1.70	4.41E-02		2.18E+00
	300.07	2.47	5.02E-01		1.79E+00
	302.65	2.20	3.96E-01		1.90E+00
	330.06	1.40	-1.31E+00		2.81E+00
U-235	143.76	10.96	2.61E-02	6.83E-02	4.07E-01
	163.33	5.08	5.21E-01		8.29E-01
	185.71	57.20	1.35E-02		6.83E-02
	202.11	1.08	-4.96E-01		3.32E+00
	205.31	5.01	-1.75E-01		7.49E-01
Am-241	59.54	35.90	-8.08E-02	1.06E+00	1.06E+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 30-Sep-19-10034

L1-12107A-FSGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10034
Sample Description	: L1-12107A-FSGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.620E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:28:00AM
Acquisition Started	: 9/30/2019 10:58:22AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80082
Fill Height	: 1620.45 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 11:13:34AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/1/19 - 0700
J Graham

Analysis Report for 30-Sep-19-10034

L1-12107A-FSGS-015SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.85	947 -	961	954.97	1.22E+02	18.52	7.66E+01	0.98
2	352.14	1399 -	1414	1407.58	8.78E+01	12.70	2.42E+01	0.42
3	558.45	2228 -	2237	2232.01	1.80E+01	5.94	6.95E+00	0.40
4	583.05	2324 -	2336	2330.32	5.94E+01	8.82	6.64E+00	0.44
5	609.29	2429 -	2442	2435.18	6.10E+01	11.19	2.30E+01	0.39
6	911.09	3635 -	3649	3641.84	4.10E+01	8.85	1.30E+01	1.27
7	1460.23	5826 -	5850	5838.84	4.19E+02	21.10	6.33E+00	1.68

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.94	1460.82	*	10.66	9.24E+00	6.15E-01
Tl-208	0.99	583.19	*	85.00	8.82E-02	1.41E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.92E-01	3.30E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.74E-01	3.37E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 30-Sep-19-10034

L1-12107A-FSGS-015SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.19E-01	3.61E-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	2.72E-01	5.98E-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 30-Sep-19-10034

L1-12107A-FSGS-015SS

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.945	9.24E+00	6.15E-01	
Tl-208	0.997	8.82E-02	1.41E-02	
Pb-212	0.993	1.92E-01	3.30E-02	
Bi-214	1.000	1.74E-01	3.37E-02	
Pb-214	0.996	2.19E-01	3.61E-02	
Ac-228	0.999	2.72E-01	5.98E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10034

L1-12107A-FSGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 11:13:34AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
3	558.45	2.00556E-02	32.93		

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.17E-02	5.86E-02	5.86E-02
	BE-7	477.60		10.44	3.96E-01	4.05E-01	4.05E-01
+	K-40	1460.82	*	10.66	9.24E+00	4.49E-01	4.49E-01
	Mn-54	834.85		99.98	3.75E-02	4.59E-02	4.59E-02
	Co-60	1173.23		99.85	1.76E-02	4.43E-02	6.33E-02
		1332.49		99.98	8.96E-03		4.43E-02
	Nb-94	702.65		99.81	1.08E-02	3.99E-02	3.99E-02
		871.09		99.89	-1.74E-02		4.12E-02
	Ag-108m	79.13		6.60	1.22E+00	3.69E-02	1.26E+00
		433.94		90.50	1.39E-02		3.69E-02
		614.28		89.80	-1.13E-02		6.27E-02
		722.94		90.80	3.00E-02		5.70E-02
	Sb-125	176.31		6.84	4.38E-02	1.13E-01	4.49E-01
		380.45		1.52	-1.36E+00		2.24E+00
		427.87		29.60	-7.68E-02		1.13E-01
		463.36		10.49	3.78E-01		4.22E-01
		600.60		17.65	3.57E-02		2.23E-01
		606.71		4.98	1.96E+00		1.40E+00

Analysis Report for 30-Sep-19-10034

L1-12107A-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	635.95	11.22	-8.16E-04	1.13E-01	3.64E-01
	671.44	1.79	-5.14E-01		2.53E+00
Ba-133	79.61	2.65	2.78E+00	6.79E-02	3.04E+00
	81.00	32.90	-3.62E-01		1.86E-01
	276.40	7.16	-2.92E-01		4.66E-01
	302.85	18.34	1.42E-02		2.04E-01
	356.01	62.05	-4.25E-03		6.79E-02
	383.85	8.94	4.72E-01		4.42E-01
Cs-134	475.36	1.48	1.90E+00	5.33E-02	2.56E+00
	563.25	8.34	-1.93E-01		4.58E-01
	569.33	15.37	1.49E-01		2.73E-01
	604.72	97.62	-7.09E-02		5.91E-02
	795.86	85.46	1.36E-02		5.33E-02
	801.95	8.69	-4.05E-01		6.08E-01
	1038.61	0.99	-3.23E+00		5.75E+00
	1167.97	1.79	2.81E+00		3.66E+00
	1365.19	3.02	6.16E-01		1.55E+00
Cs-137	661.66	85.10	1.58E-02	5.31E-02	5.31E-02
Eu-152	121.78	28.67	9.95E-03	1.13E-01	1.13E-01
	244.70	7.61	1.71E-02		4.74E-01
	295.94	0.45	1.04E+00		9.34E+00
	344.28	26.60	-4.78E-02		1.23E-01
	367.79	0.86	1.36E-01		3.76E+00
	411.12	2.24	1.72E+00		1.72E+00
	443.96	2.83	-1.78E-01		1.21E+00
	488.68	0.42	-5.98E+00		8.21E+00
	563.99	0.49	-2.13E-01		7.44E+00
	586.26	0.46	-8.73E+00		1.35E+01
	678.62	0.47	-6.47E+00		8.78E+00
	688.67	0.86	2.25E+00		4.65E+00
	719.35	0.28	4.13E+00		1.48E+01
	778.90	12.96	2.91E-01		3.85E-01
	810.45	0.32	-1.06E+00		1.43E+01
	867.37	4.26	1.21E-01		9.83E-01
	919.33	0.43	-3.11E+00		1.10E+01
	964.08	14.65	2.06E-01		4.21E-01
	1085.87	10.24	-1.19E-01		5.47E-01
	1089.74	1.73	-7.83E-01		3.82E+00
	1112.07	13.69	-3.96E-01		3.96E-01
	1212.95	1.43	-6.89E-01		4.75E+00
	1249.94	0.19	1.19E+01		3.25E+01
	1299.14	1.63	7.01E-01		4.26E+00
	1408.01	21.07	-1.12E-01		2.12E-01
	1457.64	0.50	2.00E+02		4.79E+01
	1528.10	0.28	-1.34E+00		1.18E+01
Eu-154	123.07	40.40	4.49E-05	7.84E-02	7.84E-02
	247.93	6.89	-1.84E-01		4.36E-01
	591.76	4.95	-5.82E-03		7.63E-01
	692.42	1.78	1.90E+00		2.29E+00
	723.30	20.06	1.71E-01		2.61E-01
	756.80	4.52	3.01E-01		1.03E+00

Analysis Report for 30-Sep-19-10034

L1-12107A-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	-4.35E-01	7.84E-02	3.69E-01
	996.29	10.48	2.22E-01		4.98E-01
	1004.76	18.01	-1.74E-01		2.36E-01
	1274.43	34.80	-1.27E-01		1.49E-01
	1596.48	1.80	1.15E-01		2.19E+00
Eu-155	45.30	1.31	2.80E+00	1.88E-01	1.15E+01
	60.01	1.22	-6.41E-01		1.27E+01
	86.55	30.70	7.48E-03		1.88E-01
	105.31	21.10	-3.06E-02		1.90E-01
Ra-226	186.21	3.64	4.51E-01	9.06E-01	9.06E-01
Pa-231	27.36	10.30	1.12E+00	1.37E+00	1.37E+00
	283.69	1.70	5.11E-01		2.04E+00
	300.07	2.47	-2.32E+00		1.45E+00
	302.65	2.20	3.00E-01		1.69E+00
	330.06	1.40	7.81E-01		2.78E+00
U-235	143.76	10.96	-3.54E-02	5.94E-02	3.16E-01
	163.33	5.08	3.08E-01		6.92E-01
	185.71	57.20	5.60E-02		5.94E-02
	202.11	1.08	-5.82E-01		3.01E+00
	205.31	5.01	-2.99E-01		6.64E-01
Am-241	59.54	35.90	2.04E-01	4.57E-01	4.57E-01

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

Apex-Gamma

Analysis Report for 30-Sep-19-10035

L1-12107A-FSGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10035
Sample Description	: L1-12107A-FSGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.752E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:30:00AM
Acquisition Started	: 9/30/2019 10:58:32AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80083
Fill Height	: 1752.11 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 11:13:38AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/1/19 - 0700

J Graham

Analysis Report for 30-Sep-19-10035

L1-12107A-FSGS-016SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.29	740 -	753	745.86	4.70E+01	13.50	4.80E+01	0.94
2	238.71	948 -	961	955.30	1.25E+02	18.49	7.87E+01	1.45
3	295.37	1175 -	1189	1181.70	6.08E+01	11.96	2.72E+01	0.98
4	351.87	1400 -	1414	1407.48	8.93E+01	11.97	1.87E+01	1.10
5	583.25	2327 -	2339	2332.33	3.27E+01	9.06	1.83E+01	0.60
6	608.89	2428 -	2444	2434.84	7.07E+01	8.86	2.31E+00	1.47
7	911.31	3636 -	3651	3644.27	4.20E+01	9.49	1.60E+01	0.60
8	1460.63	5831 -	5855	5842.91	3.99E+02	21.74	1.82E+01	2.33
9	1764.22	7052 -	7065	7058.93	1.50E+01	3.87	0.00E+00	0.42

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	0.99	1460.82	*	10.66	8.07E+00	5.62E-01
Tl-208	0.99	583.19	*	85.00	4.55E-02	1.29E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.92E-01	3.24E-02
		300.09		3.30		
Bi-214	0.98	609.32	*	45.49	1.89E-01	2.63E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 30-Sep-19-10035

L1-12107A-FSGS-016SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.98	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	2.43E-01	6.36E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.48E-01	5.26E-02
		351.93	*	35.60	2.12E-01	3.32E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	7.76E-01	2.31E-01
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.58E-01	5.93E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.96	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.94E-02	1.47E-02
		202.11		1.08		
		205.31		5.01		

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

Analysis Report for 30-Sep-19-10035

L1-12107A-FSGS-016SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.994	8.07E+00	5.62E-01	
	Tl-208	0.999	4.55E-02	1.29E-02	
X	Bi-211	0.903			
	Pb-212	0.999	1.92E-01	3.24E-02	
	Bi-214	0.986	1.97E-01	2.43E-02	
	Pb-214	0.999	2.22E-01	2.80E-02	
?	Ra-226	0.999	7.76E-01	2.31E-01	
	Ac-228	0.999	2.58E-01	5.93E-02	
?	U-235	0.963	4.94E-02	1.47E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10035

L1-12107A-FSGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 11:13:38AM
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	5.23E-02	5.72E-02	5.72E-02
	BE-7	477.60		10.44	3.29E-02	3.86E-01	3.86E-01
+	K-40	1460.82	*	10.66	8.07E+00	6.48E-01	6.48E-01
	Mn-54	834.85		99.98	1.13E-03	4.77E-02	4.77E-02
	Co-60	1173.23		99.85	-2.78E-03	5.67E-02	5.67E-02
		1332.49		99.98	4.28E-02		5.80E-02
	Nb-94	702.65		99.81	1.46E-05	4.41E-02	4.74E-02
		871.09		99.89	-3.07E-02		4.41E-02
	Ag-108m	79.13		6.60	-2.72E-01	3.66E-02	1.55E+00
		433.94		90.50	-1.62E-02		3.66E-02
		614.28		89.80	8.14E-03		6.39E-02
		722.94		90.80	2.35E-02		5.25E-02
	Sb-125	176.31		6.84	-1.61E-01	1.23E-01	4.96E-01
		380.45		1.52	2.61E-01		2.29E+00
		427.87		29.60	-2.21E-02		1.23E-01
		463.36		10.49	-3.47E-01		3.65E-01
		600.60		17.65	-9.03E-02		2.00E-01
		606.71		4.98	8.34E-01		1.14E+00
		635.95		11.22	1.85E-01		3.68E-01

Analysis Report for 30-Sep-19-10035

L1-12107A-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.35E+00	1.23E-01	2.50E+00
Ba-133	79.61	2.65	-1.34E+00	7.69E-02	3.75E+00
	81.00	32.90	-3.49E-01		2.65E-01
	276.40	7.16	-1.49E-01		5.07E-01
	302.85	18.34	-1.15E-01		1.90E-01
	356.01	62.05	-4.60E-02		7.69E-02
	383.85	8.94	-1.61E-02		3.53E-01
Cs-134	475.36	1.48	1.68E+00	5.31E-02	2.61E+00
	563.25	8.34	-9.76E-02		4.30E-01
	569.33	15.37	1.16E-01		2.56E-01
	604.72	97.62	-2.60E-02		5.43E-02
	795.86	85.46	2.86E-02		5.31E-02
	801.95	8.69	2.46E-01		5.32E-01
	1038.61	0.99	-1.57E+00		5.93E+00
	1167.97	1.79	-2.18E+00		3.21E+00
	1365.19	3.02	-3.10E-01		1.28E+00
Cs-137	661.66	85.10	-5.50E-02	4.60E-02	4.60E-02
Eu-152	121.78	28.67	5.28E-03	1.22E-01	1.41E-01
	244.70	7.61	2.58E-01		5.19E-01
	295.94	0.45	1.56E+00		9.73E+00
	344.28	26.60	-5.16E-03		1.22E-01
	367.79	0.86	-4.23E+00		3.93E+00
	411.12	2.24	7.99E-01		1.59E+00
	443.96	2.83	-7.06E-01		1.20E+00
	488.68	0.42	-1.57E+00		8.81E+00
	563.99	0.49	-1.70E+00		7.19E+00
	586.26	0.46	9.26E+00		1.19E+01
	678.62	0.47	-8.32E+00		9.41E+00
	688.67	0.86	1.31E+00		4.99E+00
	719.35	0.28	8.70E+00		1.52E+01
	778.90	12.96	-4.43E-01		2.96E-01
	810.45	0.32	4.79E+00		1.41E+01
	867.37	4.26	-5.08E-01		1.14E+00
	919.33	0.43	-2.44E+01		1.03E+01
	964.08	14.65	2.74E-01		4.28E-01
	1085.87	10.24	-2.42E-01		5.12E-01
	1089.74	1.73	-2.49E+00		3.21E+00
	1112.07	13.69	-7.17E-01		4.16E-01
	1212.95	1.43	1.57E+00		4.72E+00
	1249.94	0.19	3.10E+01		3.56E+01
	1299.14	1.63	1.92E+00		3.56E+00
	1408.01	21.07	-5.24E-02		1.72E-01
	1457.64	0.50	1.76E+02		4.36E+01
	1528.10	0.28	4.75E+00		1.16E+01
Eu-154	123.07	40.40	1.01E-01	1.02E-01	1.02E-01
	247.93	6.89	-1.79E-01		4.90E-01
	591.76	4.95	2.54E-01		8.56E-01
	692.42	1.78	-2.07E+00		2.30E+00
	723.30	20.06	3.72E-02		2.36E-01
	756.80	4.52	-1.17E+00		1.01E+00
	873.18	12.08	-1.69E-01		3.71E-01

Analysis Report for 30-Sep-19-10035

L1-12107A-FSGS-016SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	3.12E-01	1.02E-01	5.61E-01
		1004.76		18.01	1.19E-02		3.04E-01
		1274.43		34.80	-2.51E-01		1.40E-01
		1596.48		1.80	-1.52E+00		2.11E+00
	Eu-155	45.30		1.31	8.07E+00	2.22E-01	2.18E+01
		60.01		1.22	-3.71E+00		2.21E+01
		86.55		30.70	-1.86E-01		2.38E-01
		105.31		21.10	-2.12E-02		2.22E-01
+	Ra-226	186.21	*	3.64	7.76E-01	6.98E-01	6.98E-01
	Pa-231	27.36		10.30	2.27E+00	1.55E+00	2.33E+00
		283.69		1.70	6.83E-01		2.00E+00
		300.07		2.47	2.12E-01		1.55E+00
		302.65		2.20	4.34E-02		1.59E+00
		330.06		1.40	-2.50E+00		2.60E+00
+	U-235	143.76		10.96	3.64E-02	4.44E-02	3.35E-01
		163.33		5.08	-1.83E-01		7.14E-01
		185.71	*	57.20	4.94E-02		4.44E-02
		202.11		1.08	-1.15E+00		3.23E+00
		205.31		5.01	-1.19E-02		7.20E-01
	Am-241	59.54		35.90	-2.14E-01	7.62E-01	7.62E-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 30-Sep-19-10036
L1-12107A-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Sep-19-10036
Sample Description	: L1-12107A-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.619E+03 grams
Facility	: Default
Sample Taken On	: 9/26/2019 7:32:00AM
Acquisition Started	: 9/30/2019 11:16:41AM
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	: 9/30/2019
Efficiency Calibration Description	:
Sample Number	: 80084
Fill Height	: 1619.42 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 9/30/2019 11:31:43AM

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

DATA VALIDATED 10/1/19 - 0700
J Graham

Analysis Report for 30-Sep-19-10036

L1-12107A-FSGS-017SS

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	477.51	1.25E+02	18.49	9.76E+01	1.45
2	351.88	700 -	708	703.70	8.55E+01	13.62	4.65E+01	1.47
3	583.04	1163 -	1171	1165.69	2.88E+01	9.02	2.42E+01	1.08
4	609.34	1214 -	1223	1218.25	6.51E+01	9.70	1.29E+01	0.97
5	1460.71	2913 -	2929	2921.47	5.54E+02	23.67	2.09E+00	1.94

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	1.03E+01	6.25E-01
Tl-208	0.99	583.19	*	85.00	3.66E-02	1.17E-02
Bi-211	0.90	351.07	*	13.02	5.07E-01	9.05E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.74E-01	2.93E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.59E-01	2.56E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 30-Sep-19-10036

L1-12107A-FSGS-017SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.85E-01	3.30E-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	1.03E+01	6.25E-01	
	Tl-208	0.997	3.66E-02	1.17E-02	
?	Bi-211	0.901	5.07E-01	9.05E-02	
	Pb-212	1.000	1.74E-01	2.93E-02	
	Bi-214	1.000	1.59E-01	2.56E-02	
?	Pb-214	1.000	1.85E-01	3.30E-02	

Analysis Report for 30-Sep-19-10036

L1-12107A-FSGS-017SS

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

Errors quoted at 1.000sigma

Analysis Report for 30-Sep-19-10036

L1-12107A-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 9/30/2019 11:31:43AM
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	6.06E-02	5.22E-02	5.22E-02
	BE-7	477.60		10.44	1.20E-01	3.36E-01	3.36E-01
+	K-40	1460.82	*	10.66	1.03E+01	2.13E-01	2.13E-01
	Mn-54	834.85		99.98	1.67E-03	4.14E-02	4.14E-02
	Co-60	1173.23		99.85	-3.61E-02	4.49E-02	5.46E-02
		1332.49		99.98	7.32E-03		4.49E-02
	Nb-94	702.65		99.81	-5.90E-03	3.35E-02	3.35E-02
		871.09		99.89	-3.08E-03		3.84E-02
	Ag-108m	79.13		6.60	3.51E-01	3.84E-02	1.09E+00
		433.94		90.50	1.55E-02		3.84E-02
		614.28		89.80	-2.35E-02		4.79E-02
		722.94		90.80	-1.49E-02		4.50E-02
	Sb-125	176.31		6.84	-9.43E-02	8.84E-02	4.91E-01
		380.45		1.52	-1.25E+00		2.19E+00
		427.87		29.60	-6.02E-02		8.84E-02
		463.36		10.49	2.31E-01		3.44E-01
		600.60		17.65	1.35E-01		2.41E-01
		606.71		4.98	-3.78E-01		1.14E+00
		635.95		11.22	1.55E-01		3.66E-01

Analysis Report for 30-Sep-19-10036

L1-12107A-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-9.54E-01	8.84E-02	1.94E+00
Ba-133	79.61	2.65	-1.61E-01	6.35E-02	2.54E+00
	81.00	32.90	-2.51E-01		1.68E-01
	276.40	7.16	-1.31E-01		4.53E-01
	302.85	18.34	3.79E-02		1.85E-01
	356.01	62.05	-4.17E-02		6.35E-02
	383.85	8.94	2.51E-01		4.20E-01
Cs-134	475.36	1.48	9.94E-01	4.67E-02	2.41E+00
	563.25	8.34	1.72E-01		3.98E-01
	569.33	15.37	-6.06E-02		2.20E-01
	604.72	97.62	-4.48E-03		5.43E-02
	795.86	85.46	4.74E-04		4.67E-02
	801.95	8.69	-4.15E-02		4.35E-01
	1038.61	0.99	3.24E+00		5.60E+00
	1167.97	1.79	-1.77E+00		3.23E+00
	1365.19	3.02	-3.39E-01		1.13E+00
Cs-137	661.66	85.10	2.27E-02	4.84E-02	4.84E-02
Eu-152	121.78	28.67	-6.02E-02	1.09E-01	1.09E-01
	244.70	7.61	-1.52E-01		4.46E-01
	295.94	0.45	6.46E+00		8.50E+00
	344.28	26.60	-1.11E-01		1.30E-01
	367.79	0.86	-1.78E+00		3.78E+00
	411.12	2.24	1.23E-01		1.49E+00
	443.96	2.83	-6.62E-01		9.45E-01
	488.68	0.42	-1.82E+00		6.88E+00
	563.99	0.49	3.36E+00		6.83E+00
	586.26	0.46	-1.65E+00		1.05E+01
	678.62	0.47	3.80E-01		7.39E+00
	688.67	0.86	-1.42E+00		3.49E+00
	719.35	0.28	5.83E+00		1.39E+01
	778.90	12.96	-1.13E-01		2.66E-01
	810.45	0.32	-5.53E-01		1.16E+01
	867.37	4.26	-4.93E-01		8.35E-01
	919.33	0.43	2.78E+00		1.09E+01
	964.08	14.65	-1.09E-03		3.67E-01
	1085.87	10.24	-2.20E-01		4.94E-01
	1089.74	1.73	9.57E-01		2.97E+00
	1112.07	13.69	-3.49E-01		3.28E-01
	1212.95	1.43	1.57E+00		4.23E+00
	1249.94	0.19	1.04E+01		2.93E+01
	1299.14	1.63	-1.68E-01		3.54E+00
	1408.01	21.07	-4.05E-02		2.07E-01
	1457.64	0.50	-4.70E+00		4.56E+01
	1528.10	0.28	5.43E-01		1.13E+01
Eu-154	123.07	40.40	-2.77E-02	7.80E-02	7.80E-02
	247.93	6.89	-8.74E-02		4.51E-01
	591.76	4.95	-2.57E-01		7.59E-01
	692.42	1.78	3.83E-01		1.90E+00
	723.30	20.06	1.45E-02		2.13E-01
	756.80	4.52	2.91E-01		8.52E-01
	873.18	12.08	1.55E-01		3.40E-01

Analysis Report for 30-Sep-19-10036

L1-12107A-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.92E-01	7.80E-02	4.75E-01
	1004.76	18.01	-2.06E-01		2.13E-01
	1274.43	34.80	1.99E-02		1.41E-01
	1596.48	1.80	-1.62E+00		1.46E+00
Eu-155	45.30	1.31	2.57E+00	1.72E-01	1.14E+01
	60.01	1.22	-8.71E-01		1.25E+01
	86.55	30.70	2.71E-02		1.72E-01
	105.31	21.10	5.50E-03		1.85E-01
Ra-226	186.21	3.64	7.92E-01	1.05E+00	1.05E+00
Pa-231	27.36	10.30	1.44E-01	9.83E-01	9.83E-01
	283.69	1.70	4.12E-02		1.78E+00
	300.07	2.47	-1.14E+00		1.35E+00
	302.65	2.20	3.16E-01		1.54E+00
	330.06	1.40	-4.28E-01		2.35E+00
U-235	143.76	10.96	-3.53E-02	6.73E-02	2.84E-01
	163.33	5.08	4.68E-01		7.29E-01
	185.71	57.20	5.13E-02		6.73E-02
	202.11	1.08	9.45E-01		3.21E+00
	205.31	5.01	-4.11E-01		6.68E-01
Am-241	59.54	35.90	-9.07E-02	4.25E-01	4.25E-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 02-Oct-19-10007

L1-12107A-FSGS-010SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 02-Oct-19-10007
Sample Description	: L1-12107A-FSGS-010SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.726E+03 grams
Facility	: Default
Sample Taken On	: 9/30/2019 12:25:00PM
Acquisition Started	: 10/2/2019 9:42:47AM
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	: 10/2/2019
Efficiency Calibration Description	:
Sample Number	: 80172
Fill Height	: 1725.50 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/2/2019 9:57:57AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/3/19 - 0700

J Graham

Analysis Report for 02-Oct-19-10007

L1-12107A-FSGS-010SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.41	308 -	316	310.16	4.26E+01	14.16	7.04E+01	0.70
2	186.13	738 -	752	744.39	4.20E+01	16.52	8.00E+01	0.71
3	238.81	946 -	960	954.83	1.68E+02	20.35	8.52E+01	1.11
4	338.23	1347 -	1360	1352.00	5.26E+01	11.34	2.74E+01	1.15
5	352.00	1398 -	1413	1407.01	1.14E+02	13.67	2.42E+01	0.88
6	463.08	1847 -	1855	1850.87	8.75E+00	5.73	1.13E+01	0.44
7	583.27	2324 -	2337	2331.20	5.03E+01	10.37	2.07E+01	1.29
8	609.32	2426 -	2444	2435.30	7.58E+01	12.42	2.32E+01	0.54
9	910.83	3634 -	3647	3640.79	4.10E+01	7.76	7.00E+00	0.56
10	969.20	3868 -	3880	3874.21	3.57E+01	7.96	1.03E+01	0.32
11	1460.32	5826 -	5850	5839.23	4.68E+02	21.92	3.07E+00	2.21

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.82	*	10.66	1.02E+01	6.49E-01
Tl-208	0.99	583.19	*	85.00	7.39E-02	1.59E-02
Bi-211	0.87	351.07	*	13.02	7.66E-01	1.11E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.61E-01	3.81E-02
		300.09		3.30		

Analysis Report for 02-Oct-19-10007

L1-12107A-FSGS-010SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.95E-01	1.03E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	2.14E-01	3.73E-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	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.80E-01	4.05E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	5.21E-01	1.83E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.99	186.21	*	3.64	6.88E-01	2.77E-01
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.97E-01	9.16E-02
		409.46		1.92		
		463.00	*	4.40	2.12E-01	1.40E-01
		794.95		4.25		
		911.20	*	25.80	2.68E-01	5.20E-02
		964.77		4.99		
		968.97	*	15.80	3.97E-01	9.02E-02
		1588.20		3.22		
U-235	0.98	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.38E-02	1.76E-02
		202.11		1.08		
		205.31		5.01		

Analysis Report for 02-Oct-19-10007

L1-12107A-FSGS-010SB

* = 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	0.961	1.02E+01	6.49E-01	
X	Sb-125	0.998			
	Tl-208	0.999	7.39E-02	1.59E-02	
?	Bi-211	0.871	7.66E-01	1.11E-01	
	Pb-212	0.995	2.61E-01	3.81E-02	
?	Pb212-XR	0.993	2.95E-01	1.03E-01	
	Bi-214	1.000	2.14E-01	3.73E-02	
?	Pb-214	0.512	2.80E-01	4.05E-02	
?	Pb214-XR	0.993	5.21E-01	1.83E-01	
?	Ra-226	0.999	6.88E-01	2.77E-01	
	Ac-228	0.992	3.11E-01	3.89E-02	
?	U-235	0.980	4.38E-02	1.76E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 02-Oct-19-10007

L1-12107A-FSGS-010SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/2/2019 9:57:57AM
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	1.04E-01	6.24E-02	6.24E-02
	BE-7	477.60		10.44	1.29E-01	4.11E-01	4.11E-01
+	K-40	1460.82	*	10.66	1.02E+01	3.23E-01	3.23E-01
	Mn-54	834.85		99.98	-7.52E-03	4.71E-02	4.71E-02
	Co-60	1173.23		99.85	2.21E-02	5.14E-02	6.69E-02
		1332.49		99.98	4.11E-02		5.14E-02
	Nb-94	702.65		99.81	-1.42E-02	4.07E-02	4.07E-02
		871.09		99.89	-5.74E-03		4.15E-02
	Ag-108m	79.13		6.60	1.78E-01	4.40E-02	1.20E+00
		433.94		90.50	1.60E-02		4.40E-02
		614.28		89.80	-7.05E-03		6.31E-02
		722.94		90.80	1.56E-02		6.21E-02
	Sb-125	176.31		6.84	-2.58E-01	1.33E-01	4.69E-01
		380.45		1.52	-6.26E-01		2.35E+00
		427.87		29.60	2.62E-02		1.33E-01
		463.36	*	10.49	8.91E-02		1.99E-01
		600.60		17.65	2.42E-02		2.34E-01
		606.71		4.98	2.72E-01		1.45E+00
		635.95		11.22	-3.48E-01		3.39E-01

Analysis Report for 02-Oct-19-10007

L1-12107A-FSGS-010SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	5.58E-01	1.33E-01	2.61E+00
Ba-133	79.61	2.65	-3.80E-01	7.14E-02	2.93E+00
	81.00	32.90	-9.25E-02		1.98E-01
	276.40	7.16	1.35E-01		4.89E-01
	302.85	18.34	9.41E-02		2.09E-01
	356.01	62.05	-3.48E-02		7.14E-02
	383.85	8.94	1.66E-01		4.21E-01
Cs-134	475.36	1.48	-2.94E-01	5.25E-02	2.68E+00
	563.25	8.34	-8.51E-01		4.81E-01
	569.33	15.37	7.34E-02		2.86E-01
	604.72	97.62	-9.51E-03		6.00E-02
	795.86	85.46	2.44E-02		5.25E-02
	801.95	8.69	-1.28E-02		4.78E-01
	1038.61	0.99	1.33E+00		6.65E+00
	1167.97	1.79	4.15E-01		3.64E+00
	1365.19	3.02	9.14E-02		1.52E+00
Cs-137	661.66	85.10	-7.41E-03	5.48E-02	5.48E-02
Eu-152	121.78	28.67	-8.96E-02	1.32E-01	1.32E-01
	244.70	7.61	1.96E-01		5.64E-01
	295.94	0.45	4.27E+00		9.51E+00
	344.28	26.60	-4.97E-02		1.36E-01
	367.79	0.86	-3.58E-01		4.04E+00
	411.12	2.24	1.30E-01		1.89E+00
	443.96	2.83	-9.11E-01		1.22E+00
	488.68	0.42	4.01E-01		9.14E+00
	563.99	0.49	-1.00E+01		7.96E+00
	586.26	0.46	-2.97E+00		1.32E+01
	678.62	0.47	1.14E+00		8.54E+00
	688.67	0.86	2.69E+00		5.40E+00
	719.35	0.28	-1.20E+01		1.84E+01
	778.90	12.96	7.04E-02		3.46E-01
	810.45	0.32	8.28E+00		1.47E+01
	867.37	4.26	-3.43E-01		9.70E-01
	919.33	0.43	1.39E+00		1.08E+01
	964.08	14.65	-3.13E-01		5.04E-01
	1085.87	10.24	2.60E-01		5.99E-01
	1089.74	1.73	2.00E-01		3.64E+00
	1112.07	13.69	4.93E-03		4.77E-01
	1212.95	1.43	6.02E-01		5.29E+00
	1249.94	0.19	-1.95E+01		3.05E+01
	1299.14	1.63	-3.32E-01		3.76E+00
	1408.01	21.07	-2.24E-02		2.36E-01
	1457.64	0.50	2.20E+02		4.96E+01
	1528.10	0.28	-2.16E+00		1.24E+01
Eu-154	123.07	40.40	2.30E-03	9.70E-02	9.70E-02
	247.93	6.89	1.00E-01		5.23E-01
	591.76	4.95	-2.87E-01		6.96E-01
	692.42	1.78	-8.63E-01		2.40E+00
	723.30	20.06	4.13E-02		2.81E-01
	756.80	4.52	-5.91E-02		9.73E-01
	873.18	12.08	-5.11E-02		3.89E-01

Analysis Report for 02-Oct-19-10007

L1-12107A-FSGS-010SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	3.70E-01	9.70E-02	5.61E-01
		1004.76		18.01	2.25E-02		2.96E-01
		1274.43		34.80	-2.43E-02		1.68E-01
		1596.48		1.80	-1.58E+00		2.15E+00
	Eu-155	45.30		1.31	-2.05E-01	2.07E-01	1.21E+01
		60.01		1.22	-1.05E+00		1.33E+01
		86.55		30.70	1.37E-01		2.07E-01
		105.31		21.10	-1.51E-01		2.08E-01
+	Ra-226	186.21	*	3.64	6.88E-01	8.93E-01	8.93E-01
	Pa-231	27.36		10.30	1.51E+00	1.54E+00	1.56E+00
		283.69		1.70	-4.32E-01		1.67E+00
		300.07		2.47	-2.21E+00		1.54E+00
		302.65		2.20	9.04E-01		1.75E+00
		330.06		1.40	1.06E+00		2.91E+00
+	U-235	143.76		10.96	-2.90E-02	5.68E-02	3.30E-01
		163.33		5.08	3.20E-01		7.16E-01
		185.71	*	57.20	4.38E-02		5.68E-02
		202.11		1.08	-3.84E-01		3.09E+00
		205.31		5.01	4.51E-02		7.27E-01
	Am-241	59.54		35.90	9.33E-02	4.74E-01	4.74E-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 02-Oct-19-10008

L1-12107A-FSGS-017SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 02-Oct-19-10008
Sample Description	: L1-12107A-FSGS-017SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.648E+03 grams
Facility	: Default
Sample Taken On	: 9/30/2019 12:30:00PM
Acquisition Started	: 10/2/2019 9:42:56AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/2/2019
Efficiency Calibration Description	:
Sample Number	: 80173
Fill Height	: 1647.54 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/2/2019 9:58:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 10/3/19 - 0700
J Graham

Analysis Report for 02-Oct-19-10008

L1-12107A-FSGS-017SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.64	946 -	961	955.05	1.54E+02	19.88	8.04E+01	1.03
2	338.06	1346 -	1357	1352.28	2.17E+01	9.16	2.43E+01	0.95
3	351.82	1401 -	1414	1407.28	6.11E+01	11.27	2.39E+01	1.11
4	510.85	2038 -	2048	2042.87	2.25E+01	8.81	2.25E+01	0.65
5	583.00	2325 -	2338	2331.33	4.50E+01	9.14	1.40E+01	0.54
6	609.50	2430 -	2446	2437.27	5.61E+01	9.64	1.19E+01	1.09
7	911.16	3636 -	3650	3643.69	3.49E+01	8.53	1.31E+01	0.41
8	1460.82	5830 -	5856	5843.67	4.76E+02	22.13	3.26E+00	1.89

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	2.54E-02	1.01E-02
K-40	1.00	1460.82	*	10.66	9.77E+00	6.21E-01
Tl-208	0.99	583.19	*	85.00	6.34E-02	1.34E-02
Bi-211	0.91	351.07	*	13.02	4.01E-01	8.07E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.38E-01	3.63E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.52E-01	2.77E-02
		768.36		4.89		

Analysis Report for 02-Oct-19-10008

L1-12107A-FSGS-017SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.47E-01	2.95E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.60E-01	6.88E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.17E-01	5.38E-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 02-Oct-19-10008

L1-12107A-FSGS-017SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.996	2.54E-02	1.01E-02	
	K-40	1.000	9.77E+00	6.21E-01	
	Tl-208	0.995	6.34E-02	1.34E-02	
?	Bi-211	0.914	4.01E-01	8.07E-02	
	Pb-212	1.000	2.38E-01	3.63E-02	
	Bi-214	0.998	1.52E-01	2.77E-02	
?	Pb-214	0.999	1.47E-01	2.95E-02	
	Ac-228	0.998	1.95E-01	4.24E-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 02-Oct-19-10008

L1-12107A-FSGS-017SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/2/2019 9:58:00AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	2.54E-02	3.16E-02	3.16E-02
	BE-7	477.60		10.44	2.03E-01	4.00E-01	4.00E-01
+	K-40	1460.82	*	10.66	9.77E+00	3.19E-01	3.19E-01
	Mn-54	834.85		99.98	-4.11E-02	4.93E-02	4.93E-02
	Co-60	1173.23		99.85	-1.75E-02	5.30E-02	6.20E-02
		1332.49		99.98	2.13E-02		5.30E-02
	Nb-94	702.65		99.81	-4.31E-03	3.95E-02	3.95E-02
		871.09		99.89	-1.72E-02		4.60E-02
	Ag-108m	79.13		6.60	2.01E-01	4.36E-02	1.62E+00
		433.94		90.50	-1.30E-02		4.36E-02
		614.28		89.80	1.93E-02		6.53E-02
		722.94		90.80	-2.79E-02		5.21E-02
	Sb-125	176.31		6.84	-2.51E-01	1.25E-01	4.97E-01
		380.45		1.52	7.57E-02		2.58E+00
		427.87		29.60	1.11E-01		1.25E-01
		463.36		10.49	1.46E-01		4.03E-01
		600.60		17.65	-1.49E-01		2.33E-01
		606.71		4.98	1.25E+00		1.24E+00
		635.95		11.22	2.57E-01		3.88E-01

Analysis Report for 02-Oct-19-10008

L1-12107A-FSGS-017SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.34E-01	1.25E-01	2.29E+00
Ba-133	79.61	2.65	3.34E+00	6.86E-02	4.01E+00
	81.00	32.90	-5.84E-01		2.56E-01
	276.40	7.16	-1.25E-01		5.18E-01
	302.85	18.34	-3.34E-02		1.91E-01
	356.01	62.05	-5.43E-02		6.86E-02
	383.85	8.94	8.11E-02		4.28E-01
Cs-134	475.36	1.48	6.85E-01	5.96E-02	2.57E+00
	563.25	8.34	-4.27E-01		4.73E-01
	569.33	15.37	-1.39E-01		2.67E-01
	604.72	97.62	-2.42E-02		5.96E-02
	795.86	85.46	2.20E-02		6.60E-02
	801.95	8.69	-2.00E-01		6.42E-01
	1038.61	0.99	-3.42E+00		5.59E+00
	1167.97	1.79	-1.04E+00		3.65E+00
	1365.19	3.02	6.91E-01		1.25E+00
Cs-137	661.66	85.10	1.60E-02	5.02E-02	5.02E-02
Eu-152	121.78	28.67	3.51E-02	1.37E-01	1.40E-01
	244.70	7.61	-2.87E-02		5.20E-01
	295.94	0.45	5.70E+00		9.19E+00
	344.28	26.60	2.91E-03		1.37E-01
	367.79	0.86	2.33E+00		4.37E+00
	411.12	2.24	-1.40E-02		1.74E+00
	443.96	2.83	-2.10E+00		1.21E+00
	488.68	0.42	-2.03E+00		7.84E+00
	563.99	0.49	8.44E-02		8.02E+00
	586.26	0.46	9.16E+00		1.22E+01
	678.62	0.47	-3.08E+00		8.64E+00
	688.67	0.86	3.91E-01		4.92E+00
	719.35	0.28	1.01E-01		1.50E+01
	778.90	12.96	-4.45E-02		3.62E-01
	810.45	0.32	-4.06E+00		1.46E+01
	867.37	4.26	2.98E-01		1.18E+00
	919.33	0.43	-1.54E+01		1.16E+01
	964.08	14.65	4.26E-01		4.65E-01
	1085.87	10.24	4.66E-02		5.89E-01
	1089.74	1.73	1.03E+00		3.57E+00
	1112.07	13.69	-4.98E-01		4.37E-01
	1212.95	1.43	1.08E+00		5.23E+00
	1249.94	0.19	9.12E+00		3.57E+01
	1299.14	1.63	-2.65E+00		3.50E+00
	1408.01	21.07	1.26E-02		1.75E-01
	1457.64	0.50	2.09E+02		4.75E+01
	1528.10	0.28	-2.97E+01		1.09E+01
Eu-154	123.07	40.40	1.43E-02	9.82E-02	9.82E-02
	247.93	6.89	-1.73E-01		4.85E-01
	591.76	4.95	1.53E-01		7.83E-01
	692.42	1.78	9.47E-01		2.39E+00
	723.30	20.06	2.03E-02		2.36E-01
	756.80	4.52	-1.28E+00		9.55E-01
	873.18	12.08	1.52E-01		3.76E-01

Analysis Report for 02-Oct-19-10008

L1-12107A-FSGS-017SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.38E-01	9.82E-02	5.26E-01
	1004.76	18.01	1.34E-01		2.89E-01
	1274.43	34.80	-1.66E-01		1.61E-01
	1596.48	1.80	-4.67E-01		2.45E+00
Eu-155	45.30	1.31	-1.51E-01	2.36E-01	1.92E+01
	60.01	1.22	-1.04E+01		2.37E+01
	86.55	30.70	4.29E-02		2.58E-01
	105.31	21.10	-1.15E-01		2.36E-01
Ra-226	186.21	3.64	1.10E+00	1.11E+00	1.11E+00
Pa-231	27.36	10.30	1.92E+00	1.50E+00	2.38E+00
	283.69	1.70	-1.04E+00		2.06E+00
	300.07	2.47	-2.03E+00		1.50E+00
	302.65	2.20	-1.41E-01		1.57E+00
	330.06	1.40	1.48E-01		2.77E+00
U-235	143.76	10.96	7.79E-02	6.98E-02	3.61E-01
	163.33	5.08	-3.82E-01		6.56E-01
	185.71	57.20	2.23E-02		6.98E-02
	202.11	1.08	1.91E+00		3.43E+00
	205.31	5.01	-5.22E-01		7.09E-01
Am-241	59.54	35.90	4.43E-01	8.61E-01	8.61E-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 30-Jan-20-10008

L1-12107K-FSGS-022SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Jan-20-10008
Sample Description	: L1-12107K-FSGS-022SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.670E+03 grams
Facility	: Default
Sample Taken On	: 1/29/2020 3:25:00PM
Acquisition Started	: 1/30/2020 12:33:13PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 1/30/2020
Efficiency Calibration Description	:
Sample Number	: 82553
Fill Height	: 1669.67 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 1/30/2020 12:48:16PM

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

Analysis Report for 30-Jan-20-10008

L1-12107K-FSGS-022SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	75.09	295 -	316	300.89	9.27E+01	35.24	1.50E+02	0.83
m	2	77.47	295 -	316	310.41	1.46E+02	42.24	2.86E+02	0.83
	3	209.74	831 -	842	838.69	3.84E+01	16.59	9.46E+01	0.78
	4	238.84	947 -	961	954.93	3.88E+02	28.48	1.47E+02	1.01
	5	270.12	1075 -	1087	1079.89	4.89E+01	15.03	6.71E+01	0.84
	6	295.42	1172 -	1187	1180.98	1.93E+02	19.69	6.49E+01	1.04
	7	338.31	1347 -	1360	1352.32	5.41E+01	15.90	7.09E+01	0.74
	8	352.13	1400 -	1416	1407.53	3.22E+02	22.07	5.34E+01	1.25
	9	583.20	2325 -	2339	2330.92	1.18E+02	14.27	2.96E+01	1.01
	10	609.41	2428 -	2445	2435.69	2.39E+02	18.65	3.35E+01	1.35
	11	665.54	2656 -	2665	2660.03	8.00E+00	5.58	1.00E+01	0.71
	12	768.49	3067 -	3076	3071.62	1.37E+01	7.78	2.03E+01	0.76
	13	910.97	3633 -	3652	3641.35	9.63E+01	13.28	2.27E+01	1.04
	14	1460.64	5827 -	5853	5840.51	7.71E+02	28.84	1.36E+01	1.99

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	1.69E+01	9.68E-01
Tl-208	1.00	583.19	*	85.00	1.75E-01	2.35E-02
Pb-212	0.99	115.18		0.60		

Analysis Report for 30-Jan-20-10008

L1-12107K-FSGS-022SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	238.63	*	43.60	6.07E-01	6.62E-02
		300.09		3.30		
Pb212-XR	0.98	74.82	*	10.28	1.17E+00	4.60E-01
		77.11	*	17.10	1.01E+00	3.10E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.82	609.32	*	45.49	6.78E-01	6.68E-02
		768.36	*	4.89	4.24E-01	2.42E-01
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	8.13E-01	1.05E-01
		351.93	*	35.60	7.96E-01	8.39E-02
		785.96		1.06		
Ac-228	0.74	129.07		2.42		
		209.25	*	3.89	6.28E-01	2.76E-01
		270.24	*	3.46	1.04E+00	3.30E-01
		328.00		2.95		
		338.32	*	11.27	4.11E-01	1.25E-01
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	6.34E-01	9.15E-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 30-Jan-20-10008

L1-12107K-FSGS-022SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.995	1.69E+01	9.68E-01	
	Tl-208	1.000	1.75E-01	2.35E-02	
	Pb-212	0.994	6.07E-01	6.62E-02	
	Pb212-XR	0.985	1.06E+00	2.57E-01	
	Bi-214	0.824	6.60E-01	6.44E-02	
	Pb-214	0.995	8.03E-01	6.56E-02	
X	Pb214-XR	0.985			
	Ac-228	0.740	5.82E-01	6.98E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Jan-20-10008

L1-12107K-FSGS-022SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 1/30/2020 12:48:16PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
11	665.54	8.88889E-03	69.73		

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	9.32E-02	7.23E-02	7.23E-02
	BE-7	477.60		10.44	-3.94E-02	4.85E-01	4.85E-01
+	K-40	1460.82	*	10.66	1.69E+01	6.40E-01	6.40E-01
	Mn-54	834.85		99.98	-1.36E-02	5.20E-02	5.20E-02
	Co-60	1173.23		99.85	3.79E-02	6.72E-02	9.08E-02
		1332.49		99.98	4.90E-02		6.72E-02
	Nb-94	702.65		99.81	-2.60E-02	5.65E-02	5.75E-02
		871.09		99.89	-9.74E-02		5.65E-02
	Ag-108m	79.13		6.60	9.40E-02	5.61E-02	1.74E+00
		433.94		90.50	8.84E-03		5.61E-02
		614.28		89.80	1.42E-02		1.00E-01
		722.94		90.80	9.57E-03		7.61E-02
	Sb-125	176.31		6.84	-1.12E-01	1.78E-01	6.65E-01
		380.45		1.52	-9.70E-01		3.01E+00
		427.87		29.60	1.19E-01		1.78E-01
		463.36		10.49	4.62E-01		5.14E-01
		600.60		17.65	-5.44E-03		2.99E-01
		606.71		4.98	-5.05E-01		2.27E+00

Analysis Report for 30-Jan-20-10008

L1-12107K-FSGS-022SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	635.95	11.22	1.11E-02	1.78E-01	4.90E-01
	671.44	1.79	2.15E+00		2.86E+00
Ba-133	79.61	2.65	1.68E-02	1.13E-01	4.24E+00
	81.00	32.90	-6.09E-02		2.72E-01
	276.40	7.16	2.65E-01		6.98E-01
	302.85	18.34	2.20E-03		2.52E-01
	356.01	62.05	-1.55E-02		1.13E-01
	383.85	8.94	-6.07E-01		4.92E-01
Cs-134	475.36	1.48	2.91E+00	7.43E-02	3.44E+00
	563.25	8.34	3.42E-01		6.53E-01
	569.33	15.37	-7.02E-02		3.41E-01
	604.72	97.62	-2.70E-02		8.98E-02
	795.86	85.46	-1.21E-02		7.43E-02
	801.95	8.69	-3.23E-01		6.72E-01
	1038.61	0.99	5.52E+00		7.01E+00
	1167.97	1.79	-4.47E+00		4.71E+00
	1365.19	3.02	-7.73E-01		1.58E+00
Cs-137	661.66	85.10	-1.49E-02	6.58E-02	6.58E-02
Eu-152	121.78	28.67	1.19E-01	1.74E-01	1.76E-01
	244.70	7.61	3.62E-01		7.27E-01
	295.94	0.45	2.98E+01		1.54E+01
	344.28	26.60	-3.89E-02		1.74E-01
	367.79	0.86	2.15E+00		5.34E+00
	411.12	2.24	6.90E-01		2.36E+00
	443.96	2.83	2.08E-01		1.73E+00
	488.68	0.42	-1.28E-01		1.25E+01
	563.99	0.49	-7.49E+00		1.05E+01
	586.26	0.46	-7.15E+00		1.86E+01
	678.62	0.47	-7.01E+00		1.07E+01
	688.67	0.86	4.69E+00		7.08E+00
	719.35	0.28	6.18E+00		2.12E+01
	778.90	12.96	-3.05E-01		4.53E-01
	810.45	0.32	-8.80E+00		1.88E+01
	867.37	4.26	-1.43E+00		1.48E+00
	919.33	0.43	-1.23E+01		1.25E+01
	964.08	14.65	2.99E-01		6.48E-01
	1085.87	10.24	-1.30E+00		6.91E-01
	1089.74	1.73	8.66E-01		4.25E+00
	1112.07	13.69	-3.69E-01		5.48E-01
	1212.95	1.43	4.02E+00		6.46E+00
	1249.94	0.19	-5.63E+01		4.56E+01
	1299.14	1.63	1.33E+00		4.94E+00
	1408.01	21.07	8.00E-02		3.00E-01
	1457.64	0.50	-7.88E+00		6.40E+01
	1528.10	0.28	-4.29E+00		1.73E+01
Eu-154	123.07	40.40	-2.85E-02	1.23E-01	1.23E-01
	247.93	6.89	3.47E-01		6.79E-01
	591.76	4.95	-5.84E-01		9.42E-01
	692.42	1.78	2.44E+00		3.30E+00
	723.30	20.06	1.39E-01		3.50E-01
	756.80	4.52	5.91E-01		1.46E+00

Analysis Report for 30-Jan-20-10008

L1-12107K-FSGS-022SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	6.82E-02	1.23E-01	5.02E-01
	996.29	10.48	-1.47E-01		6.50E-01
	1004.76	18.01	3.28E-01		4.06E-01
	1274.43	34.80	-1.28E-01		2.80E-01
	1596.48	1.80	3.13E-01		3.07E+00
Eu-155	45.30	1.31	-1.36E+01	2.78E-01	1.57E+01
	60.01	1.22	1.40E+01		2.00E+01
	86.55	30.70	9.90E-02		2.78E-01
	105.31	21.10	6.05E-03		2.83E-01
Ra-226	186.21	3.64	1.51E+00	1.46E+00	1.46E+00
Pa-231	27.36	10.30	2.07E+00	1.85E+00	1.85E+00
	283.69	1.70	-1.65E+00		2.82E+00
	300.07	2.47	1.35E-01		1.99E+00
	302.65	2.20	-3.97E-01		2.09E+00
	330.06	1.40	3.25E+00		3.65E+00
U-235	143.76	10.96	3.63E-02	9.32E-02	4.69E-01
	163.33	5.08	-4.89E-01		8.76E-01
	185.71	57.20	1.25E-01		9.32E-02
	202.11	1.08	-3.95E-01		4.29E+00
	205.31	5.01	-3.97E-01		9.05E-01
Am-241	59.54	35.90	1.36E-01	6.88E-01	6.88E-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 30-Jan-20-10007

L1-12107K-FSGS-021SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Jan-20-10007
Sample Description	: L1-12107K-FSGS-021SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.613E+03 grams
Facility	: Default
Sample Taken On	: 1/29/2020 3:00:00PM
Acquisition Started	: 1/30/2020 12:33:06PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 902.6 seconds
Dead Time	: 0.28 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 1/30/2020
Efficiency Calibration Description	:
Sample Number	: 82552
Fill Height	: 1612.85 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 1/30/2020 12:48:11PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Analysis Report for 30-Jan-20-10007

L1-12107K-FSGS-021SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.82	296 -	316	300.02	5.34E+01	18.45	9.59E+01	0.83
m	2	77.25	296 -	316	309.73	1.24E+02	35.04	1.36E+02	0.83
M	3	238.64	947 -	976	954.67	3.58E+02	20.14	1.06E+02	0.98
m	4	242.02	947 -	976	968.17	8.82E+01	11.55	9.44E+01	0.98
M	5	295.27	1174 -	1205	1180.99	1.54E+02	13.63	5.95E+01	1.01
m	6	300.11	1174 -	1205	1200.34	3.77E+01	8.18	5.00E+01	1.01
	7	338.37	1346 -	1359	1353.25	7.52E+01	15.92	6.48E+01	0.71
	8	351.94	1399 -	1415	1407.51	2.75E+02	21.60	6.13E+01	1.15
	9	510.84	2034 -	2048	2042.70	4.55E+01	12.38	3.65E+01	1.08
	10	583.06	2323 -	2339	2331.47	1.00E+02	15.19	4.10E+01	1.17
	11	609.29	2425 -	2443	2436.34	2.43E+02	17.90	2.30E+01	1.04
	12	795.24	3175 -	3186	3179.93	1.31E+01	7.24	1.49E+01	0.46
	13	911.34	3635 -	3653	3644.32	6.73E+01	12.85	2.87E+01	1.56
	14	969.08	3868 -	3882	3875.31	4.81E+01	10.58	2.09E+01	0.75
	15	1120.27	4472 -	4488	4480.19	7.54E+01	11.00	1.46E+01	1.32
	16	1460.76	5832 -	5855	5842.89	6.47E+02	26.68	1.68E+01	1.90
	17	1764.45	7052 -	7065	7058.81	2.50E+01	6.65	7.00E+00	0.37

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

Analysis Report for 30-Jan-20-10007

L1-12107K-FSGS-021SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	5.90E-02	1.65E-02
K-40	0.99	1460.82	*	10.66	1.59E+01	9.52E-01
Tl-208	0.99	583.19	*	85.00	1.65E-01	2.69E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	6.33E-01	6.24E-02
		300.09	*	3.30	1.00E+00	2.32E-01
Bi-214	1.00	609.32	*	45.49	7.71E-01	7.33E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	1.10E+00	1.67E-01
		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	4.95E-01	1.33E-01
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99	*	7.25	9.46E-01	1.45E-01
		295.22	*	18.42	7.24E-01	8.66E-02
		351.93	*	35.60	7.61E-01	8.54E-02
		785.96		1.06		
Pb214-XR	0.99	74.82	*	5.80	2.18E+00	7.91E-01
		77.11	*	9.70	2.65E+00	8.04E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	6.40E-01	1.45E-01
		409.46		1.92		
		463.00		4.40		
		794.95	*	4.25	5.32E-01	2.96E-01
		911.20	*	25.80	4.95E-01	9.69E-02
		964.77		4.99		
		968.97	*	15.80	6.02E-01	1.35E-01
		1588.20		3.22		

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

Analysis Report for 30-Jan-20-10007

L1-12107K-FSGS-021SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.996	5.90E-02	1.65E-02	
	K-40	0.999	1.59E+01	9.52E-01	
X	Cs-134	0.976			
	Tl-208	0.998	1.65E-01	2.69E-02	
X	Bi-211	0.885			
	Pb-212	1.000	6.58E-01	6.02E-02	
X	Pb212-XR	0.998			
	Bi-214	1.000	7.58E-01	5.99E-02	
	Pb-214	1.000	7.73E-01	5.61E-02	
	Pb214-XR	0.998	2.41E+00	5.64E-01	
	Ac-228	0.998	5.54E-01	6.74E-02	
X	Pa-231	1.000			

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

Errors quoted at 1.000sigma

Analysis Report for 30-Jan-20-10007

L1-12107K-FSGS-021SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 1/30/2020 12:48:11PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	5.90E-02	4.94E-02	4.94E-02
	BE-7	477.60		10.44	-6.01E-02	5.52E-01	5.52E-01
+	K-40	1460.82	*	10.66	1.59E+01	7.40E-01	7.40E-01
	Mn-54	834.85		99.98	2.95E-02	7.00E-02	7.00E-02
	Co-60	1173.23		99.85	5.22E-02	7.22E-02	8.93E-02
		1332.49		99.98	-2.82E-02		7.22E-02
	Nb-94	702.65		99.81	-2.66E-02	6.13E-02	6.13E-02
		871.09		99.89	-1.08E-03		6.77E-02
	Ag-108m	79.13		6.60	-1.74E-02	5.99E-02	2.75E+00
		433.94		90.50	-7.66E-02		5.99E-02
		614.28		89.80	-1.29E-01		1.03E-01
		722.94		90.80	2.72E-02		8.32E-02
	Sb-125	176.31		6.84	4.50E-02	2.01E-01	8.15E-01
		380.45		1.52	-9.66E-01		3.40E+00
		427.87		29.60	8.08E-03		2.01E-01
		463.36		10.49	2.30E-01		5.81E-01
		600.60		17.65	2.31E-01		3.56E-01
		606.71		4.98	7.13E+00		2.52E+00
		635.95		11.22	-1.33E-01		5.43E-01

Analysis Report for 30-Jan-20-10007

L1-12107K-FSGS-021SB

Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44		1.79	6.25E-01	2.01E-01	3.34E+00
Ba-133	79.61		2.65	3.02E-01	1.22E-01	6.56E+00
	81.00		32.90	-1.84E-01		4.30E-01
	276.40		7.16	2.58E-01		7.89E-01
	302.85		18.34	-6.18E-02		3.09E-01
	356.01		62.05	-4.00E-03		1.22E-01
	383.85		8.94	-7.76E-02		5.80E-01
Cs-134	475.36		1.48	7.00E-01	4.90E-02	3.78E+00
	563.25		8.34	-6.57E-02		7.07E-01
	569.33		15.37	-1.96E-02		3.70E-01
	604.72		97.62	1.47E-03		1.14E-01
	795.86	*	85.46	2.65E-02		4.90E-02
	801.95		8.69	-1.48E-01		7.71E-01
	1038.61		0.99	3.09E+00		6.96E+00
	1167.97		1.79	-3.19E+00		5.23E+00
	1365.19		3.02	2.89E-01		2.37E+00
Cs-137	661.66		85.10	-3.56E-02	6.79E-02	6.79E-02
Eu-152	121.78		28.67	8.95E-02	1.91E-01	2.32E-01
	244.70		7.61	1.21E-01		8.67E-01
	295.94		0.45	-3.10E-01		1.61E+01
	344.28		26.60	-1.23E-01		1.91E-01
	367.79		0.86	-2.15E+00		5.74E+00
	411.12		2.24	-3.16E-01		2.49E+00
	443.96		2.83	-1.21E+00		1.86E+00
	488.68		0.42	-3.04E+00		1.30E+01
	563.99		0.49	5.60E+00		1.21E+01
	586.26		0.46	-7.35E+00		2.05E+01
	678.62		0.47	-1.58E+00		1.24E+01
	688.67		0.86	-3.24E+00		7.03E+00
	719.35		0.28	-1.87E-01		2.30E+01
	778.90		12.96	-3.47E-01		4.89E-01
	810.45		0.32	5.03E+00		2.24E+01
	867.37		4.26	-3.06E+00		1.51E+00
	919.33		0.43	-1.98E+00		1.58E+01
	964.08		14.65	-1.81E-01		6.94E-01
	1085.87		10.24	5.71E-01		8.96E-01
	1089.74		1.73	5.81E-01		5.28E+00
	1112.07		13.69	-3.62E-01		6.39E-01
	1212.95		1.43	2.48E+00		6.96E+00
	1249.94		0.19	-1.41E+01		4.60E+01
	1299.14		1.63	-4.79E+00		4.56E+00
	1408.01		21.07	-1.01E-01		3.19E-01
	1457.64		0.50	3.51E+02		6.65E+01
	1528.10		0.28	-2.08E+00		1.66E+01
Eu-154	123.07		40.40	-1.93E-03	1.66E-01	1.66E-01
	247.93		6.89	-3.28E-01		7.82E-01
	591.76		4.95	3.25E-01		1.25E+00
	692.42		1.78	5.64E-01		3.71E+00
	723.30		20.06	5.09E-02		3.77E-01
	756.80		4.52	-1.26E-01		1.52E+00
	873.18		12.08	-2.51E-01		5.66E-01

Analysis Report for 30-Jan-20-10007

L1-12107K-FSGS-021SB

Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29		10.48	-4.08E-01	1.66E-01	7.01E-01
	1004.76		18.01	-5.90E-02		4.61E-01
	1274.43		34.80	-3.04E-02		2.55E-01
	1596.48		1.80	1.84E+00		3.63E+00
Eu-155	45.30		1.31	6.14E+00	3.99E-01	4.34E+01
	60.01		1.22	1.02E+01		4.59E+01
	86.55		30.70	1.14E-01		4.02E-01
	105.31		21.10	2.79E-02		3.99E-01
Ra-226	186.21		3.64	2.43E+00	1.79E+00	1.79E+00
Pa-231	27.36		10.30	6.87E+00	1.31E+00	5.48E+00
	283.69		1.70	-1.01E+00		3.01E+00
	300.07	*	2.47	1.34E+00		1.31E+00
	302.65		2.20	-2.70E-01		2.57E+00
	330.06		1.40	2.85E+00		4.08E+00
U-235	143.76		10.96	1.23E-01	1.15E-01	5.88E-01
	163.33		5.08	4.89E-01		1.13E+00
	185.71		57.20	1.45E-01		1.15E-01
	202.11		1.08	1.90E+00		5.29E+00
	205.31		5.01	-7.00E-01		1.14E+00
Am-241	59.54		35.90	1.03E+00	1.66E+00	1.66E+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 30-Jan-20-10006

L1-12107K-FSGS-020SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Jan-20-10006
Sample Description	: L1-12107K-FSGS-020SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.699E+03 grams
Facility	: Default
Sample Taken On	: 1/29/2020 2:00:00PM
Acquisition Started	: 1/30/2020 11:59:40AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.5 seconds
Dead Time	: 0.05 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 1/30/2020
Efficiency Calibration Description	:
Sample Number	: 82551
Fill Height	: 1699.27 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 1/30/2020 12:15:05PM

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

Analysis Report for 30-Jan-20-10006

L1-12107K-FSGS-020SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	76.99	305 -	316	309.29	4.96E+01	22.12	1.74E+02	0.91
	2	92.64	367 -	379	371.77	5.99E+01	20.94	1.40E+02	0.80
	3	186.06	736 -	751	744.97	9.36E+01	24.15	1.62E+02	0.99
M	4	238.59	948 -	977	954.83	3.40E+02	19.31	9.92E+01	1.19
m	5	241.81	948 -	977	967.71	9.49E+01	10.99	7.66E+01	1.20
	6	277.50	1107 -	1114	1110.31	2.20E+01	10.25	4.10E+01	0.95
	7	295.21	1171 -	1188	1181.07	1.99E+02	21.34	7.88E+01	0.93
	8	338.21	1347 -	1360	1352.90	6.41E+01	14.58	5.39E+01	1.50
	9	351.84	1401 -	1413	1407.36	2.57E+02	18.75	3.59E+01	1.25
	10	510.58	2033 -	2049	2041.79	5.27E+01	13.60	4.23E+01	1.30
	11	583.10	2326 -	2339	2331.72	9.58E+01	13.69	3.32E+01	1.15
	12	609.07	2427 -	2447	2435.53	2.41E+02	18.36	2.50E+01	1.34
	13	910.63	3632 -	3652	3641.56	9.55E+01	13.46	2.35E+01	2.52
	14	968.75	3867 -	3880	3874.06	4.75E+01	9.78	1.75E+01	0.81
	15	1120.08	4471 -	4488	4479.60	5.83E+01	11.05	1.97E+01	0.83
	16	1460.38	5827 -	5854	5841.88	7.52E+02	28.30	1.06E+01	2.02
	17	1763.92	7051 -	7064	7057.76	2.99E+01	6.63	5.14E+00	0.88

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty

Analysis Report for 30-Jan-20-10006

L1-12107K-FSGS-020SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.97	511.00	*	100.00	5.83E-02	1.56E-02
K-40	0.96	1460.82	*	10.66	1.53E+01	8.80E-01
Tl-208	0.99	583.19	*	85.00	1.34E-01	2.08E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	5.23E-01	5.17E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	4.61E-01	2.11E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.98	609.32	*	45.49	6.49E-01	6.30E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	7.11E-01	1.38E-01
		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	4.88E-01	1.10E-01
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	8.86E-01	1.25E-01
		295.22	*	18.42	8.15E-01	1.09E-01
		351.93	*	35.60	6.14E-01	6.65E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	8.13E-01	3.74E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.99	186.21	*	3.64	1.55E+00	4.18E-01
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	4.71E-01	1.14E-01
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	5.89E-01	8.70E-02
		964.77		4.99		
		968.97	*	15.80	4.98E-01	1.05E-01
		1588.20		3.22		
Ac228-XR	0.95	89.96		1.90		
		93.35	*	3.10	1.87E+00	7.21E-01
Th-234	0.99	92.38		2.13		
		92.80	*	2.10	2.83E+00	1.06E+00

Analysis Report for 30-Jan-20-10006

L1-12107K-FSGS-020SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Th-234	0.99	112.81		0.21		
U-235	0.98	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	9.84E-02	2.66E-02
		202.11		1.08		
		205.31		5.01		
U235-XR	0.95	89.96		3.47		
		93.35	*	5.60	1.03E+00	3.77E-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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.972	5.83E-02	1.56E-02	
	K-40	0.969	1.53E+01	8.80E-01	
	Tl-208	0.999	1.34E-01	2.08E-02	
X	Bi-211	0.909			
	Pb-212	1.000	5.23E-01	5.17E-02	
?	Pb212-XR	0.999	4.61E-01	2.11E-01	
	Bi-214	0.988	6.23E-01	5.08E-02	
	Pb-214	0.999	7.06E-01	5.17E-02	
?	Pb214-XR	0.999	8.13E-01	3.74E-01	
?	Ra-226	0.996	1.55E+00	4.18E-01	
	Ac-228	0.982	5.31E-01	5.77E-02	
?	Ac228-XR	0.951	1.87E+00	7.21E-01	
?	Th-234	0.998	2.83E+00	1.06E+00	
?	U-235	0.986	9.84E-02	2.66E-02	
?	U235-XR	0.957	1.03E+00	3.77E-01	

Analysis Report for 30-Jan-20-10006

L1-12107K-FSGS-020SB

? = 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 30-Jan-20-10006

L1-12107K-FSGS-020SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 1/30/2020 12:15:05PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
6	277.50	2.44444E-02	46.60		

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	5.83E-02	4.63E-02	4.63E-02
	BE-7	477.60		10.44	4.84E-01	5.13E-01	5.13E-01
+	K-40	1460.82	*	10.66	1.53E+01	5.40E-01	5.40E-01
	Mn-54	834.85		99.98	-5.83E-03	5.74E-02	5.74E-02
	Co-60	1173.23		99.85	8.84E-03	6.97E-02	8.53E-02
		1332.49		99.98	1.33E-02		6.97E-02
	Nb-94	702.65		99.81	-6.51E-03	5.47E-02	5.47E-02
		871.09		99.89	5.87E-03		5.84E-02
	Ag-108m	79.13		6.60	-2.52E-01	5.51E-02	2.14E+00
		433.94		90.50	3.44E-02		5.51E-02
		614.28		89.80	-5.39E-03		1.11E-01
		722.94		90.80	1.66E-02		7.74E-02
	Sb-125	176.31		6.84	1.47E-01	1.68E-01	7.42E-01
		380.45		1.52	-2.31E-01		2.82E+00
		427.87		29.60	5.89E-02		1.68E-01
		463.36		10.49	1.19E-01		5.31E-01
		600.60		17.65	-1.14E-01		3.09E-01
		606.71		4.98	5.20E+00		2.14E+00

Analysis Report for 30-Jan-20-10006

L1-12107K-FSGS-020SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	635.95	11.22	-2.02E-01	1.68E-01	5.14E-01
	671.44	1.79	1.56E-01		3.18E+00
Ba-133	79.61	2.65	-6.27E-01	1.17E-01	5.25E+00
	81.00	32.90	-1.00E-01		3.62E-01
	276.40	7.16	-8.36E-02		7.05E-01
	302.85	18.34	1.30E-01		2.80E-01
	356.01	62.05	-1.49E-01		1.17E-01
	383.85	8.94	-2.28E-01		4.71E-01
Cs-134	475.36	1.48	-1.79E+00	7.19E-02	3.36E+00
	563.25	8.34	6.23E-02		6.25E-01
	569.33	15.37	-8.80E-02		3.28E-01
	604.72	97.62	-1.78E-02		1.05E-01
	795.86	85.46	4.17E-02		7.19E-02
	801.95	8.69	-2.93E-01		7.00E-01
	1038.61	0.99	-2.71E+00		6.85E+00
	1167.97	1.79	-6.09E+00		4.11E+00
	1365.19	3.02	8.13E-01		2.09E+00
Cs-137	661.66	85.10	-1.98E-02	6.83E-02	6.83E-02
Eu-152	121.78	28.67	-6.74E-02	1.79E-01	2.01E-01
	244.70	7.61	-1.61E-01		6.96E-01
	295.94	0.45	3.71E+01		1.61E+01
	344.28	26.60	-1.77E-02		1.79E-01
	367.79	0.86	-2.96E+00		5.53E+00
	411.12	2.24	-7.05E-01		2.20E+00
	443.96	2.83	3.24E-01		1.72E+00
	488.68	0.42	3.36E+00		1.12E+01
	563.99	0.49	2.51E+00		1.07E+01
	586.26	0.46	2.56E+01		1.72E+01
	678.62	0.47	-2.60E+00		1.06E+01
	688.67	0.86	4.92E+00		6.69E+00
	719.35	0.28	-2.14E+01		2.00E+01
	778.90	12.96	-5.45E-01		4.30E-01
	810.45	0.32	-9.19E+00		1.95E+01
	867.37	4.26	-3.14E+00		1.37E+00
	919.33	0.43	-2.85E+00		1.50E+01
	964.08	14.65	1.79E-01		6.47E-01
	1085.87	10.24	-3.84E-01		6.75E-01
	1089.74	1.73	-2.13E+00		4.32E+00
	1112.07	13.69	-2.94E-01		5.80E-01
	1212.95	1.43	1.01E+00		6.48E+00
	1249.94	0.19	2.63E+01		4.43E+01
	1299.14	1.63	-8.61E-01		4.52E+00
	1408.01	21.07	9.53E-02		3.26E-01
	1457.64	0.50	3.24E+02		5.89E+01
	1528.10	0.28	2.86E+00		1.80E+01
Eu-154	123.07	40.40	-3.13E-02	1.43E-01	1.43E-01
	247.93	6.89	3.01E-02		6.38E-01
	591.76	4.95	5.03E-01		1.06E+00
	692.42	1.78	1.35E+00		3.31E+00
	723.30	20.06	7.40E-02		3.54E-01
	756.80	4.52	1.15E-01		1.44E+00

Analysis Report for 30-Jan-20-10006

L1-12107K-FSGS-020SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	873.18		12.08	-5.62E-02	1.43E-01	4.80E-01
		996.29		10.48	3.26E-01		6.93E-01
		1004.76		18.01	3.68E-01		4.21E-01
		1274.43		34.80	-2.23E-01		2.22E-01
		1596.48		1.80	-7.54E-02		3.21E+00
	Eu-155	45.30		1.31	2.25E+01	3.19E-01	3.10E+01
		60.01		1.22	-9.54E+00		3.04E+01
		86.55		30.70	3.06E-02		3.51E-01
		105.31		21.10	-6.72E-04		3.19E-01
+	Ra-226	186.21	*	3.64	1.55E+00	1.29E+00	1.29E+00
	Pa-231	27.36		10.30	4.88E+00	2.21E+00	3.45E+00
		283.69		1.70	-7.05E-02		2.82E+00
		300.07		2.47	5.86E-01		2.21E+00
		302.65		2.20	2.68E-01		2.32E+00
		330.06		1.40	2.14E+00		3.81E+00
+	U-235	143.76		10.96	-1.18E-02	8.20E-02	5.13E-01
		163.33		5.08	1.45E-01		9.92E-01
		185.71	*	57.20	9.84E-02		8.20E-02
		202.11		1.08	-1.10E+00		4.85E+00
		205.31		5.01	-2.37E-01		1.07E+00
	Am-241	59.54		35.90	4.08E-01	1.10E+00	1.10E+00

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

Apex-Gamma

Analysis Report for 30-Jan-20-10005

L1-12107K-FSGS-019SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Jan-20-10005
Sample Description	: L1-12107K-FSGS-019SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.524E+03 grams
Facility	: Default
Sample Taken On	: 1/29/2020 2:30:00PM
Acquisition Started	: 1/30/2020 11:59:32AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 1/30/2020
Efficiency Calibration Description	:
Sample Number	: 82550
Fill Height	: 1524.33 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 1/30/2020 12:14:36PM

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

Analysis Report for 30-Jan-20-10005

L1-12107K-FSGS-019SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	75.14	297 -	316	301.10	7.86E+01	13.28	1.63E+02	0.99
m	2	77.37	297 -	316	310.00	1.35E+02	14.86	1.89E+02	0.99
M	3	238.86	947 -	976	955.01	3.41E+02	19.13	1.07E+02	1.13
m	4	242.04	947 -	976	967.73	9.90E+01	11.70	1.02E+02	1.14
	5	295.35	1175 -	1189	1180.68	1.59E+02	19.37	7.51E+01	1.32
	6	352.12	1399 -	1414	1407.49	2.52E+02	21.42	6.84E+01	1.19
	7	510.81	2035 -	2049	2041.59	4.75E+01	12.51	3.75E+01	1.18
	8	583.35	2322 -	2340	2331.53	1.26E+02	14.24	2.28E+01	1.60
	9	609.33	2427 -	2444	2435.36	2.17E+02	17.83	3.12E+01	1.31
	10	911.01	3633 -	3650	3641.49	9.09E+01	12.49	2.01E+01	1.13
	11	969.11	3867 -	3882	3873.86	4.45E+01	10.40	2.05E+01	1.15
	12	1120.49	4473 -	4486	4479.35	4.50E+01	9.28	1.50E+01	0.65
	13	1460.73	5827 -	5854	5840.87	6.78E+02	26.36	3.61E+00	1.71
	14	1764.60	7051 -	7064	7057.47	2.88E+01	7.18	8.20E+00	0.59

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	5.63E-02	1.53E-02
K-40	0.99	1460.82	*	10.66	1.52E+01	8.88E-01
Tl-208	0.99	583.19	*	85.00	1.90E-01	2.43E-02

Analysis Report for 30-Jan-20-10005

L1-12107K-FSGS-019SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	5.42E-01	5.33E-02
		300.09		3.30		
Pb212-XR	0.98	74.82	*	10.28	9.98E-01	1.97E-01
		77.11	*	17.10	9.45E-01	1.42E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	6.29E-01	6.40E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	6.01E-01	1.26E-01
		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	5.22E-01	1.32E-01
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	9.53E-01	1.36E-01
		295.22	*	18.42	6.80E-01	9.91E-02
		351.93	*	35.60	6.34E-01	7.41E-02
		785.96		1.06		
Ac-228	0.73	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	6.12E-01	8.80E-02
		964.77		4.99		
		968.97	*	15.80	5.09E-01	1.21E-01
		1588.20		3.22		

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

Analysis Report for 30-Jan-20-10005

L1-12107K-FSGS-019SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.994	5.63E-02	1.53E-02	
	K-40	0.999	1.52E+01	8.88E-01	
	Tl-208	0.996	1.90E-01	2.43E-02	
	Pb-212	0.992	5.42E-01	5.33E-02	
	Pb212-XR	0.989	9.63E-01	1.16E-01	
	Bi-214	0.999	6.07E-01	5.24E-02	
	Pb-214	0.996	6.99E-01	5.44E-02	
X	Pb214-XR	0.989			
	Ac-228	0.736	5.76E-01	7.12E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 30-Jan-20-10005

L1-12107K-FSGS-019SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 1/30/2020 12:14:36PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	5.63E-02	4.53E-02	4.53E-02
	BE-7	477.60		10.44	-1.48E-01	4.92E-01	4.92E-01
+	K-40	1460.82	*	10.66	1.52E+01	3.75E-01	3.75E-01
	Mn-54	834.85		99.98	3.73E-02	6.65E-02	6.65E-02
	Co-60	1173.23		99.85	-1.39E-02	6.61E-02	8.03E-02
		1332.49		99.98	-1.62E-02		6.61E-02
	Nb-94	702.65		99.81	-1.85E-02	5.77E-02	5.83E-02
		871.09		99.89	-4.84E-02		5.77E-02
	Ag-108m	79.13		6.60	-3.23E-02	5.34E-02	1.71E+00
		433.94		90.50	1.34E-02		5.34E-02
		614.28		89.80	-1.95E-02		9.33E-02
		722.94		90.80	-1.76E-04		7.43E-02
	Sb-125	176.31		6.84	-2.75E-02	1.56E-01	6.62E-01
		380.45		1.52	3.91E-01		3.14E+00
		427.87		29.60	-1.50E-01		1.56E-01
		463.36		10.49	3.69E-01		4.99E-01
		600.60		17.65	-2.06E-01		2.85E-01
		606.71		4.98	-2.52E-01		2.22E+00
		635.95		11.22	-1.70E-01		4.54E-01

Analysis Report for 30-Jan-20-10005

L1-12107K-FSGS-019SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.00E+00	1.56E-01	3.03E+00
Ba-133	79.61	2.65	-6.29E-01	1.10E-01	4.08E+00
	81.00	32.90	-2.49E-01		2.54E-01
	276.40	7.16	2.14E-01		6.82E-01
	302.85	18.34	1.33E-01		2.55E-01
	356.01	62.05	-4.80E-02		1.10E-01
	383.85	8.94	-1.71E-02		5.15E-01
Cs-134	475.36	1.48	2.19E-01	7.06E-02	3.31E+00
	563.25	8.34	-3.14E-02		6.46E-01
	569.33	15.37	6.93E-02		3.38E-01
	604.72	97.62	-3.55E-02		9.07E-02
	795.86	85.46	5.62E-03		7.06E-02
	801.95	8.69	3.89E-01		7.16E-01
	1038.61	0.99	-3.54E+00		6.22E+00
	1167.97	1.79	-8.68E-01		4.21E+00
	1365.19	3.02	-7.85E-01		1.87E+00
Cs-137	661.66	85.10	-5.33E-03	6.82E-02	6.82E-02
Eu-152	121.78	28.67	-6.63E-02	1.69E-01	1.74E-01
	244.70	7.61	-2.58E-01		7.56E-01
	295.94	0.45	1.27E+01		1.51E+01
	344.28	26.60	-2.20E-01		1.69E-01
	367.79	0.86	-1.50E+00		5.20E+00
	411.12	2.24	-1.03E+00		2.32E+00
	443.96	2.83	9.36E-03		1.70E+00
	488.68	0.42	5.08E+00		1.18E+01
	563.99	0.49	-2.60E+00		1.05E+01
	586.26	0.46	1.69E+00		1.85E+01
	678.62	0.47	-5.42E+00		1.05E+01
	688.67	0.86	3.13E+00		6.84E+00
	719.35	0.28	3.50E+00		1.95E+01
	778.90	12.96	-3.64E-01		3.81E-01
	810.45	0.32	-1.11E+01		1.75E+01
	867.37	4.26	-1.42E-01		1.38E+00
	919.33	0.43	-7.94E-01		1.50E+01
	964.08	14.65	7.26E-02		6.38E-01
	1085.87	10.24	-5.92E-01		6.82E-01
	1089.74	1.73	-6.09E-01		4.05E+00
	1112.07	13.69	-4.54E-01		5.33E-01
	1212.95	1.43	-6.34E+00		6.45E+00
	1249.94	0.19	-4.49E+01		4.67E+01
	1299.14	1.63	4.74E-01		4.88E+00
	1408.01	21.07	-8.76E-02		2.75E-01
	1457.64	0.50	-3.41E+00		6.14E+01
	1528.10	0.28	1.14E+01		1.77E+01
Eu-154	123.07	40.40	4.66E-02	1.24E-01	1.24E-01
	247.93	6.89	-5.22E-01		6.32E-01
	591.76	4.95	1.67E-01		1.02E+00
	692.42	1.78	5.87E-01		3.14E+00
	723.30	20.06	4.70E-02		3.38E-01
	756.80	4.52	1.49E-01		1.36E+00
	873.18	12.08	-1.94E-02		5.08E-01

Analysis Report for 30-Jan-20-10005

L1-12107K-FSGS-019SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-4.06E-01	1.24E-01	6.47E-01
	1004.76	18.01	9.14E-02		4.28E-01
	1274.43	34.80	-8.36E-02		2.31E-01
	1596.48	1.80	-4.52E-01		3.32E+00
Eu-155	45.30	1.31	9.68E+00	2.75E-01	1.61E+01
	60.01	1.22	-2.48E+00		1.73E+01
	86.55	30.70	1.54E-01		2.75E-01
	105.31	21.10	6.99E-02		2.79E-01
Ra-226	186.21	3.64	1.24E+00	1.43E+00	1.43E+00
Pa-231	27.36	10.30	2.47E+00	1.75E+00	1.75E+00
	283.69	1.70	-2.47E-01		2.71E+00
	300.07	2.47	3.78E-02		1.96E+00
	302.65	2.20	1.13E+00		2.11E+00
	330.06	1.40	2.22E-01		3.64E+00
U-235	143.76	10.96	1.76E-01	9.26E-02	4.64E-01
	163.33	5.08	9.10E-02		8.81E-01
	185.71	57.20	1.09E-01		9.26E-02
	202.11	1.08	-2.19E+00		3.83E+00
	205.31	5.01	-9.98E-01		8.54E-01
Am-241	59.54	35.90	-2.69E-01	5.99E-01	5.99E-01

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

Apex-Gamma

Analysis Report for 30-Jan-20-10004

L1-12107K-FSGS-018SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 30-Jan-20-10004
Sample Description	: L1-12107K-FSGS-018SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.549E+03 grams
Facility	: Default
Sample Taken On	: 1/29/2020 1:17:00PM
Acquisition Started	: 1/30/2020 11:59:26AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 902.4 seconds
Dead Time	: 0.27 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 1/30/2020
Efficiency Calibration Description	:
Sample Number	: 82549
Fill Height	: 1548.89 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 1/30/2020 12:14:31PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Analysis Report for 30-Jan-20-10004

L1-12107K-FSGS-018SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.07	306 -	315	308.99	5.38E+01	17.79	1.15E+02	0.27
	2	186.12	738 -	751	744.78	6.64E+01	20.92	1.35E+02	0.69
M	3	238.70	948 -	973	954.88	3.24E+02	51.62	9.94E+01	1.02
m	4	241.86	948 -	973	967.52	8.73E+01	16.77	1.02E+02	1.02
	5	295.13	1175 -	1188	1180.41	1.62E+02	17.65	5.42E+01	0.79
	6	338.33	1346 -	1358	1353.08	4.85E+01	15.37	7.15E+01	1.14
	7	351.96	1400 -	1415	1407.58	2.50E+02	20.30	5.38E+01	1.17
	8	510.81	2038 -	2047	2042.59	2.79E+01	10.52	3.61E+01	0.34
	9	583.20	2324 -	2338	2332.00	9.99E+01	13.69	3.01E+01	0.68
	10	609.28	2428 -	2444	2436.29	2.09E+02	16.60	2.13E+01	1.27
	11	726.88	2900 -	2912	2906.56	3.68E+01	8.14	1.12E+01	0.35
	12	911.38	3637 -	3653	3644.49	6.48E+01	11.48	2.13E+01	0.86
	13	968.96	3866 -	3883	3874.81	6.58E+01	10.41	1.32E+01	1.08
	14	1120.32	4474 -	4488	4480.40	5.33E+01	10.38	1.88E+01	1.15
	15	1460.77	5831 -	5854	5842.91	6.05E+02	25.29	8.73E+00	1.97
	16	1764.34	7052 -	7065	7058.36	3.67E+01	6.77	3.30E+00	0.80

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	3.66E-02	1.40E-02

Analysis Report for 30-Jan-20-10004

L1-12107K-FSGS-018SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	1.50E+01	9.06E-01
Tl-208	1.00	583.19	*	85.00	1.66E-01	2.49E-02
Bi-212	0.97	39.86		1.06		
		727.33	*	6.67	9.08E-01	2.07E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	5.78E-01	1.03E-01
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	6.59E-01	2.28E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	6.68E-01	6.66E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	7.86E-01	1.56E-01
		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	7.36E-01	1.39E-01
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	9.42E-01	1.96E-01
		295.22	*	18.42	7.69E-01	1.04E-01
		351.93	*	35.60	6.99E-01	7.96E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	1.16E+00	4.06E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.99	186.21	*	3.64	1.27E+00	4.12E-01
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	4.16E-01	1.36E-01
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	4.81E-01	8.78E-02
		964.77		4.99		
		968.97	*	15.80	8.32E-01	1.37E-01
		1588.20		3.22		
U-235	0.98	143.76		10.96		

Analysis Report for 30-Jan-20-10004

L1-12107K-FSGS-018SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
U-235	0.98	163.33		5.08		
		185.71	*	57.20	8.06E-02	2.62E-02
		202.11		1.08		
		205.31		5.01		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.994	3.66E-02	1.40E-02	
	K-40	1.000	1.50E+01	9.06E-01	
	Tl-208	1.000	1.66E-01	2.49E-02	
X	Bi-211	0.880			
	Bi-212	0.979	9.08E-01	2.07E-01	
	Pb-212	0.999	5.78E-01	1.03E-01	
?	Pb212-XR	1.000	6.59E-01	2.28E-01	
	Bi-214	0.999	6.94E-01	5.61E-02	
	Pb-214	0.999	7.45E-01	6.02E-02	
?	Pb214-XR	1.000	1.16E+00	4.06E-01	
?	Ra-226	0.999	1.27E+00	4.12E-01	
	Ac-228	0.998	5.45E-01	6.49E-02	
?	U-235	0.981	8.06E-02	2.62E-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 30-Jan-20-10004

L1-12107K-FSGS-018SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 1/30/2020 12:14:31PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	3.66E-02	4.42E-02	4.42E-02
	BE-7	477.60		10.44	1.33E-01	5.21E-01	5.21E-01
+	K-40	1460.82	*	10.66	1.50E+01	5.65E-01	5.65E-01
	Mn-54	834.85		99.98	2.99E-03	6.77E-02	6.77E-02
	Co-60	1173.23		99.85	-1.54E-01	6.63E-02	8.20E-02
		1332.49		99.98	-3.27E-02		6.63E-02
	Nb-94	702.65		99.81	1.75E-02	6.58E-02	6.69E-02
		871.09		99.89	-1.90E-02		6.58E-02
	Ag-108m	79.13		6.60	-2.98E-01	6.10E-02	2.43E+00
		433.94		90.50	-5.68E-02		6.10E-02
		614.28		89.80	-9.18E-02		1.02E-01
		722.94		90.80	-4.39E-02		7.96E-02
	Sb-125	176.31		6.84	-5.46E-02	1.94E-01	7.93E-01
		380.45		1.52	1.16E+00		3.54E+00
		427.87		29.60	-4.79E-02		1.94E-01
		463.36		10.49	-1.02E-02		5.52E-01
		600.60		17.65	1.82E-01		3.54E-01
		606.71		4.98	5.41E+00		2.36E+00
		635.95		11.22	-3.69E-01		5.01E-01

Analysis Report for 30-Jan-20-10004

L1-12107K-FSGS-018SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.44E-01	1.94E-01	2.92E+00
Ba-133	79.61	2.65	-1.14E+00	1.22E-01	5.62E+00
	81.00	32.90	-3.74E-01		3.99E-01
	276.40	7.16	-1.88E-01		7.69E-01
	302.85	18.34	9.58E-02		2.97E-01
	356.01	62.05	1.50E-02		1.22E-01
	383.85	8.94	-3.23E-01		5.79E-01
Cs-134	475.36	1.48	9.97E-01	7.02E-02	3.77E+00
	563.25	8.34	-6.42E-01		6.54E-01
	569.33	15.37	-1.52E-02		3.48E-01
	604.72	97.62	9.14E-03		1.08E-01
	795.86	85.46	-5.14E-03		7.02E-02
	801.95	8.69	2.29E-01		6.40E-01
	1038.61	0.99	-4.62E+00		7.27E+00
	1167.97	1.79	1.26E+00		5.02E+00
	1365.19	3.02	2.49E-01		2.12E+00
Cs-137	661.66	85.10	-3.68E-03	6.85E-02	6.85E-02
Eu-152	121.78	28.67	-5.75E-02	1.96E-01	2.25E-01
	244.70	7.61	-3.96E-02		8.42E-01
	295.94	0.45	2.33E+01		1.64E+01
	344.28	26.60	-5.95E-02		1.96E-01
	367.79	0.86	1.40E+00		6.19E+00
	411.12	2.24	-1.15E+00		2.54E+00
	443.96	2.83	-1.86E+00		1.96E+00
	488.68	0.42	4.50E+00		1.33E+01
	563.99	0.49	1.27E+00		1.13E+01
	586.26	0.46	-7.53E+00		2.03E+01
	678.62	0.47	3.32E+00		1.21E+01
	688.67	0.86	-3.18E+00		6.85E+00
	719.35	0.28	-2.80E+00		1.88E+01
	778.90	12.96	1.26E-01		4.89E-01
	810.45	0.32	-6.61E+00		1.58E+01
	867.37	4.26	-6.21E-01		1.68E+00
	919.33	0.43	-4.41E+00		1.63E+01
	964.08	14.65	-1.69E-02		7.10E-01
	1085.87	10.24	-4.41E-01		6.83E-01
	1089.74	1.73	-6.51E-01		4.68E+00
	1112.07	13.69	-4.75E-01		5.78E-01
	1212.95	1.43	-1.40E+00		7.36E+00
	1249.94	0.19	-3.08E+01		4.56E+01
	1299.14	1.63	3.19E+00		4.67E+00
	1408.01	21.07	1.99E-01		3.51E-01
	1457.64	0.50	3.06E+02		6.43E+01
	1528.10	0.28	-9.55E+00		1.83E+01
Eu-154	123.07	40.40	-8.06E-02	1.60E-01	1.60E-01
	247.93	6.89	-2.64E-01		7.35E-01
	591.76	4.95	9.03E-01		1.23E+00
	692.42	1.78	2.89E+00		3.53E+00
	723.30	20.06	-1.89E-01		3.58E-01
	756.80	4.52	-3.06E-01		1.31E+00
	873.18	12.08	2.13E-01		5.45E-01

Analysis Report for 30-Jan-20-10004

L1-12107K-FSGS-018SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	6.11E-02	1.60E-01	7.34E-01
		1004.76		18.01	1.62E-01		4.52E-01
		1274.43		34.80	-3.61E-01		2.39E-01
		1596.48		1.80	-2.90E-01		3.93E+00
	Eu-155	45.30		1.31	1.07E+01	3.95E-01	4.38E+01
		60.01		1.22	-1.85E+01		4.42E+01
		86.55		30.70	1.27E-01		4.09E-01
		105.31		21.10	8.79E-02		3.95E-01
+	Ra-226	186.21	*	3.64	1.27E+00	1.30E+00	1.30E+00
	Pa-231	27.36		10.30	2.73E+00	2.13E+00	4.60E+00
		283.69		1.70	1.61E+00		3.04E+00
		300.07		2.47	1.49E-01		2.13E+00
		302.65		2.20	7.64E-01		2.48E+00
		330.06		1.40	1.73E+00		3.94E+00
+	U-235	143.76		10.96	1.87E-01	8.29E-02	5.60E-01
		163.33		5.08	-4.19E-01		1.12E+00
		185.71	*	57.20	8.06E-02		8.29E-02
		202.11		1.08	-5.94E-01		4.92E+00
		205.31		5.01	-1.04E+00		1.05E+00
	Am-241	59.54		35.90	2.43E-01	1.61E+00	1.61E+00

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

ATTACHMENT 8
EBERLINE ANALYTICAL REPORTS

EBERLINE ANALYTICAL

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

EBS-OR-46634

January 22, 2020

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

CASE NARRATIVE
Work Order # 19-10093-OR

SAMPLE RECEIPT

This work order contains twelve soil samples received 10/21/2019. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-12107-A-FSGS-012-SS-A	19-10093-04	L1-12104-A-FSGS-013-SS-A	19-10093-10
L1-12105-A-FSGS-016-SS-A	19-10093-05	L1-12205-A-FSGS-101-SB-A	19-10093-11
L1-12105-A-FSGS-002-SS-A	19-10093-06	L1-12109-A-FSGS-012-SS-A	19-10093-12
L1-12107-A-FSGS-010-SB-A	19-10093-07	L1-12205-C-FSGS-105-SS-A	19-10093-13
L1-12205-A-FSGS-111-SS-A	19-10093-08	L1-12111-A-FSGS-003-SS-A	19-10093-14
L1-12104-A-FSGS-011-SS-A	19-10093-09	L1-12205-D-FSGS-111-SB-A	19-10093-15

ANALYTICAL METHODS

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

Laboratory qualifiers are as follows:

U - Result is less than the MDA.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

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

ANALYTICAL RESULTS CONTINUED

TOTAL STRONTIUM

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

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

TRITIUM

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

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

NICKEL-63

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

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

GAMMA SPECTROSCOPY

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

ANALYTICAL RESULTS CONTINUED

GAMMA SPECTROSCOPY CONTINUED

Samples demonstrated acceptable results for all gamma-emitting radionuclides as reported. The method blank demonstrated acceptable results for all radionuclides as reported. Results for the Actinium-228, 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: 1/22/2020

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	2.04E+02	7.36E+00				pCi/g
19-10093-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.85E+02	7.36E+00	1.27E+01	5.48E+00		pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	3.02E+00	3.29E+00	3.30E+00	5.53E+00	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.47E+00	3.16E+00	3.16E+00	5.39E+00	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.99E+00	3.12E+00	3.13E+00	5.30E+00	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	-1.72E-01	2.89E+00	2.89E+00	5.04E+00	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	2.46E+00	3.06E+00	3.06E+00	5.15E+00	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.40E+00	3.00E+00	3.01E+00	5.13E+00	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	3.68E-01	3.11E+00	3.11E+00	5.38E+00	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.26E+00	3.09E+00	3.09E+00	5.28E+00	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	2.76E+00	3.21E+00	3.21E+00	5.39E+00	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	-5.42E-01	3.03E+00	3.03E+00	5.30E+00	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	9.18E-01	3.13E+00	3.13E+00	5.37E+00	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.50E+00	3.22E+00	3.22E+00	5.49E+00	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	1.64E+00	3.13E+00	3.13E+00	5.33E+00	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	11/26/2019	19-10093	Tritium	LANL ER-210 Modified	-3.56E-01	2.99E+00	2.99E+00	5.21E+00	U	pCi/g
19-10093-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.51E+03	4.54E+01				pCi/g
19-10093-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.56E+03	1.34E+01	9.26E+01	3.17E+00		pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	4.38E-01	1.83E+00	1.83E+00	3.13E+00	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.14E+00	1.72E+00	1.73E+00	2.92E+00	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	4.93E-01	1.72E+00	1.72E+00	2.94E+00	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.16E+00	1.75E+00	1.75E+00	2.95E+00	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-9.21E-02	1.90E+00	1.90E+00	3.29E+00	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.96E+00	1.99E+00	1.99E+00	3.33E+00	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-4.57E-01	1.88E+00	1.88E+00	3.26E+00	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	9.68E-01	1.85E+00	1.85E+00	3.14E+00	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-6.24E-01	2.13E+00	2.13E+00	3.71E+00	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-4.37E-01	1.79E+00	1.79E+00	3.12E+00	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	9.06E-01	1.90E+00	1.90E+00	3.23E+00	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	12/27/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-1.02E+00	1.89E+00	1.89E+00	3.31E+00	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	12/28/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	1.85E-01	1.92E+00	1.92E+00	3.30E+00	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	12/28/2019	19-10093	Nickel-63	ASTM 3500-Ni Modified	-1.61E+00	2.33E+00	2.33E+00	4.11E+00	U	pCi/g

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

0019

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	5.06E+01	2.83E-01				pCi/g
19-10093-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	5.71E+01	3.42E+00	2.02E+01	1.22E+00		pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	3.78E-01	3.95E-01	4.16E-01	8.02E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	6.37E-02	3.07E-01	3.08E-01	6.49E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	-1.58E-01	2.93E-01	2.98E-01	6.42E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	3.56E-01	2.94E-01	3.19E-01	5.89E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	2.83E-02	3.31E-01	3.31E-01	7.05E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	1.61E-01	3.00E-01	3.05E-01	6.23E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	9.02E-02	2.72E-01	2.74E-01	5.74E-01	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	3.74E-01	2.89E-01	3.17E-01	5.72E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	2.44E-01	3.04E-01	3.15E-01	6.22E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	3.63E-02	3.22E-01	3.22E-01	6.85E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	3.50E-01	2.96E-01	3.20E-01	5.94E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	-1.34E-01	3.46E-01	3.50E-01	7.53E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	8.98E-02	2.56E-01	2.58E-01	5.39E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	11/21/2019	19-10093	Strontium-90	ElChroM SRW01 Modified	9.69E-02	3.10E-01	3.12E-01	6.53E-01	U	pCi/g
19-10093-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
19-10093-01	LCS	KNOWN	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
19-10093-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	1.31E+02	7.49E+00	1.01E+01	1.08E+00		pCi/g
19-10093-01	LCS	SPIKE	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	8.62E+01	7.30E+00	8.53E+00	1.47E+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

0020

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	-3.61E-02	1.09E-01	1.09E-01	1.75E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	7.53E-03	2.99E-02	2.99E-02	4.13E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-2.61E-02	3.86E-02	3.86E-02	5.37E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	7.61E-03	5.08E-02	5.08E-02	5.80E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	4.74E-02	7.87E-02	7.87E-02	1.26E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-1.07E-02	3.21E-02	3.21E-02	5.04E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-1.32E-02	4.28E-02	4.28E-02	5.70E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	4.74E-03	3.80E-02	3.80E-02	5.63E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	3.83E-02	1.10E-01	1.10E-01	9.02E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	2.99E-02	8.81E-02	8.81E-02	4.62E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	-5.49E-02	4.85E-02	4.86E-02	6.08E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	5.20E-02	4.75E-02	4.76E-02	3.64E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	6.62E-02	8.55E-02	8.56E-02	1.36E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	2.20E-01	3.55E-01	3.55E-01	7.41E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-2.14E-02	3.82E-02	3.82E-02	5.10E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	2.47E-02	3.16E-02	3.16E-02	4.77E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	4.42E-03	2.53E-02	2.53E-02	4.81E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	6.37E-01	3.93E-01	3.95E-01	6.78E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	1.97E-02	3.91E-02	3.91E-02	6.38E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	1.04E-01	9.35E-02	9.36E-02	1.44E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-5.31E-02	6.47E-02	6.48E-02	8.82E-02	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	4.74E-02	7.87E-02	7.87E-02	1.26E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	5.57E-02	8.37E-02	8.37E-02	1.35E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	1.54E-01	3.53E-01	3.53E-01	5.49E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	-5.79E-03	9.81E-02	9.81E-02	1.23E-01	U	pCi/g
19-10093-02	MBL	BLANK	10/21/19 00:00	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	-5.60E-02	1.42E-01	1.42E-01	2.06E-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

0021

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	2.86E-01	1.43E-01	1.44E-01	3.26E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	1.76E-03	2.91E-02	2.91E-02	5.05E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-6.95E-02	6.88E-02	6.89E-02	1.04E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-3.10E-02	4.07E-02	4.07E-02	7.76E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.92E-01	9.57E-02	9.68E-02	1.62E-01		pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-3.29E-03	5.18E-02	5.18E-02	7.53E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	4.62E-03	1.32E-02	1.32E-02	5.48E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	-7.32E-03	3.65E-02	3.65E-02	5.47E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	5.44E-03	8.68E-02	8.68E-02	1.71E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	1.12E-02	1.16E-01	1.16E-01	8.59E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	1.05E-01	8.54E-02	8.55E-02	1.31E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-5.03E-02	6.62E-02	6.63E-02	5.20E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	3.43E-02	1.72E-01	1.72E-01	2.80E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.27E+01	1.69E+00	1.81E+00	6.54E-01		pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-1.35E-02	3.32E-02	3.32E-02	4.79E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	1.10E-02	3.11E-02	3.11E-02	5.14E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	2.70E-02	3.52E-02	3.52E-02	5.28E-02	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	1.10E+00	7.19E-01	7.21E-01	1.24E+00	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	1.81E-01	6.93E-02	6.99E-02	1.23E-01		pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.11E-01	8.42E-02	8.49E-02	1.10E-01		pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	3.94E-02	1.19E-01	1.19E-01	1.96E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.92E-01	9.57E-02	9.68E-02	1.62E-01		pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	2.91E-02	9.73E-02	9.73E-02	1.54E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	7.00E-01	6.03E-01	6.04E-01	1.02E+00	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	1.29E-01	9.00E-02	9.03E-02	1.70E-01	U	pCi/g
19-10093-03	DUP	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	1.18E-01	2.15E-01	2.15E-01	3.28E-01	U	pCi/g

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

0022

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	2.70E-01	1.23E-01	1.23E-01	3.72E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-1.80E-02	4.13E-02	4.13E-02	4.65E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	2.19E-02	4.45E-02	4.45E-02	1.05E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-6.22E-03	1.57E-02	1.57E-02	7.63E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.88E-01	1.12E-01	1.13E-01	1.59E-01		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	9.06E-03	2.90E-02	2.90E-02	6.22E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-1.52E-01	7.02E-02	7.07E-02	5.43E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	-1.73E-02	3.68E-02	3.68E-02	5.32E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-4.14E-03	1.09E-01	1.09E-01	1.60E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-9.99E-03	1.19E-01	1.19E-01	8.03E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	-2.85E-02	9.02E-02	9.02E-02	1.28E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-2.39E-02	6.33E-02	6.33E-02	5.03E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	-1.48E-02	1.66E-01	1.66E-01	2.66E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.25E+01	1.69E+00	1.80E+00	8.30E-01		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-2.76E-02	4.18E-02	4.18E-02	5.57E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	-4.09E-02	3.53E-02	3.54E-02	4.40E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-2.13E-02	3.98E-02	3.98E-02	5.02E-02	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	6.82E-01	7.44E-01	7.45E-01	1.24E+00	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.71E-01	8.89E-02	9.00E-02	1.21E-01		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.45E-01	1.03E-01	1.04E-01	1.83E-01		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	1.99E-02	1.14E-01	1.14E-01	1.87E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.88E-01	1.12E-01	1.13E-01	1.59E-01		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-4.69E-02	9.63E-02	9.63E-02	1.36E-01	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	8.11E-01	8.08E-01	8.09E-01	1.35E+00	U	pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.27E-01	9.64E-02	9.71E-02	4.48E-02		pCi/g
19-10093-04	DO	L1-12107-A-FSGS-012-SS-A	09/26/19 07:22	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	6.89E-02	2.06E-01	2.06E-01	3.11E-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

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Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	5.49E-02	2.06E-01	2.06E-01	3.47E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	4.72E-04	4.47E-02	4.47E-02	6.35E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-6.98E-02	7.31E-02	7.32E-02	1.01E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	1.26E-02	1.87E-02	1.87E-02	1.05E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.12E-01	1.18E-01	1.18E-01	8.99E-02		pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-3.27E-02	7.97E-02	7.97E-02	9.94E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-6.94E-03	2.59E-02	2.59E-02	7.68E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	1.85E-02	5.79E-02	5.79E-02	8.38E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-3.77E-02	1.85E-01	1.85E-01	1.47E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-1.34E-01	1.99E-01	1.99E-01	7.57E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	1.06E-01	7.90E-02	7.92E-02	1.22E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	6.63E-02	7.51E-02	7.51E-02	5.93E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	2.32E-03	1.33E-01	1.33E-01	1.98E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.14E+01	1.83E+00	1.92E+00	1.04E+00		pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	6.50E-03	2.45E-02	2.45E-02	8.31E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	2.23E-02	4.19E-02	4.19E-02	7.20E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	2.21E-02	4.44E-02	4.45E-02	6.60E-02	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	1.11E+00	6.99E-01	7.01E-01	1.12E+00	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	3.79E-01	1.61E-01	1.62E-01	2.00E-01		pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.15E-01	1.05E-01	1.05E-01	1.81E-01		pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-1.33E-01	1.05E-01	1.06E-01	1.39E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.12E-01	1.18E-01	1.18E-01	8.99E-02		pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-1.97E-02	1.31E-01	1.31E-01	1.80E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	7.35E-01	6.33E-01	6.34E-01	9.92E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	1.67E-01	1.69E-01	1.69E-01	2.66E-01	U	pCi/g
19-10093-05	TRG	L1-12105-A-FSGS-016-SS-A	09/30/19 13:30	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	2.92E-02	2.30E-01	2.30E-01	3.45E-01	U	pCi/g

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Final Report of Analysis

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

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SDG: 19-10093
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Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	9.19E-02	5.03E-02	5.05E-02	1.59E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-9.55E-04	3.62E-02	3.62E-02	4.07E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-9.37E-02	7.79E-02	7.80E-02	1.04E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-1.86E-02	5.89E-02	5.89E-02	6.50E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.38E-01	8.80E-02	8.88E-02	1.46E-01		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-1.35E-02	3.63E-02	3.63E-02	3.97E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-4.98E-03	1.19E-02	1.19E-02	6.06E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	-2.80E-02	3.58E-02	3.58E-02	4.42E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-8.76E-02	1.24E-01	1.24E-01	1.34E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-2.42E-02	9.29E-02	9.29E-02	6.62E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	2.52E-02	6.11E-02	6.11E-02	1.18E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	2.27E-02	6.01E-02	6.01E-02	4.95E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	4.24E-02	1.13E-01	1.13E-01	1.70E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.14E+01	1.44E+00	1.56E+00	7.80E-01		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-3.48E-03	9.29E-03	9.29E-03	4.87E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	-1.21E-02	3.26E-02	3.26E-02	4.29E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-4.27E-02	3.85E-02	3.86E-02	4.34E-02	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	9.29E-02	6.93E-01	6.93E-01	1.02E+00	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	3.21E-01	9.06E-02	9.20E-02	1.21E-01		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.03E-01	8.88E-02	8.94E-02	1.64E-01		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-4.37E-02	9.84E-02	9.85E-02	1.40E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.38E-01	8.80E-02	8.88E-02	1.46E-01		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-1.86E-02	7.77E-02	7.77E-02	1.15E-01	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	7.86E-01	8.40E-01	8.41E-01	1.40E+00	U	pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.58E-01	8.80E-02	8.90E-02	8.32E-02		pCi/g
19-10093-06	TRG	L1-12105-A-FSGS-002-SS-A	09/30/19 13:02	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	-1.88E-02	2.02E-01	2.02E-01	2.97E-01	U	pCi/g

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

0025

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
Purchase Order: 677118
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Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	5.64E-01	1.64E-01	1.67E-01	2.37E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	9.35E-03	2.39E-02	2.39E-02	4.32E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-6.06E-02	1.03E-01	1.03E-01	1.23E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-1.03E-02	2.39E-02	2.39E-02	6.60E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	4.21E-01	1.02E-01	1.04E-01	1.32E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	1.79E-02	5.34E-02	5.34E-02	7.01E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-6.64E-03	1.80E-02	1.80E-02	4.79E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	3.82E-03	4.16E-02	4.16E-02	6.50E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-1.76E-02	9.03E-02	9.03E-02	1.75E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	3.57E-02	1.25E-01	1.25E-01	8.97E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	1.95E-02	1.16E-01	1.16E-01	1.51E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-1.80E-02	6.30E-02	6.30E-02	6.66E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	4.54E-01	1.99E-01	2.00E-01	2.80E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.39E+01	1.79E+00	1.92E+00	6.74E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-6.06E-03	4.61E-02	4.61E-02	6.89E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	9.10E-03	3.43E-02	3.43E-02	4.62E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	2.31E-02	3.55E-02	3.55E-02	6.07E-02	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	9.41E-01	1.04E+00	1.05E+00	1.42E+00	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	4.85E-01	1.35E-01	1.37E-01	1.77E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	4.24E-01	1.20E-01	1.22E-01	1.97E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-6.33E-02	1.57E-01	1.58E-01	1.95E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	4.21E-01	1.02E-01	1.04E-01	1.32E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-4.28E-02	8.50E-02	8.50E-02	1.30E-01	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	8.76E-01	9.70E-01	9.71E-01	1.30E+00	U	pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	3.73E-01	1.13E-01	1.14E-01	1.33E-01		pCi/g
19-10093-07	TRG	L1-12107-A-FSGS-010-SB-A	09/30/19 12:25	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	2.70E-01	2.84E-01	2.84E-01	4.04E-01	U	pCi/g

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

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Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	7.56E-02	2.28E-01	2.28E-01	3.85E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-1.24E-02	5.36E-02	5.36E-02	6.67E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-4.85E-02	7.58E-02	7.58E-02	1.07E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	6.25E-03	2.58E-02	2.58E-02	1.12E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.91E-01	1.27E-01	1.28E-01	2.05E-01		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-6.67E-02	8.00E-02	8.01E-02	9.19E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	2.40E-02	3.19E-02	3.20E-02	8.38E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	-4.35E-02	6.47E-02	6.48E-02	7.81E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-3.49E-02	1.95E-01	1.95E-01	1.56E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	2.81E-02	8.22E-02	8.22E-02	7.92E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	-1.13E-02	8.29E-02	8.29E-02	1.21E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	4.02E-03	8.60E-02	8.60E-02	6.17E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	-8.91E-03	1.36E-01	1.36E-01	2.01E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.15E+01	1.85E+00	1.94E+00	1.04E+00		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-3.24E-02	5.96E-02	5.96E-02	8.32E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	1.08E-03	4.81E-02	4.81E-02	7.64E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	1.11E-02	4.83E-02	4.83E-02	7.63E-02	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	6.50E-01	7.07E-01	7.08E-01	1.10E+00	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.38E-01	1.03E-01	1.04E-01	2.00E-01		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.37E-01	1.12E-01	1.13E-01	1.68E-01		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-2.42E-02	1.03E-01	1.03E-01	1.50E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.91E-01	1.27E-01	1.28E-01	2.05E-01		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-1.17E-01	1.49E-01	1.49E-01	1.80E-01	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	8.60E-01	6.64E-01	6.65E-01	1.04E+00	U	pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.58E-01	1.25E-01	1.26E-01	2.32E-01		pCi/g
19-10093-08	TRG	L1-12205-A-FSGS-111-SS-A	09/25/19 13:05	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	-1.58E-02	9.48E-02	9.49E-02	3.58E-01	U	pCi/g

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

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Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	2.90E-02	1.80E-02	1.80E-02	3.30E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-2.96E-03	4.19E-03	4.19E-03	4.89E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-3.72E-03	6.98E-03	6.98E-03	1.05E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	6.19E-04	1.79E-03	1.79E-03	8.09E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.99E-02	1.01E-02	1.02E-02	6.28E-03		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-1.09E-03	5.32E-03	5.32E-03	5.49E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	1.49E-04	1.29E-03	1.29E-03	5.78E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	2.17E-03	3.38E-03	3.39E-03	5.82E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-1.10E-02	1.42E-02	1.42E-02	1.63E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	6.57E-03	5.08E-03	5.09E-03	9.70E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	4.81E-03	8.81E-03	8.81E-03	1.31E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	4.73E-03	4.75E-03	4.75E-03	5.57E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	8.69E-03	1.74E-02	1.74E-02	2.84E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.23E+00	1.64E-01	1.76E-01	7.28E-02		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-2.75E-04	2.95E-03	2.95E-03	5.77E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	2.37E-03	2.69E-03	2.69E-03	3.36E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	1.35E-03	3.50E-03	3.50E-03	5.20E-03	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	1.36E-01	7.25E-02	7.29E-02	1.25E-01	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.08E-02	7.45E-03	7.52E-03	1.55E-02		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.90E-02	1.03E-02	1.04E-02	1.78E-02		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-3.45E-04	1.12E-02	1.12E-02	1.82E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.99E-02	1.01E-02	1.02E-02	6.28E-03		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-1.07E-02	1.04E-02	1.04E-02	1.33E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	-1.33E-02	6.10E-02	6.10E-02	9.78E-02	U	pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.09E-02	9.44E-03	9.50E-03	4.37E-03		pCi/g
19-10093-09	TRG	L1-12104-A-FSGS-011-SS-A	10/01/19 09:20	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	1.51E-02	2.06E-02	2.07E-02	3.17E-02	U	pCi/g

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

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Final Report of Analysis

Report To:
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Work Order Details:
SDG: 19-10093
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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
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	2.15E-01	1.34E-01	1.35E-01	2.54E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-9.26E-03	1.66E-02	1.66E-02	3.55E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-6.62E-02	7.86E-02	7.87E-02	1.08E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-6.21E-03	2.53E-02	2.53E-02	6.48E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	1.58E-01	7.50E-02	7.54E-02	1.48E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-7.45E-03	4.03E-02	4.03E-02	5.08E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	1.05E-02	1.76E-02	1.76E-02	5.26E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	1.25E-02	3.38E-02	3.39E-02	5.08E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-3.62E-02	1.19E-01	1.19E-01	1.38E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	2.61E-02	9.81E-02	9.81E-02	7.01E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	8.59E-02	7.76E-02	7.77E-02	1.19E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-7.00E-03	5.85E-02	5.85E-02	5.28E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	2.40E-02	1.19E-01	1.19E-01	1.78E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.23E+01	1.54E+00	1.67E+00	5.49E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	8.16E-03	3.61E-02	3.61E-02	5.28E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	-4.95E-03	3.07E-02	3.07E-02	3.35E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-1.69E-02	3.07E-02	3.07E-02	3.87E-02	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	7.78E-01	6.93E-01	6.94E-01	1.14E+00	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.35E-01	8.25E-02	8.34E-02	1.19E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.89E-01	7.75E-02	7.89E-02	2.50E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	1.56E-02	9.58E-02	9.58E-02	1.43E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	1.58E-01	7.50E-02	7.54E-02	1.48E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	4.30E-02	7.65E-02	7.65E-02	1.24E-01	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	9.69E-01	6.87E-01	6.88E-01	1.07E+00	U	pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.33E-01	9.24E-02	9.31E-02	1.71E-01		pCi/g
19-10093-10	TRG	L1-12104-A-FSGS-013-SS-A	10/01/19 09:24	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	1.18E-02	2.01E-01	2.01E-01	2.99E-01	U	pCi/g

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

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	3.35E-01	1.57E-01	1.58E-01	2.80E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	3.35E-04	4.49E-02	4.49E-02	4.66E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-2.36E-02	1.05E-01	1.05E-01	1.28E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	8.04E-03	2.70E-02	2.70E-02	5.70E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	4.21E-01	1.03E-01	1.05E-01	1.30E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	8.00E-03	3.44E-02	3.44E-02	5.39E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-1.03E-03	2.10E-02	2.10E-02	5.26E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	-1.99E-02	4.12E-02	4.12E-02	5.84E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	2.96E-02	1.39E-01	1.39E-01	1.74E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-1.15E-02	1.11E-01	1.11E-01	8.89E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	-2.20E-02	1.08E-01	1.08E-01	1.39E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-3.17E-02	6.41E-02	6.42E-02	6.61E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	5.31E-01	2.00E-01	2.02E-01	2.73E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.21E+01	1.61E+00	1.73E+00	7.35E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	2.62E-02	2.83E-02	2.83E-02	5.28E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	5.38E-03	2.44E-02	2.44E-02	4.40E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-9.87E-03	4.12E-02	4.12E-02	5.36E-02	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	8.82E-01	8.07E-01	8.08E-01	1.33E+00	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	4.39E-01	1.19E-01	1.21E-01	1.53E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	5.03E-01	1.14E-01	1.17E-01	1.42E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	1.42E-02	1.49E-01	1.49E-01	1.92E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	4.21E-01	1.03E-01	1.05E-01	1.30E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-3.59E-02	7.54E-02	7.54E-02	1.15E-01	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	1.33E+00	8.76E-01	8.79E-01	1.26E+00	U	pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.49E-01	9.46E-02	9.55E-02	1.77E-01		pCi/g
19-10093-11	TRG	L1-12205-A-FSGS-101-SB-A	10/01/19 08:25	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	-1.99E-01	2.76E-01	2.77E-01	3.30E-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

0030

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	3.10E-01	1.38E-01	1.39E-01	2.14E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-2.82E-02	4.46E-02	4.46E-02	4.16E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-1.23E-01	7.07E-02	7.09E-02	1.01E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	7.09E-03	2.12E-02	2.12E-02	7.51E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.08E-01	9.31E-02	9.37E-02	1.59E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-1.71E-03	4.56E-02	4.56E-02	5.54E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	7.18E-03	1.83E-02	1.83E-02	5.60E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	1.92E-02	3.52E-02	3.52E-02	5.91E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-2.05E-02	4.88E-02	4.88E-02	1.54E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	1.04E-01	1.20E-01	1.20E-01	7.85E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	1.05E-01	7.86E-02	7.88E-02	1.63E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-1.84E-02	6.48E-02	6.48E-02	5.54E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	-1.99E-03	1.63E-01	1.63E-01	2.64E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.09E+01	1.51E+00	1.61E+00	6.83E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-1.94E-02	4.10E-02	4.10E-02	5.90E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	1.61E-02	3.26E-02	3.26E-02	5.23E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	1.54E-02	3.12E-02	3.12E-02	4.78E-02	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	9.52E-01	7.32E-01	7.34E-01	1.24E+00	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	3.34E-01	9.93E-02	1.01E-01	1.31E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.33E-01	9.26E-02	9.34E-02	1.61E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	2.86E-02	1.13E-01	1.13E-01	1.85E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.08E-01	9.31E-02	9.37E-02	1.59E-01		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-1.71E-03	9.66E-02	9.66E-02	1.46E-01	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	1.07E+00	6.19E-01	6.22E-01	1.06E+00	U	pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.44E-01	1.07E-01	1.07E-01	4.38E-02		pCi/g
19-10093-12	TRG	L1-12109-A-FSGS-012-SS-A	09/17/19 09:22	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	1.66E-01	2.12E-01	2.12E-01	3.26E-01	U	pCi/g

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

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Final Report of Analysis

Report To:
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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
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	1.91E-01	2.26E-01	2.26E-01	3.96E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	6.72E-03	2.15E-02	2.15E-02	6.12E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-2.40E-02	7.42E-02	7.42E-02	1.05E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	5.13E-03	3.96E-02	3.96E-02	1.04E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.89E-01	1.07E-01	1.08E-01	1.53E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	5.97E-02	6.90E-02	6.90E-02	1.03E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	1.02E-02	3.14E-02	3.14E-02	8.66E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	1.48E-02	3.26E-02	3.26E-02	7.38E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-2.67E-02	5.42E-02	5.42E-02	1.59E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-1.19E-01	1.88E-01	1.88E-01	7.97E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	6.20E-03	8.52E-02	8.52E-02	1.25E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-3.68E-02	7.89E-02	7.89E-02	6.02E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	-1.63E-01	1.41E-01	1.41E-01	1.81E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	1.26E+01	1.92E+00	2.02E+00	8.10E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	2.35E-02	5.43E-02	5.43E-02	9.27E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	1.64E-02	4.34E-02	4.34E-02	6.63E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-2.79E-03	4.32E-02	4.32E-02	7.02E-02	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	4.80E-01	7.09E-01	7.09E-01	1.08E+00	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.87E-01	1.41E-01	1.42E-01	1.91E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	1.89E-01	1.07E-01	1.07E-01	1.70E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	1.69E-02	1.05E-01	1.05E-01	1.53E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.89E-01	1.07E-01	1.08E-01	1.53E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	-5.41E-02	1.45E-01	1.45E-01	1.90E-01	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	8.78E-01	6.46E-01	6.47E-01	1.02E+00	U	pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	2.58E-01	1.00E-01	1.01E-01	1.25E-01		pCi/g
19-10093-13	TRG	L1-12205-C-FSGS-105-SS-A	09/24/19 13:08	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	3.26E-02	2.28E-01	2.28E-01	3.42E-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

0032

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	3.11E-01	2.08E-01	2.09E-01	3.84E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-1.66E-02	5.63E-02	5.63E-02	5.71E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-5.51E-02	6.77E-02	6.78E-02	9.32E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	-4.12E-02	3.93E-02	3.93E-02	1.01E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	8.43E-02	1.20E-01	1.20E-01	1.82E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	-1.97E-02	6.98E-02	6.98E-02	8.37E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-8.46E-02	7.52E-02	7.53E-02	7.68E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	2.43E-02	5.57E-02	5.58E-02	8.53E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	1.48E-02	8.00E-02	8.00E-02	1.58E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	-5.22E-02	1.71E-01	1.71E-01	8.05E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	5.63E-02	6.74E-02	6.74E-02	1.13E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	2.66E-02	7.92E-02	7.93E-02	5.89E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	-2.32E-03	1.24E-01	1.24E-01	1.83E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	9.59E+00	1.68E+00	1.75E+00	1.25E+00		pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-1.65E-02	5.49E-02	5.49E-02	8.28E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	-1.18E-03	3.99E-02	3.99E-02	6.27E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	2.88E-02	4.38E-02	4.38E-02	7.50E-02	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	5.03E-01	6.54E-01	6.54E-01	1.01E+00	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	2.23E-01	1.00E-01	1.01E-01	1.75E-01		pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.80E-01	1.09E-01	1.10E-01	1.52E-01		pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-8.62E-02	9.92E-02	9.93E-02	1.36E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	8.43E-02	1.20E-01	1.20E-01	1.82E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	1.96E-02	1.27E-01	1.27E-01	1.82E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	-3.16E-01	6.31E-01	6.32E-01	8.98E-01	U	pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	3.10E-01	1.63E-01	1.64E-01	2.29E-01		pCi/g
19-10093-14	TRG	L1-12111-A-FSGS-003-SS-A	09/16/19 08:06	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	3.45E-02	2.19E-01	2.19E-01	3.28E-01	U	pCi/g

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

0033

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-10093
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
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Actinium-228	EPA 901.1 Modified	3.26E-01	1.76E-01	1.77E-01	3.23E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Silver-108m	EPA 901.1 Modified	-1.15E-02	4.44E-02	4.44E-02	5.05E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Americium-241	EPA 901.1 Modified	-1.31E-01	7.88E-02	7.91E-02	1.12E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Barium-133	EPA 901.1 Modified	2.62E-02	2.66E-02	2.66E-02	8.71E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Bismuth-214	EPA 901.1 Modified	2.96E-01	1.11E-01	1.12E-01	2.22E-01		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Cobalt-60	EPA 901.1 Modified	5.36E-02	2.58E-02	2.60E-02	3.98E-02		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Cesium-134	EPA 901.1 Modified	-2.72E-04	1.46E-02	1.46E-02	6.22E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Cesium-137	EPA 901.1 Modified	7.34E-03	4.69E-02	4.69E-02	7.15E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Europium-152	EPA 901.1 Modified	-1.47E-01	1.77E-01	1.77E-01	1.80E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Europium-154	EPA 901.1 Modified	7.81E-03	1.15E-01	1.15E-01	9.19E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Europium-155	EPA 901.1 Modified	7.78E-02	9.68E-02	9.69E-02	1.45E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Holmium-166m	EPA 901.1 Modified	-4.54E-02	5.67E-02	5.68E-02	5.75E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Iodine-129	EPA 901.1 Modified	3.14E-02	1.76E-01	1.76E-01	2.88E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Potassium-40	EPA 901.1 Modified	9.36E+00	1.43E+00	1.51E+00	8.93E-01		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Manganese-54	EPA 901.1 Modified	-5.37E-03	4.30E-02	4.30E-02	6.35E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Molybdenum-93	EPA 901.1 Modified	1.57E-02	3.15E-02	3.15E-02	5.28E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Niobium-94	EPA 901.1 Modified	-2.47E-02	3.46E-02	3.46E-02	5.42E-02	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Lead-210	EPA 901.1 Modified	5.59E-01	8.01E-01	8.01E-01	1.33E+00	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Lead-212	EPA 901.1 Modified	4.05E-01	1.23E-01	1.25E-01	1.66E-01		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Lead-214	EPA 901.1 Modified	2.85E-01	9.14E-02	9.26E-02	2.94E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Promethium-145	EPA 901.1 Modified	-1.04E-01	1.28E-01	1.28E-01	1.95E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Radium-226	EPA 901.1 Modified	2.96E-01	1.11E-01	1.12E-01	2.22E-01		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Antimony-125	EPA 901.1 Modified	8.40E-02	8.89E-02	8.90E-02	1.53E-01	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Thorium-234	EPA 901.1 Modified	8.88E-01	6.66E-01	6.67E-01	1.13E+00	U	pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Thallium-208	EPA 901.1 Modified	3.00E-01	1.22E-01	1.23E-01	2.40E-01		pCi/g
19-10093-15	TRG	L1-12205-D-FSGS-111-SB-A	09/16/19 14:00	10/21/2019	10/23/2019	19-10093	Uranium-235	EPA 901.1 Modified	9.72E-02	2.22E-01	2.22E-01	3.36E-01	U	pCi/g

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

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Attachment 1 – Chain-of-Custody Form

	Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
4	L1-12107-A-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/26/2019	0722	5 ROC HTD	NA	939.51
5	L1-12105-A-FSGS-016-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/30/2019	1330	5 ROC HTD	NA	1026.88
6	L1-12105-A-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/30/2019	1302	5 ROC HTD	NA	969.33
7	L1-12107-A-FSGS-010-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/30/2019	1225	5 ROC HTD	NA	923.24
8	L1-12205-A-FSGS-111-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1305	5 ROC HTD	NA	952.09
9	L1-12104-A-FSGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/1/2019	0920	5 ROC HTD	NA	1013.10
10	L1-12104-A-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/1/2019	0924	5 ROC HTD	NA	975.70
11	L1-12205-A-FSGS-101-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/1/2019	0825	5 ROC HTD	NA	859.10
12	L1-12109-A-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/17/2019	0922	5 ROC HTD	NA	1013.58
13	L1-12205-C-FSGS-105-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/24/2019	1308	5 ROC HTD	NA	979.04
14	L1-12111-A-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/16/2019	0806	5 ROC HTD	NA	1122.70
15	L1-12205-D-FSGS-111-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/16/2019	1400	5 ROC HTD	NA	974.36
	L1-12205-E-FSGS-104-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1306	5 ROC HTD	NA	1087.82
	L1-12205-E-QLGS-101-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/11/2019	0900	5 ROC HTD	NA	829.86
	L1-12205-D-FSGS-117-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1022	5 ROC HTD	NA	1028.72
	L1-12205-E-FSGS-117-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1332	5 ROC HTD	NA	1106.09
	L1-12205-A-FSGS-116-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1315	5 ROC HTD	NA	1078.92

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L1-12111-A-QJGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/23/2019	1330	5 ROC HTD	NA	1137.81
L1-12111-A-FJGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/23/2019	1334	5 ROC HTD	NA	1029.33
L1-12205-B-FSGS-105-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	0908	5 ROC HTD	NA	1044.71
L1-12106-A-FSGS-009-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/26/2019	1246	5 ROC HTD	NA	1127.18
L1-12205-A-FSGS-104-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1251	5 ROC HTD	NA	1135.95
L1-12205-A-FSGS-109-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1301	5 ROC HTD	NA	1130.91
L1-12106-A-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/26/2019	1254	5 ROC HTD	NA	1159.18

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

Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	
Jack Mucia	10/16/19	0710	Richard E. Rickert	10/16/2019	0710
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	
Richard E. Rickert	10/17/2019	1600	Fed Ex Ground	10/17/2019	1600
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	
Fedex G			Randolph Spencer	10/21/2019	1100
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	

Comments

PO # 67718 HTD's 30 Day turnaround

9000

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EBS-OR-46838

February 26, 2020

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

CASE NARRATIVE
Work Order # 20-02088-OR

SAMPLE RECEIPT

This work order contains sixteen soil samples relogged 02/18/2020 per client request. Samples were analyzed for Total Strontium.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-10209D-FSGS-003-SB-A	20-02088-04	L1-10221A-FIGS-007-SB-A	20-02088-12
L1-10220J-FSGS-005-SB-A	20-02088-05	L1-10221A-FSGS-002-SB-A	20-02088-13
L1-10221A-FIGS-001-SB-A	20-02088-06	L1-10221C-FSGS-013-SB-A	20-02088-14
L1-10221A-QIGS-001-SB-A	20-02088-07	L1-10221D-FIGS-010-SB-A	20-02088-15
L1-10221A-FIGS-002-SB-A	20-02088-08	L1-12204B-FSGS-010-SB-A	20-02088-16
L1-10221A-FIGS-003-SB-A	20-02088-09	L1-12202C-FSGS-013-SB-A	20-02088-17
L1-10221A-FIGS-004-SB-A	20-02088-10	L1-12202D-FSGS-015-SB-A	20-02088-18
L1-10209C-FSGS-004-SB-A	20-02088-11	L1-12107A-FSGS-010-SB-A	20-02088-19

ANALYTICAL METHODS

Total Strontium was analyzed using EIChroM Method SRW01 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. Chemical separations were conducted by selective precipitations. Strontium was precipitated and mounted on filter media and then attached to planchets. Chemical recovery was determined by use of a stable Strontium carrier and subsequent mass measurements. Samples were counted by gas flow proportional counting and corrected for Yttrium-90 ingrowth.

Large aliquots were analyzed to improve method detection limits as best possible. Samples demonstrated acceptable results for all Total Strontium determinations. Strontium-90 results are reported from Total Strontium assuming secular equilibrium. Chemical recovery was acceptable for all samples. Results for the Total Strontium method blank demonstrated acceptable results. Results for the Total Strontium duplicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. Results for the Total Strontium laboratory control sample demonstrated an acceptable percent recovery.

CERTIFICATION OF ACCURACY

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

M.R. McDougall
Laboratory Manager

Date: 2/26/2020

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

Eberline Analytical
Final Report of Analysis

Report To:

Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	**20-02088**
Purchase Order:	677118
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-02088-01	LCS	KNOWN	02/18/20 00:00	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	5.02E+01	2.81E-01				pCi/g
20-02088-01	LCS	SPIKE	02/18/20 00:00	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	4.84E+01	1.34E+00	1.69E+01	6.16E-01		pCi/g
20-02088-02	MBL	BLANK	02/18/20 00:00	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	3.15E-01	4.09E-01	4.23E-01	8.39E-01	U	pCi/g
20-02088-03	DUP	L1-10209D-FSGS-003-SB-A	05/28/19 09:00	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	2.01E-02	3.84E-02	3.90E-02	7.98E-02	U	pCi/g
20-02088-04	DO	L1-10209D-FSGS-003-SB-A	05/28/19 09:00	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	3.36E-02	3.74E-02	3.92E-02	7.63E-02	U	pCi/g
20-02088-05	TRG	L1-10220J-FSGS-005-SB-A	05/28/19 13:25	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	1.88E-02	3.50E-02	3.56E-02	7.27E-02	U	pCi/g
20-02088-06	TRG	L1-10221A-FIGS-001-SB-A	06/26/19 10:00	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	4.56E-02	3.80E-02	4.12E-02	7.63E-02	U	pCi/g
20-02088-07	TRG	L1-10221A-QIGS-001-SB-A	06/26/19 10:00	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	5.69E-02	3.92E-02	4.39E-02	7.78E-02	U	pCi/g
20-02088-08	TRG	L1-10221A-FIGS-002-SB-A	06/26/19 10:02	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	6.72E-02	3.55E-02	4.25E-02	6.84E-02	U	pCi/g
20-02088-09	TRG	L1-10221A-FIGS-003-SB-A	06/26/19 10:04	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	2.21E-02	3.26E-02	3.35E-02	6.73E-02	U	pCi/g
20-02088-10	TRG	L1-10221A-FIGS-004-SB-A	06/26/19 10:06	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	3.49E-02	3.24E-02	3.46E-02	6.53E-02	U	pCi/g
20-02088-11	TRG	L1-10209C-FSGS-004-SB-A	07/30/19 13:27	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	2.09E-02	3.85E-02	3.92E-02	8.00E-02	U	pCi/g
20-02088-12	TRG	L1-10221A-FIGS-007-SB-A	07/29/19 10:25	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	2.17E-02	2.86E-02	2.96E-02	5.87E-02	U	pCi/g
20-02088-13	TRG	L1-10221A-FSGS-002-SB-A	07/29/19 14:00	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	5.80E-02	3.46E-02	4.00E-02	6.75E-02	U	pCi/g
20-02088-14	TRG	L1-10221C-FSGS-013-SB-A	07/29/19 15:20	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	4.90E-02	3.43E-02	3.83E-02	6.77E-02	U	pCi/g
20-02088-15	TRG	L1-10221D-FIGS-010-SB-A	07/30/19 09:06	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	2.11E-02	3.05E-02	3.14E-02	6.29E-02	U	pCi/g
20-02088-16	TRG	L1-12204B-FSGS-010-SB-A	02/09/19 14:07	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	2.68E-02	3.58E-02	3.70E-02	7.35E-02	U	pCi/g
20-02088-17	TRG	L1-12202C-FSGS-013-SB-A	09/16/19 08:30	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	4.02E-02	3.73E-02	3.98E-02	7.51E-02	U	pCi/g
20-02088-18	TRG	L1-12202D-FSGS-015-SB-A	09/16/19 13:00	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	3.09E-02	3.64E-02	3.80E-02	7.44E-02	U	pCi/g
20-02088-19	TRG	L1-12107A-FSGS-010-SB-A	09/30/19 12:25	2/18/2020	2/19/2020	20-02088	Strontium-90	ElChroM SRW01 Modified	6.44E-02	4.08E-02	4.65E-02	7.95E-02	U	pCi/g

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

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L2-10213A-AJCS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/16/2019	1234	FULL SUITE	NA	341.36g
L2-10213A-AJCS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/16/2019	1236	FULL SUITE	NA	403.45g
L2-10213A-AJCS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/16/2019	1238	FULL SUITE	NA	519.02g
L1-10221D-FSCS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/15/2019	0720	5 ROC HTD	NA	798.42g
L1-10209E-FICS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/17/2019	1035	5 ROC HTD	NA	683.69g
L1-10209E-QICS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/17/2019	1035	5 ROC HTD	NA	695.73g
L1-10209E-FICS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/17/2019	1500	5 ROC HTD	NA	723.26g
L1-10209E-FICS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/17/2019	1510	5 ROC HTD	NA	704.72g
L1-10209E-FSCS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/20/2019	0810	5 ROC HTD	NA	802.05g
L1-10209D-FSCS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/21/2019	0820	5 ROC HTD	NA	637.16g
L1-10209D-FSCS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/21/2019	0825	5 ROC HTD	NA	598.17g
L1-10209D-FSCS-015-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/21/2019	0920	5 ROC HTD	NA	708.91g
L1-10220J-FSCS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/22/2019	0700	5 ROC HTD	NA	603.35g
L1-10220I-FSCS-010-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/23/2019	0745	5 ROC HTD	NA	672.61g
L1-10209D-FSCS-003-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/28/2019	0900	5 ROC HTD	NA	739.91g
L1-10220J-FSCS-005-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	5/28/2019	1325	5 ROC HTD	NA	678.76g
L1-10220G-FSCS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/3/2019	0744	5 ROC HTD	NA	840.01g
L1-10220G-FSCS-014-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/3/2019	0756	5 ROC HTD	NA	902.77g
L1-10220A-FSCS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/3/2019	0655	5 ROC HTD	NA	939.49g

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L1-10221A-FIGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/11/2019	1217	5 ROC HTD	NA	922.34g
L1-10221A-FIGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/11/2019	1219	5 ROC HTD	NA	929.16g
L1-10221A-FIGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/11/2019	1221	5 ROC HTD	NA	925.96g
L1-10220I-FJGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/9/2019	0830	5 ROC HTD	NA	572.09g
L1-10220I-QJGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/9/2019	0830	5 ROC HTD	NA	648.58g
L1-10221A-FIGS-003-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/26/2019	1004	5 ROC HTD	NA	812.22g
L1-10221A-FIGS-001-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/26/2019	1000	5 ROC HTD	NA	677.47g
L1-10221A-FIGS-004-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/26/2019	1006	5 ROC HTD	NA	757.61g
L1-10221A-FIGS-002-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/26/2019	1002	5 ROC HTD	NA	756.86g
L1-10221A-QIGS-001-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/26/2019	1000	5 ROC HTD	NA	614.42g
L1-10221A-FJGS-007-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/17/2019	0856	5 ROC HTD	NA	710.95g
L1-10221B-FJGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/17/2019	0830	5 ROC HTD	NA	714.12g
L1-10221A-FJGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/17/2019	0846	5 ROC HTD	NA	771.65g
L1-10221A-FJGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/17/2019	0844	5 ROC HTD	NA	707.40g
L1-10221A-FIGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/13/2019	0745	5 ROC HTD	NA	774.76g
L1-10221A-FIGS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/13/2019	0747	5 ROC HTD	NA	783.08g
L1-10221A-FIGS-007-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/13/2019	0749	5 ROC HTD	NA	708.49g
L1-10221A-FIGS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/13/2019	0751	5 ROC HTD	NA	794.16g
L1-10221A-FIGS-009-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/13/2019	0753	5 ROC HTD	NA	774.52g

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L1-10221A-FIGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/11/2019	1217	5 ROC HTD	NA	922.34g
L1-10221A-FIGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/11/2019	1219	5 ROC HTD	NA	929.16g
L1-10221A-FIGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/11/2019	1221	5 ROC HTD	NA	925.96g
L1-10220I-FJGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/9/2019	0830	5 ROC HTD	NA	572.09g
L1-10220I-QJGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/9/2019	0830	5 ROC HTD	NA	648.58g
L1-10221A-FIGS-003-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/26/2019	1004	5 ROC HTD	NA	812.22g
L1-10221A-FIGS-001-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/26/2019	1000	5 ROC HTD	NA	677.47g
L1-10221A-FIGS-004-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/26/2019	1006	5 ROC HTD	NA	757.61g
L1-10221A-FIGS-002-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/26/2019	1002	5 ROC HTD	NA	756.86g
L1-10221A-QIGS-001-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/26/2019	1000	5 ROC HTD	NA	614.42g
L1-10221A-FJGS-007-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/17/2019	0856	5 ROC HTD	NA	710.95g
L1-10221B-FJGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/17/2019	0830	5 ROC HTD	NA	714.12g
L1-10221A-FJGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/17/2019	0846	5 ROC HTD	NA	771.65g
L1-10221A-FJGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/17/2019	0844	5 ROC HTD	NA	707.40g
L1-10221A-FIGS-005-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/13/2019	0745	5 ROC HTD	NA	774.76g
L1-10221A-FIGS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/13/2019	0747	5 ROC HTD	NA	783.08g
L1-10221A-FIGS-007-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/13/2019	0749	5 ROC HTD	NA	708.49g
L1-10221A-FIGS-008-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/13/2019	0751	5 ROC HTD	NA	794.16g
L1-10221A-FIGS-009-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	6/13/2019	0753	5 ROC HTD	NA	774.52g

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4	L1-10203D-FQGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	4/9/2019	0805	5 ROC HTD	NA	868.92g
7	L1-10203E-FSGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	4/8/2019	1230	5 ROC HTD	NA	813.36g
8	L1-10203E-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	4/8/2019	1235	5 ROC HTD	NA	702.73g
12 9	L1-10221A-FIGS-007-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/29/2019	1025	5 ROC HTD	NA	874.41g
13 10	L1-10221A-FSGS-002-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/29/2019	1400	5 ROC HTD	NA	1109.56g
11	L1-10221A-FSGS-108-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/23/2019	1244	5 ROC HTD	NA	918.06g
12	L1-10221A-FSGS-110-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/23/2019	1248	5 ROC HTD	NA	805.48g
13	L1-10221A-FSGS-112-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/23/2019	1252	5 ROC HTD	NA	1136.57g
14 14	L1-10221C-FSGS-013-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/29/2019	1520	5 ROC HTD	NA	825.45g
15 15	L1-10221D-FIGS-010-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/30/2019	0906	5 ROC HTD	NA	599.72g
16	L1-10209C-FSGS-010-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	8/5/2019	0820	5 ROC HTD	NA	1051.63g
17	L1-10209C-FQGS-010-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	8/5/2019	0820	5 ROC HTD	NA	795.39g
11 18	L1-10209C-FSGS-004-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/30/2019	1327	5 ROC HTD	NA	709.07g
	L1-10209C-FQGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/25/2019	1300	5 ROC HTD	NA	1062.99g
	L1-10209C-FIGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/25/2019	1306	5 ROC HTD	NA	945.02g
	L1-10209C-FIGS-006-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/30/2019	1240	5 ROC HTD	NA	752.63g
	L2-10213A-FSGS-001-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/29/2019	0730	5 ROC HTD	NA	663.96g
	L2-10213A-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/29/2019	0734	5 ROC HTD	NA	865.77g
	L2-10213A-FSGS-004-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	7/29/2019	0736	5 ROC HTD	NA	773.20g

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Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L1-12204-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
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
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
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
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
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
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
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
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

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Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L1-12204-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
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
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
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
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
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
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
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
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

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Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L1-12107-A-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/26/2019	0722	5 ROC HTD	NA	939.51
L1-12105-A-FSGS-016-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/30/2019	1330	5 ROC HTD	NA	1026.88
L1-12105-A-FSGS-002-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/30/2019	1302	5 ROC HTD	NA	969.33
L1-12107-A-FSGS-010-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/30/2019	1225	5 ROC HTD	NA	923.24
L1-12205-A-FSGS-111-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1305	5 ROC HTD	NA	952.09
L1-12104-A-FSGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/1/2019	0920	5 ROC HTD	NA	1013.10
L1-12104-A-FSGS-013-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/1/2019	0924	5 ROC HTD	NA	975.70
L1-12205-A-FSGS-101-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/1/2019	0825	5 ROC HTD	NA	859.10
L1-12109-A-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/17/2019	0922	5 ROC HTD	NA	1013.58
L1-12205-C-FSGS-105-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/24/2019	1308	5 ROC HTD	NA	979.04
L1-12111-A-FSGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/16/2019	0806	5 ROC HTD	NA	1122.70
L1-12205-D-FSGS-111-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/16/2019	1400	5 ROC HTD	NA	974.36
L1-12205-E-FSGS-104-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1306	5 ROC HTD	NA	1087.82
L1-12205-E-QIGS-101-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/11/2019	0900	5 ROC HTD	NA	829.86
L1-12205-D-FSGS-117-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1022	5 ROC HTD	NA	1028.72
L1-12205-E-FSGS-117-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/9/2019	1332	5 ROC HTD	NA	1106.09
L1-12205-A-FSGS-116-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	9/25/2019	1315	5 ROC HTD	NA	1078.92

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SURVEY UNIT 12107
ADDENDUM 1

REVISION 1

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1. EXECUTIVE SUMMARY

Addendum 1 to the FSS Release Record for Survey Unit 12107, "South Half of Fuel & Auxiliary Buildings," has been generated for the ZSRP in accordance with Zion*Solutions* procedure ZS-LT-300-001-005 and satisfies the requirements of Section 5.11 of the ZSRP LTP. This addendum to the Release Record for survey unit 12107 was written to document the results of an FSS performed on subsurface soil in an open excavation that was located within the GPS boundaries of the surface survey unit 12107 prior to backfill to grade. When the FSS was performed, this survey unit was designated as survey unit 12107K.

In the spring of 2018, an area was excavated to expose the remaining foundation of the FHB and Car Shed. This excavation included the west half of survey units 12105, 12106, and 12107. An FSS sample plan (L1-12107K-F) was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, the ZSRP LTP, and guidance from NUREG-1575.

This survey area within the excavation was assigned 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 α and β decision error rates were set at 0.05. Scanning was performed on 100% of the total exposed excavation surface area. No areas of elevated activity were detected during the scans. Seventeen (17) systematic soil samples were acquired from the survey area. When compared to the OpDCGL for subsurface soils, the OpSOF was 0.453, with a mean OpSOF of 0.155. This area was subsequently backfilled with clean fill prior to the demolition of the Containment Buildings.

2. SURVEY UNIT DESCRIPTION

Survey unit 12107K consists of the exposed subsurface soil and remaining concrete foundation of the FHB, west of the Spent Fuel Pool. Figure 1 below shows an overhead picture of the excavation, and the survey unit designated as 12107K.

Figure 1 – Fuel Handling Building Excavation

3. CLASSIFICATION BASIS

Survey unit 12107K was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002.

The area encompassing this survey unit is made up of part of the north half of survey unit 10107 and part of the south half of survey unit 10105 as identified in the HSA. This area was eventually described as survey unit 12107, a Class 1 open land survey unit, and described as "Area Around the South Half of Fuel Handling and Auxiliary Buildings" in Table 2-4 of the LTP. As a conservative measure, the subsurface soil within the survey unit boundaries was also classified as Class 1.

An RE and a C/LT Supervisor performed a visual inspection and walk-down of the survey unit on July 25, 2018, prior to performing FSS. The purpose of the walk-down was to assess the physical condition of the survey unit, evaluate access points and travel paths and identify potentially hazardous conditions. A final classification assessment was performed in accordance with ZS-LT-300-001-002, as part of the survey design for FSS. The assessment confirmed that survey unit 12107K was correctly classified as Class 1.

4. DATA QUALITY OBJECTIVES

The ROC for 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).

The subsurface soil BcDCGLs for the unrestricted release of open land survey units are listed in Table 5-6 of the LTP and are provided in Table 2. The 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 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

The OpDCGLs for the FSS of subsurface soils are listed in Table 5-8 of the LTP and are presented in Table 3.

Table 3 - 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

Instrument DQOs included a verification of the ability of the survey instrument to detect the radiation(s) of interest at the required scan MDC, which for Class 1 open land survey units, is the *a priori* DCGL$_{EMC}$. 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 DQO process determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 would be the ROC in survey unit 12107K. Concentrations for HTD ROC Ni-63 and Sr-90 were inferred using a surrogate approach. Cs-137 is the principle surrogate radionuclide for Sr-90 and Co-60 is the principle surrogate radionuclide for Ni-63. The surrogate ratios are provided in Table 4.

Table 4 - 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 12107K, the surrogate OpDCGLs for Co-60 and Cs-137 were computed based on the maximum ratios from Table 4.

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 BcDCGLs for subsurface soils presented in Table 2 and the maximum ratios from Table 4, the following surrogate calculations for subsurface soils were performed:

Equation 2

$$Surrogate_{BcDCGL\ (Cs-137)} = \frac{1}{\left[\left(\frac{1}{7.75_{(Cs-137)}}\right) + \left(\frac{0.002}{1.66_{(Sr-90)}}\right)\right]} = 7.68\ pCi/g$$

The surrogate BcDCGL for subsurface soils that was used for Cs-137 in this survey area for direct comparison of subsurface soil sample results to demonstrate compliance is 7.68 pCi/g.

Equation 3

$$Surrogate_{BcDCGL\ (Co-60)} = \frac{1}{\left[\left(\frac{1}{3.44_{(Co-60)}}\right) + \left(\frac{180.45}{763.02_{(Ni-63)}}\right)\right]} = 1.90\ pCi/g$$

The surrogate BcDCGL for subsurface soils that was used for Co-60 in this survey unit for direct comparison of subsurface soil sample results to demonstrate compliance is 1.90 pCi/g.

Using the OpDCGLs for subsurface soils presented in Table 3 and the maximum ratios from Table 4, the following surrogate calculations for subsurface soils were performed:

Equation 4

$$Surrogate_{OpDCGL\,(Cs-137)} = \frac{1}{\left[\left(\frac{1}{1.984_{(Cs-137)}}\right) + \left(\frac{0.002}{0.425_{(Sr-90)}}\right)\right]} = 1.97\ pCi/g$$

The surrogate OpDCGL for subsurface soils that was used for Cs-137 in this survey unit for direct comparison of subsurface soil sample results to demonstrate compliance is 1.97 pCi/g.

Equation 5

$$Surrogate_{OpDCGL\,(Co-60)} = \frac{1}{\left[\left(\frac{1}{0.881_{(Co-60)}}\right) + \left(\frac{180.45}{195.333_{(Ni-63)}}\right)\right]} = 0.486\ pCi/g$$

The surrogate OpDCGL for subsurface soils that was used for Co-60 in this survey unit for direct comparison of subsurface soil sample results to demonstrate compliance is 0.486 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 5.

Table 5 - 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 with the following parameters:

- background count rate of 3,000 counts per minute (cpm)
- scan speed of 0.5 m/sec
- distance from detector to surface of 3 inches
- isotopic mix of 90% Cs-137 and 10% Co-60

The calculated MDC_{scan} value was 3.06 pCi/g, which was greater than the calculated Surrogate DCGLs, therefore the scan investigation level was set at the MDC_{scan} of the 2350-1/44-10. The collimator was used during the scan surveys to lower the background count rate.

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

The number of soil samples for FSS was determined in accordance with ZS-LT-300-001-001. The relative shift (Δ/σ) for the survey unit data set is defined as shift (Δ), which is the Upper

Bound of the Gray Region (UBGR), or the DCGL (SOF of 1), minus the Lower Bound of the Gray Region (LBGR) (SOF of 0.5), divided by sigma (σ), which is the standard deviation of the data set used for survey design. The optimal value for Δ/σ should range between one and three. The largest value the Δ/σ can have is three. If the Δ/σ exceeds three, then the value of three will be used for Δ/σ. For this survey design, a conservative estimate of the sample variability of 0.30 was used as the coefficient of variation to calculate Δ/σ.

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

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

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: $A = \frac{A_{SU}}{N} = \frac{607}{17} = 35.71\ m^2$
- From the LTP, Table 5-17, the Area Factors for the next larger area (100 m^2) were used:
  - Cs-137 - 2.59
  - Cs-134 - 1.95
  - Co-60 - 1.37
- The $DCGL_{EMC}$ is the Surrogate Base Case DCGL times the Area Factor:
  - The $DCGL_{EMC}$ for Cs-137 = $2.59 * 7.68 = 19.89\ pCi/g$
  - The $DCGL_{EMC}$ for Cs-134 = $1.95 * 4.44 = 8.66\ pCi/g$
  - The $DCGL_{EMC}$ for Co-60 = $1.37 * 1.90 = 2.60\ pCi/g$
- The calculated MDC_{scan}, 3.06 pCi/g, was greater than the $DCGL_{EMC}$ value for Co-60 calculated above; therefore, the alternate method of determining the number of samples, from the LTP, Section 5.6.4.3, was used:
  1. $Adjusted\ AF = \frac{Actual\ Scan\ MDC}{DCGLw} = \frac{3.06}{1.90} = 1.61$
  2. Use the Adjusted AF to select a new adjusted area, A′, from Table 5-17: 40.5 m^2 (This area was calculated by using logarithmic interpolation based on the Co-60 AF/Area values for 30 m^2 and 100 m^2.)
  3. $n_{emc} = \frac{Asu}{A'} = \frac{607}{40.5} =$ 15 samples

4. Since the number calculated above is less than 17, 17 samples were taken.

The implementation of QC measures as referenced by LTP, Section 5.9 and Zion*Solutions* ZS-LT-01 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) subsurface soil sample (L1-12107K-FQGS-002-SB) was selected randomly for split sample analysis for the FSS of this survey unit.

The locations of the seventeen (17) systematic samples are listed in Table 6. A map of the systematic sample locations is included in Attachment 1.

Table 6 - Systematic Sample Measurement Locations

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L1-12107K-FSGS-001-SB	641772.5140	343623.3845
L1-12107K-FSGS-002-SB	641778.0768	343600.9027
L1-12107K-FSGS-003-SB	641778.0768	343607.3260
L1-12107K-FSGS-004-SB	641778.0768	343613.7494
L1-12107K-FSGS-005-SB	641778.0768	343620.1728
L1-12107K-FSGS-006-SB	641783.6396	343591.2676
L1-12107K-FSGS-007-SB	641783.6396	343597.6910
L1-12107K-FSGS-008-SB	641783.6396	343604.1143
L1-12107K-FSGS-009-SB	641783.6396	343610.5377
L1-12107K-FSGS-010-SB	641783.6396	343616.9611
L1-12107K-FSGS-011-SB	641789.2024	343594.4793
L1-12107K-FSGS-012-SB	641789.2024	343600.9027
L1-12107K-FSGS-013-SB	641789.2024	343607.3260
L1-12107K-FSGS-014-SB	641789.2024	343613.7494
L1-12107K-FSGS-015-SB	641789.2024	343620.1728
L1-12107K-FSGS-016-SB	641794.7653	343597.6910
L1-12107K-FSGS-017-SB	641794.7653	343604.1143

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 4). 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. Thirteen (13) sample, exceeded on OpSOF of 0.1 during the FSS of survey unit 12107:

- L1-12107K-FSGS-001-SB
- L1-12107K-FSGS-002-SB
- L1-12107K-FQGS-002-SB
- L1-12107K-FSGS-004-SB
- L1-12107K-FSGS-005-SB
- L1-12107K-FSGS-006-SB
- L1-12107K-FSGS-008-SB
- L1-12107K-FSGS-010-SB
- L1-12107K-FSGS-013-SB
- L1-12107K-FSGS-014-SB
- L1-12107K-FSGS-015-SB
- L1-12107K-FSGS-016-SB
- L1-12107K-FSGS-017-SB

These samples met the requirement that 10% of the samples collected for the FSS of survey area 12107K be analyzed for HTD ROC. Each sample was sent off-site (Eberline Analytical) for analysis of the HTD ROC as specified in LTP Chapter 5, Section 5.1. Eberline analytical reports are provided in Attachment 8.

Table 7 provides a synopsis of the survey design for survey unit 12107K.

Table 7 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	607 m^2	GPS measurements of area
Number of Subsurface Soil Samples	17 (Systematic)	• $\sigma = 0.30$ • UBGR = SOF of 1 • LBGR = SOF of 0.5 • Type I error = 0.05 • Type II error = 0.05 • $\Delta/\sigma = 1.67$ (MARSSIM Table 5.5)
Grid Spacing	6.4 m	(LTP, Section 5.6.4.5.2)
DCGLs	• Co-60 – 0.881 pCi/g • Cs-134 – 1.137 pCi/g • Cs-137 – 1.9844 pCi/g • Ni-63 – 195.333 pCi/g • Sr-90 – 0.425 pCi/g	Operational DCGLs for Subsurface Soils, (LTP, Table 5-7)
HTD ROC Analysis	A minimum of two (2) soil samples selected for HTD ROC analysis	(LTP, Section 5.1)
Measurement Investigation Level	Operational DCGL	(LTP, Table 5-25)
Scan Survey Area Coverage	100%	(LTP, Table 5-24)
QC	One (1) soil sample selected randomly for split sample analysis	(LTP, Section 5.9)
Number of Subsurface Soil Samples	N/A	(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 L1-12107K-F, which was developed in accordance with ZS-LT-300-001-001. The FSS unit was inspected and controlled in accordance with Zion*Solutions* procedure ZS-LT-300-001-003.

For survey unit 12107K, compliance with the unrestricted release criteria was demonstrated through a combination of scanning with a Ludlum Model 44-10 gamma detector and the sampling of subsurface soil for isotopic analysis.

FSS field activities were conducted under FSS sample plan L1-12107K-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 FSS field activities were performed during normal working hours on July 25, 2018.

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

Gamma scans were performed on 100% of the exposed surface area of the excavation in 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 3 inches of the ground and was moved at a scan speed of approximately 0.5 meters per second. No areas of elevated activity were detected on the scans.

Daily, prior to and following use, each detector was subjected to an Operational Response Check in accordance with Zion*Solutions* procedure ZS-RP-108-004-011. 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 8. The instruments and detectors were verified to be properly calibrated prior to use.

Table 8 - Instruments and Detectors

Instrument/Detector Type	Serial #	Calibration Due Date
Ludlum 2350-1/Ludlum 44-10	304711/PR321902	9/29/2018
Ludlum 2350-1/Ludlum 44-10	304726/PR363452	1/9/2019
Ludlum 2350-1/Ludlum 44-10	304730/PR375273	1/9/2019

In accordance with the survey design, seventeen (17) subsurface soil samples were collected at the designated systematic sample points.

Thirteen (13) samples were selected for HTD radionuclide analysis. One (1) subsurface soil sample (L1-12107K-FQGS-002-SB) was selected randomly for QC sample analysis.

7. SURVEY RESULTS

One hundred percent (100%) of the exposed surface of the excavation in the survey unit was scanned for elevated radiation levels. Thirty-nine (39) 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 9 provides an overview of the FSS scan results. Complete scan results are provided in Attachment 2.

Table 9 - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[(1)] (cpm)	# of Scan Alarms	Investigation Samples
Row 1	3042	3194	None	None
Row 2	3131	3194	None	None
Row 3	3113	3194	None	None
Row 4	3143	3194	None	None
Row 5	3115	3194	None	None
Row 6	3031	3194	None	None
Row 7	3063	3194	None	None
Row 8	2992	3194	None	None
Row 9	2916	3194	None	None
Row 10	2887	3261	None	None
Row 11	3019	3261	None	None
Row 12	2932	3261	None	None
Row 13	2941	3261	None	None
Row 14	2926	3261	None	None
Row 15	2945	3261	None	None

Table 9 (continued) - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[1] (cpm)	# of Scan Alarms	Investigation Samples
Row 16	2768	3261	None	None
Row 17	2872	3261	None	None
Row 18	2978	3261	None	None
Row 19	2991	3096	None	None
Row 20	3068	3096	None	None
Row 21	2998	3096	None	None
Row 22	3006	3096	None	None
Row 23	2934	3096	None	None
Row 24	3049	3096	None	None
Row 25	2800	3096	None	None
Row 26	2900	3096	None	None
Row 27	3063	3096	None	None
Row 28	3042	3096	None	None
Row 29	2918	3261	None	None
Row 30	2907	3261	None	None
Row 31	2794	3261	None	None
Row 32	2796	3261	None	None
Row 33	2890	3261	None	None
Row 34	2902	3261	None	None
Row 35	2909	3261	None	None
Row 36	3064	3261	None	None
Row 37	3135	3261	None	None
Row 38	3067	3261	None	None
Row 39	3206	3261	None	None

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

The seventeen (17) soil samples taken for non-parametric statistical testing were analyzed using the on-site gamma spectroscopy system. Summaries of the sample analysis results are provided in Table 10. The basic statistics for the systematic sample population are summarized in Table 15. The gamma spectroscopy results revealed eight (8) samples with activity levels above the MDC for Cs-137, two (2) samples with activity levels above the MDC for Co-60, and no samples with activity levels above the MDC for Cs-134. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 4. 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. The complete gamma spectroscopy reports are presented in Attachment 7.

Table 10 - Summary of Gamma Spectroscopy Results for Subsurface 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)
L1-12107K-FSGS-001-SB	3.92E-02	2.22E-02	**5.36E-02**	7.07E+00	1.07E-04
L1-12107K-FSGS-002-SB	5.81E-02	6.75E-02	**5.38E-02**	1.05E+01	1.08E-04
L1-12107K-FSGS-003-SB	1.69E-02	0.00E+00	4.95E-02	3.05E+00	9.90E-05
L1-12107K-FSGS-004-SB	4.89E-02	4.84E-02	3.33E-02	8.82E+00	6.66E-05
L1-12107K-FSGS-005-SB	6.68E-02	0.00E+00	**1.01E-01**	1.21E+01	2.02E-04
L1-12107K-FSGS-006-SB	5.05E-02	0.00E+00	9.14E-02	9.11E+00	1.83E-04
L1-12107K-FSGS-007-SB	1.85E-02	3.04E-02	0.00E+00	3.34E+00	0.00E+00
L1-12107K-FSGS-008-SB	7.05E-02	2.67E-02	**5.57E-02**	1.27E+01	1.11E-04
L1-12107K-FSGS-009-SB	2.86E-02	1.47E-02	5.03E-02	5.16E+00	1.01E-04
L1-12107K-FSGS-010-SB	**1.62E-01**	9.64E-03	**2.19E-01**	2.92E+01	4.38E-04
L1-12107K-FSGS-011-SB	2.58E-02	2.04E-02	4.06E-02	4.65E+00	8.12E-05
L1-12107K-FSGS-012-SB	2.94E-03	6.19E-02	2.57E-02	5.30E-01	5.14E-05
L1-12107K-FSGS-013-SB	7.28E-02	0.00E+00	**6.45E-02**	1.31E+01	1.29E-04
L1-12107K-FSGS-014-SB	**3.20E-02**	1.68E-02	**8.30E-02**	5.77E+00	1.66E-04
L1-12107K-FSGS-015-SB	3.78E-02	0.00E+00	**1.60E-01**	6.82E+00	3.20E-04
L1-12107K-FSGS-016-SB	5.05E-02	0.00E+00	3.08E-02	9.11E+00	6.16E-05
L1-12107K-FSGS-017-SB	6.05E-02	3.62E-02	4.49E-02	1.09E+01	8.98E-05

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

The off-site laboratory, Eberline Analytical, processed the thirteen (13) samples selected for HTD ROC analysis. Only HTD radionuclides included as ROC (Ni-63 and Sr-90 for soils) were included in the analysis. All analyses met the required MDC. One sample, L1-12107K-FSGS-010-SB-A, had activity that was positively detected at a concentration greater than MDC for both a surrogate and HTD nuclide, for Co-60 and Ni-63. This sample had a Ni-63/Co-60 ratio of 11.82. The off-site analysis results are provided in Table 11.

Table 11 - Off-Site Analysis Results

Sample # L1-12107K-FSGS-001-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	7.43E-02	4.16E-02	8.04E-02	No
Cs-134	-4.94E-03	1.67E-02	4.07E-02	No
Cs-137	1.42E-02	4.07E-02	6.49E-02	No
Ni-63	2.89E+00	1.38E+00	2.26E+00	Yes
Sr-90[(3)]	4.11E-02	3.67E-02	8.88E-02	No

Table 11 (continued) - Off-Site Analysis Results

Sample # L1-12107K-FSGS-002-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	7.04E-03	7.08E-02	1.01E-01	No
Cs-134	-1.41E-01	9.20E-02	9.18E-02	No
Cs-137	2.75E-02	6.17E-02	9.34E-02	No
Ni-63	-4.43E-01	1.33E+00	2.29E+00	No
Sr-90[3]	2.46E-02	3.14E-02	8.05E-02	No

Sample # L1-12107K-FQGS-002-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	3.82E-03	3.60E-02	4.76E-02	No
Cs-134	1.50E-03	1.43E-02	4.50E-02	No
Cs-137	3.52E-02	2.65E-02	4.16E-02	No
Ni-63	1.95E-01	1.48E+00	2.53E+00	No
Sr-90[3]	3.65E-02	3.82E-02	9.31E-02	No

Sample # L1-12107K-FSGS-004-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	4.55E-02	6.69E-02	1.27E-01	No
Cs-134	-9.93E-03	2.90E-02	9.03E-02	No
Cs-137	5.15E-02	5.14E-02	9.20E-02	No
Ni-63	-7.26E-01	1.36E+00	2.35E+00	No
Sr-90[3]	6.69E-02	3.62E-02	8.42E-02	No

Sample # L1-12107K-FSGS-005-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	4.20E-02	9.32E-02	1.47E-01	No
Cs-134	-2.05E-02	3.94E-02	8.95E-02	No
Cs-137	2.10E-01	8.04E-02	2.42E-01	No
Ni-63	-4.98E-01	1.50E+00	2.58E+00	No
Sr-90[3]	8.98E-03	3.23E-02	8.52E-02	No

Table 11 (continued) - Off-Site Analysis Results

Sample # L1-12107K-FSGS-006-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	-2.90E-02	5.13E-02	5.55E-02	No
Cs-134	1.90E-02	2.16E-02	5.61E-02	No
Cs-137	9.56E-02	4.23E-02	1.01E-01	No
Ni-63	1.04E+00	1.46E+00	2.45E+00	No
Sr-90(3)	6.38E-02	3.83E-02	8.96E-02	No

Sample # L1-12107K-FSGS-008-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	1.03E-02	4.45E-02	6.60E-02	No
Cs-134	-9.13E-03	1.64E-02	3.94E-02	No
Cs-137	5.67E-02	4.14E-02	6.55E-02	No
Ni-63	-7.10E-01	1.33E+00	2.30E+00	No
Sr-90(3)	4.89E-02	3.37E-02	8.34E-02	No

Sample # L1-12107K-FSGS-010-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	3.28E-01	7.10E-02	6.94E-02	Yes
Cs-134	-4.53E-03	2.39E-02	7.75E-02	No
Cs-137	2.40E-01	8.77E-02	1.29E-01	Yes
Ni-63	3.88E+00	1.48E+00	2.39E+00	Yes
Sr-90(3)	6.89E-02	3.40E-02	8.02E-02	No

Sample # L1-12107K-FSGS-013-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	2.77E-02	5.80E-02	1.03E-01	No
Cs-134	-1.44E-03	3.35E-02	9.27E-02	No
Cs-137	1.52E-01	9.61E-02	1.52E-01	No
Ni-63	-2.60E-01	1.30E+00	2.24E+00	No
Sr-90(3)	2.12E-02	3.05E-02	7.54E-02	No

Table 11 (continued) - Off-Site Analysis Results

Sample # L1-12107K-FSGS-014-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	1.21E-01	4.48E-02	8.32E-02	Yes
Cs-134	-3.78E-03	1.26E-02	4.21E-02	No
Cs-137	1.23E-01	3.82E-02	8.89E-02	Yes
Ni-63	4.16E-01	1.27E+00	2.15E+00	No
Sr-90(3)	6.13E-02	3.54E-02	8.52E-02	No

Sample # L1-12107K-FSGS-015-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	5.11E-02	6.64E-02	1.10E-01	No
Cs-134	6.87E-04	1.44E-02	7.25E-02	No
Cs-137	1.81E-01	5.67E-02	1.29E-01	Yes
Ni-63	-8.64E-01	1.29E+00	2.24E+00	No
Sr-90(3)	4.22E-02	3.62E-02	9.07E-02	No

Sample # L1-12107K-FSGS-016-SB-A(2)

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	1.33E-02	3.42E-02	5.68E-02	No
Cs-134	-2.06E-01	7.43E-02	4.89E-02	No
Cs-137	1.97E-02	3.26E-02	5.37E-02	No
Ni-63	1.83E-01	1.39E+00	2.37E+00	No
Sr-90(3)	6.30E-02	4.00E-02	9.77E-02	Yes

(1) An additional aliquot of this sample, designated as L1-12107K-FSGS-016-SB-C, from the original sample was sent to Eberline Laboratories for reanalysis for Sr-90. The results for Sr-90 was less than MDC with a reported concentration of 5.60 E-02 pCi/g, a MDC of 6.40 E-02 pCi/g and an uncertainty of 3.29 E-02 pCi/g.

(2) Five (5) additional samples were taken at the same depth of the original sample (L1-12107K-FSGS-018-SB taken at the GPS coordinates of L1-12107K-FSGS-016-SB, and L1-12107K-FSGS-019-SB through L1-12107K-FSGS-022-SB taken 1-meter east, north, west, and south respectively. The results of the analysis of the 5 investigation samples are provided at the end of Table 14.

Table 11 (continued) - Off-Site Analysis Results

Sample # L1-12107K-FSGS-017-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	5.34E-02	5.81E-02	8.99E-02	No
Cs-134	-9.52E-02	4.36E-02	4.23E-02	No
Cs-137	3.31E-02	4.05E-02	6.88E-02	No
Ni-63	0.00E+00	1.27E+00	2.16E+00	No
Sr-90[3]	7.36E-02	3.44E-02	7.84E-02	No

Sample # L1-12107K-FSGS-018-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	-3.71E-02	8.55E-02	8.71E-02	No
Cs-134	-1.48E-02	1.91E-02	8.41E-02	No
Cs-137	2.41E-02	5.87E-02	9.41E-02	No
Ni-63	1.55E+00	1.88E+00	3.17E+00	No
Sr-90	1.80E-02	3.81E-02	7.94E-02	No

Sample # L1-12107K-FSGS-019-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	4.89E-02	6.45E-02	7.38E-02	No
Cs-134	1.88E-03	9.24E-02	1.02E-01	No
Cs-137	3.23E-04	6.08E-02	8.43E-02	No
Ni-63	1.77E-01	1.89E+00	3.25E+00	No
Sr-90	1.60E-02	2.65E-02	5.50E-02	No

Sample # L1-12107K-FSGS-020-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	1.64E-02	5.17E-02	7.61E-02	No
Cs-134	2.40E-03	2.42E-02	7.34E-02	No
Cs-137	5.73E-02	4.87E-02	8.32E-02	No
Ni-63	3.19E+00	1.93E+00	3.17E+00	Yes
Sr-90	1.60E-02	2.62E-02	5.44E-02	No

Table 11 (continued) - Off-Site Analysis Results

Sample # L1-12107K-FSGS-021-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	-2.97E-02	7.14E-02	8.61E-02	No
Cs-134	1.31E-02	2.42E-02	1.03E-01	No
Cs-137	4.52E-02	6.21E-02	9.36E-02	No
Ni-63	5.56E-01	1.71E+00	2.93E+00	No
Sr-90	1.65E-02	3.38E-02	7.04E-02	No

Sample # L1-12107K-FSGS-022-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	3.05E-02	6.08E-02	6.52E-02	No
Cs-134	-3.51E-03	2.66E-02	7.77E-02	No
Cs-137	-8.03E-03	1.86E-02	7.32E-02	No
Ni-63	6.81E-01	1.84E+00	3.13E+00	No
Sr-90	1.48E-02	2.82E-02	5.86E-02	No

(3) Sr-90 recounted March 2020 to achieve adequate MDC.

The implementation of survey specific QC measures included the collection of one (1) systematic sample (L1-12107K-FQGS-002-SB) 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 12) indicate that concentrations for Cs-137, Co-60 and Cs-134 were less than MDC in the sample. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 4.

Table 12 - Summary of Gamma Spectroscopy Results for QC Subsurface 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)
L1-12107K-FQGS-002-SB	4.08E-02	1.71E-02	4.37E-03	7.36E+00	8.74E-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.

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 subsurface soils for survey area 12107K are provided in Table 13. The results of the unity rule calculations for the ROC for the QC sample are provided in Table 14.

Table 13 - Sum of Fractions for Systematic Subsurface Soil Samples compared to the OpDCGLs

MEASUREMENT ID	Fraction of the OpDCGLs for Subsurface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12107K-FSGS-001-SB	4.45E-02	1.95E-02	2.70E-02	3.62E-02	2.52E-04	0.127
L1-12107K-FSGS-002-SB	6.59E-02	5.94E-02	2.71E-02	5.37E-02	2.53E-04	0.206
L1-12107K-FSGS-003-SB	1.92E-02	0.00E+00	2.49E-02	1.56E-02	2.33E-04	0.060
L1-12107K-FSGS-004-SB	5.55E-02	4.26E-02	1.68E-02	4.52E-02	1.57E-04	0.160
L1-12107K-FSGS-005-SB	7.58E-02	0.00E+00	5.09E-02	6.17E-02	4.75E-04	0.189
L1-12107K-FSGS-006-SB	5.73E-02	0.00E+00	4.61E-02	4.66E-02	4.30E-04	0.150
L1-12107K-FSGS-007-SB	2.10E-02	2.67E-02	0.00E+00	1.71E-02	0.00E+00	0.065
L1-12107K-FSGS-008-SB	8.00E-02	2.35E-02	2.81E-02	6.51E-02	2.62E-04	0.197
L1-12107K-FSGS-009-SB	3.25E-02	1.29E-02	2.54E-02	2.64E-02	2.37E-04	0.097
L1-12107K-FSGS-010-SB	1.84E-01	8.48E-03	1.10E-01	1.50E-01	1.03E-03	0.453
L1-12107K-FSGS-011-SB	2.93E-02	1.79E-02	2.05E-02	2.38E-02	1.91E-04	0.092
L1-12107K-FSGS-012-SB	3.34E-03	5.44E-02	1.30E-02	2.72E-03	1.21E-04	0.074
L1-12107K-FSGS-013-SB	8.26E-02	0.00E+00	3.25E-02	6.72E-02	3.04E-04	0.183
L1-12107K-FSGS-014-SB	3.63E-02	1.48E-02	4.18E-02	2.96E-02	3.91E-04	0.123
L1-12107K-FSGS-015-SB	4.29E-02	0.00E+00	8.06E-02	3.49E-02	7.53E-04	0.159
L1-12107K-FSGS-016-SB	5.73E-02	0.00E+00	1.55E-02	4.66E-02	1.45E-04	0.120
L1-12107K-FSGS-017-SB	6.87E-02	3.18E-02	2.26E-02	5.59E-02	2.11E-04	0.179

Systematic Measurements

Number of Systematic Measurements =	17
# of Systematic Measurements with OpSOF $\geq$ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	12
Max Individual Systematic Measurement OpSOF =	0.453
Mean Systematic Measurement OpSOF =	0.155

Table 14 - Sum of Fractions for QC Soil Sample compared to the OpDCGLs

MEASUREMENT ID	Fraction of the OpDCGLs for Subsurface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12107K-FQGS-002-SB	4.63E-02	1.50E-02	2.20E-03	3.77E-02	2.06E-05	0.101

Table 15 - Basic Statistical Properties of Systematic Sample Population

ROC	Mean (pCi/g)	Median (pCi/g)	Max (pCi/g)	Min (pCi/g)	Std. Dev. (pCi/g)
Co-60	4.95E-02	4.89E-02	1.62E-01	2.94E-03	0.035
Cs-134	2.09E-02	1.68E-02	6.75E-02	0.00E+00	0.022
Cs-137	6.81E-02	5.36E-02	2.19E-01	0.00E+00	0.053
Ni-63	8.94E+00	8.82E+00	2.92E+01	5.30E-01	6.359
Sr-90	1.36E-04	1.07E-04	4.38E-04	0.00E+00	0.000

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

8. QUALITY CONTROL

The on-site laboratory processed one (1) split sample, L1-12107K-FQGS-002-SB, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in ZS-LT-01. For sample #34, the standard and comparison samples did not both have a positive result for a gamma-emitting ROC, therefore K-40 was used in the QC comparisons. There was acceptable agreement between standard and comparison results. Refer to Attachment 5 for data and QC analysis results.

9. INVESTIGATIONS AND RESULTS

No investigations were performed in survey area 12107K.

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 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 area meets the unrestricted release criteria with adequate power as required by the DQOs.

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

13. ANOMALIES

An anomaly was identified during the review of the data for the FSS of the subsurface survey unit 12107K. The results of the HTD analyses of sample L1-12107K-FSGS-016-SB performed by Eberline Laboratories showed a positive result for Sr-90. To investigate this activity, an additional aliquot from the original sample was sent to Eberline Laboratories for re-analysis of Sr-90. This sample was designated as L1-12107K-FSGS-016-SB-C. In addition, five (5) subsurface samples were obtained at the depth of the original sample: L1-12107K-FSGS-018-SB was taken at the GPS coordinates of the original sample, L1-12107K-FSGS-016-SB, and L1-12107K-FSGS-019-SB through L1-12107K-FSGS-022-SB were taken 1-meter east, north, west, and south respectively from the location of L1-12107K-FSGS-016-SB. The Sr-90 results for all of the samples was less than MDC (with the highest MDC of the six samples being 7.94E-02 pCi/g). For the reanalysis of the original sample aliquot, the results for Sr-90 was less than MDC with a reported concentration of 5.60 E-02 pCi/g, a MDC of 6.40 E-02 pCi/g and an uncertainty of 3.29 E-02 pCi/g. The results of the investigation samples are presented in Table 11.

14. CONCLUSION

Survey unit 12107K 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 area.

All identified ROC were used for statistical testing to determine the adequacy of the survey area 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 area 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 conclusion is that survey unit 12107K is acceptable for unrestricted release. Once demonstration with the unrestricted release criteria was demonstrated, the open excavation was backfilled with clean fill to the 591-foot elevation. FSS was then performed on the final end-state surface of Class 1 open land survey unit 12107.

15. 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 MAPS

Survey Area 12107K Final Status Survey Boundaries and Systematic Sample Points

Survey Area 12107K Final Status Survey Scan Rows

ATTACHMENT 2
SCAN DATA

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR321902	304711	12107K	SG001	7/25/2018 10:15	2875	2644	3194	No
44-10	PR321902	304711	12107K	SG001	7/25/2018 10:18	3042	2644	3194	No
44-10	PR321902	304711	12107K	SG001	7/25/2018 10:21	3014	2644	3194	No
44-10	PR321902	304711	12107K	SG002	7/25/2018 10:26	2783	2644	3194	No
44-10	PR321902	304711	12107K	SG002	7/25/2018 10:29	3131	2644	3194	No
44-10	PR321902	304711	12107K	SG002	7/25/2018 10:32	2888	2644	3194	No
44-10	PR321902	304711	12107K	SG003	7/25/2018 10:37	3092	2644	3194	No
44-10	PR321902	304711	12107K	SG003	7/25/2018 10:40	3113	2644	3194	No
44-10	PR321902	304711	12107K	SG003	7/25/2018 10:47	2856	2644	3194	No
44-10	PR321902	304711	12107K	SG004	7/25/2018 12:29	2822	2644	3194	No
44-10	PR321902	304711	12107K	SG004	7/25/2018 12:33	2903	2644	3194	No
44-10	PR321902	304711	12107K	SG004	7/25/2018 12:37	3143	2644	3194	No
44-10	PR321902	304711	12107K	SG005	7/25/2018 12:43	3147	2644	3194	No
44-10	PR321902	304711	12107K	SG005	7/25/2018 12:47	3103	2644	3194	No
44-10	PR321902	304711	12107K	SG005	7/25/2018 12:50	3115	2644	3194	No
44-10	PR321902	304711	12107K	SG006	7/25/2018 12:54	3031	2644	3194	No
44-10	PR321902	304711	12107K	SG006	7/25/2018 12:57	2948	2644	3194	No
44-10	PR321902	304711	12107K	SG006	7/25/2018 13:02	2706	2644	3194	No
44-10	PR321902	304711	12107K	SG007	7/25/2018 13:06	2944	2644	3194	No
44-10	PR321902	304711	12107K	SG007	7/25/2018 13:10	3063	2644	3194	No
44-10	PR321902	304711	12107K	SG007	7/25/2018 13:13	2981	2644	3194	No
44-10	PR321902	304711	12107K	SG008	7/25/2018 13:18	2992	2644	3194	No
44-10	PR321902	304711	12107K	SG008	7/25/2018 13:21	2974	2644	3194	No
44-10	PR321902	304711	12107K	SG008	7/25/2018 13:25	2881	2644	3194	No
44-10	PR321902	304711	12107K	SG009	7/25/2018 13:31	2834	2644	3194	No
44-10	PR321902	304711	12107K	SG009	7/25/2018 13:35	2768	2644	3194	No
44-10	PR321902	304711	12107K	SG009	7/25/2018 13:39	2916	2644	3194	No
44-10	PR363452	304726	12107K	SG029	7/25/2018 10:09	2918	2705	3261	No
44-10	PR363452	304726	12107K	SG030	7/25/2018 10:14	2907	2705	3261	No
44-10	PR363452	304726	12107K	SG031	7/25/2018 10:17	2794	2705	3261	No
44-10	PR363452	304726	12107K	SG032	7/25/2018 10:23	2796	2705	3261	No
44-10	PR363452	304726	12107K	SG033	7/25/2018 10:26	2890	2705	3261	No
44-10	PR363452	304726	12107K	SG034	7/25/2018 10:32	2902	2705	3261	No
44-10	PR363452	304726	12107K	SG035	7/25/2018 10:35	2909	2705	3261	No
44-10	PR363452	304726	12107K	SG036	7/25/2018 10:39	3064	2705	3261	No
44-10	PR363452	304726	12107K	SG010	7/25/2018 12:28	2738	2705	3261	No
44-10	PR363452	304726	12107K	SG010	7/25/2018 12:31	2783	2705	3261	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR363452	304726	12107K	SG010	7/25/2018 12:35	2887	2705	3261	No
44-10	PR363452	304726	12107K	SG011	7/25/2018 12:38	2910	2705	3261	No
44-10	PR363452	304726	12107K	SG011	7/25/2018 12:43	2913	2705	3261	No
44-10	PR363452	304726	12107K	SG011	7/25/2018 12:46	3019	2705	3261	No
44-10	PR363452	304726	12107K	SG012	7/25/2018 12:50	2799	2705	3261	No
44-10	PR363452	304726	12107K	SG012	7/25/2018 12:53	2776	2705	3261	No
44-10	PR363452	304726	12107K	SG012	7/25/2018 12:57	2932	2705	3261	No
44-10	PR363452	304726	12107K	SG013	7/25/2018 13:02	2871	2705	3261	No
44-10	PR363452	304726	12107K	SG013	7/25/2018 13:06	2860	2705	3261	No
44-10	PR363452	304726	12107K	SG013	7/25/2018 13:09	2941	2705	3261	No
44-10	PR363452	304726	12107K	SG014	7/25/2018 13:13	2877	2705	3261	No
44-10	PR363452	304726	12107K	SG014	7/25/2018 13:16	2900	2705	3261	No
44-10	PR363452	304726	12107K	SG014	7/25/2018 13:19	2926	2705	3261	No
44-10	PR363452	304726	12107K	SG015	7/25/2018 13:54	2820	2705	3261	No
44-10	PR363452	304726	12107K	SG015	7/25/2018 13:57	2945	2705	3261	No
44-10	PR363452	304726	12107K	SG015	7/25/2018 14:00	2810	2705	3261	No
44-10	PR363452	304726	12107K	SG037	7/25/2018 14:10	3135	2705	3261	No
44-10	PR363452	304726	12107K	SG038	7/25/2018 14:13	3067	2705	3261	No
44-10	PR363452	304726	12107K	SG039	7/25/2018 14:17	3206	2705	3261	No
44-10	PR363452	304726	12107K	SG016	7/25/2018 14:23	2678	2705	3261	No
44-10	PR363452	304726	12107K	SG016	7/25/2018 14:27	2768	2705	3261	No
44-10	PR363452	304726	12107K	SG016	7/25/2018 14:31	2756	2705	3261	No
44-10	PR363452	304726	12107K	SG017	7/25/2018 14:35	2799	2705	3261	No
44-10	PR363452	304726	12107K	SG017	7/25/2018 14:38	2872	2705	3261	No
44-10	PR363452	304726	12107K	SG017	7/25/2018 14:41	2705	2705	3261	No
44-10	PR363452	304726	12107K	SG018	7/25/2018 14:45	2978	2705	3261	No
44-10	PR363452	304726	12107K	SG018	7/25/2018 14:49	2823	2705	3261	No
44-10	PR363452	304726	12107K	SG018	7/25/2018 14:52	2795	2705	3261	No
44-10	PR321896	304730	12107K	SG019	7/25/2018 10:16	2923	2556	3096	No
44-10	PR321896	304730	12107K	SG019	7/25/2018 10:21	2991	2556	3096	No
44-10	PR321896	304730	12107K	SG019	7/25/2018 10:25	2947	2556	3096	No
44-10	PR321896	304730	12107K	SG020	7/25/2018 10:34	3068	2556	3096	No
44-10	PR321896	304730	12107K	SG020	7/25/2018 10:39	3019	2556	3096	No
44-10	PR321896	304730	12107K	SG020	7/25/2018 10:43	3050	2556	3096	No
44-10	PR321896	304730	12107K	SG021	7/25/2018 12:33	2998	2556	3096	No
44-10	PR321896	304730	12107K	SG021	7/25/2018 12:37	2935	2556	3096	No
44-10	PR321896	304730	12107K	SG021	7/25/2018 12:41	2922	2556	3096	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	PR321896	304730	12107K	SG022	7/25/2018 12:47	3006	2556	3096	No
44-10	PR321896	304730	12107K	SG022	7/25/2018 12:50	2953	2556	3096	No
44-10	PR321896	304730	12107K	SG022	7/25/2018 12:54	2813	2556	3096	No
44-10	PR321896	304730	12107K	SG023	7/25/2018 13:00	2764	2556	3096	No
44-10	PR321896	304730	12107K	SG023	7/25/2018 13:04	2934	2556	3096	No
44-10	PR321896	304730	12107K	SG023	7/25/2018 13:07	2787	2556	3096	No
44-10	PR321896	304730	12107K	SG024	7/25/2018 13:12	3028	2556	3096	No
44-10	PR321896	304730	12107K	SG024	7/25/2018 13:15	3049	2556	3096	No
44-10	PR321896	304730	12107K	SG024	7/25/2018 13:18	2951	2556	3096	No
44-10	PR321896	304730	12107K	SG025	7/25/2018 14:00	2800	2556	3096	No
44-10	PR321896	304730	12107K	SG026	7/25/2018 14:05	2900	2556	3096	No
44-10	PR321896	304730	12107K	SG027	7/25/2018 14:09	3063	2556	3096	No
44-10	PR321896	304730	12107K	SG028	7/25/2018 14:14	3042	2556	3096	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. 12107K **Description:** Subsurface Soil - FHB/Car Shed Excavation
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	4.45E-02	1.95E-02	2.70E-02	3.62E-02	2.52E-04	SOF	0.127	0.873	+
2	6.59E-02	5.94E-02	2.71E-02	5.37E-02	2.53E-04	SOF	0.206	0.794	+
3	1.92E-02	0.00E+00	2.49E-02	1.56E-02	2.33E-04	SOF	0.060	0.940	+
4	5.55E-02	4.26E-02	1.68E-02	4.52E-02	1.57E-04	SOF	0.160	0.840	+
5	7.58E-02	0.00E+00	5.09E-02	6.17E-02	4.75E-04	SOF	0.189	0.811	+
6	5.73E-02	0.00E+00	4.61E-02	4.66E-02	4.30E-04	SOF	0.150	0.850	+
7	2.10E-02	2.67E-02	0.00E+00	1.71E-02	0.00E+00	SOF	0.065	0.935	+
8	8.00E-02	2.35E-02	2.81E-02	6.51E-02	2.62E-04	SOF	0.197	0.803	+
9	3.25E-02	1.29E-02	2.54E-02	2.64E-02	2.37E-04	SOF	0.097	0.903	+
10	1.84E-01	8.48E-03	1.10E-01	1.50E-01	1.03E-03	SOF	0.453	0.547	+
11	2.93E-02	1.79E-02	2.05E-02	2.38E-02	1.91E-04	SOF	0.092	0.908	+
12	3.34E-03	5.44E-02	1.30E-02	2.72E-03	1.21E-04	SOF	0.074	0.926	+
13	8.26E-02	0.00E+00	3.25E-02	6.72E-02	3.04E-04	SOF	0.183	0.817	+
14	3.63E-02	1.48E-02	4.18E-02	2.96E-02	3.91E-04	SOF	0.123	0.877	+
15	4.29E-02	0.00E+00	8.06E-02	3.49E-02	7.53E-04	SOF	0.159	0.841	+
16	5.73E-02	0.00E+00	1.55E-02	4.66E-02	1.45E-04	SOF	0.120	0.880	+
17	6.87E-02	3.18E-02	2.26E-02	5.59E-02	2.11E-04	SOF	0.179	0.821	+

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] 7/30/18
(Print Name) (Signature) (Date)

Peer Reviewed By (RE): R.J. Mandis / [signature] 9-28-18
(Print Name) (Signature) (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #: 12100	Survey Unit # 12107K	Survey Unit Name: SFB/Car Shed Excavation
Sample Plan#: L112107KF		

Sample Description: Comparison of split samples collected from surface soil samples from Systematic Location #2 and analyzed using gamma spectroscopy by on-site HpGe System. The sample/QC sample was L1-112107K-FSGS-002SB/L1-112107K-FQGS-002SB.

	STANDARD				COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
K-40	7.79E+00	5.36E-01	14.53	0.6 - 1.66	8.89E+00	6.19E-01	0.88	Yes

Comments/Corrective Actions: The sample pair did not both have positive results for a ROC, therefore a comparison was made of the K-40 for the samples. The K-40 comparisons passed the QC check.

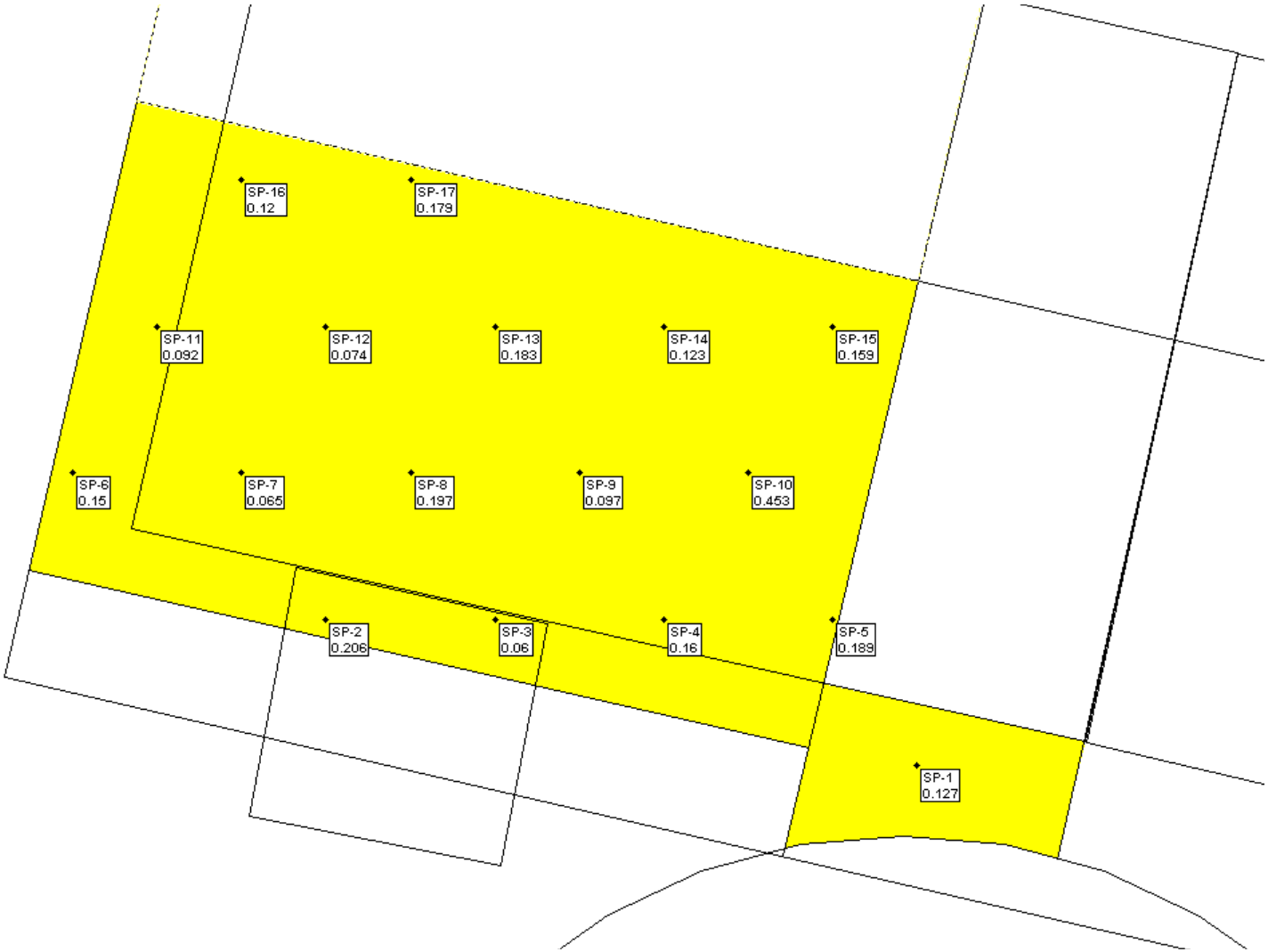
Table is provided to show acceptance criteria used to assess split samples.

Resolution	Agreement Range
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: J. Graham	Date: 7/30/18	Reveiwed by: R. Mandic / JMack	Date: 9-28-18

ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot

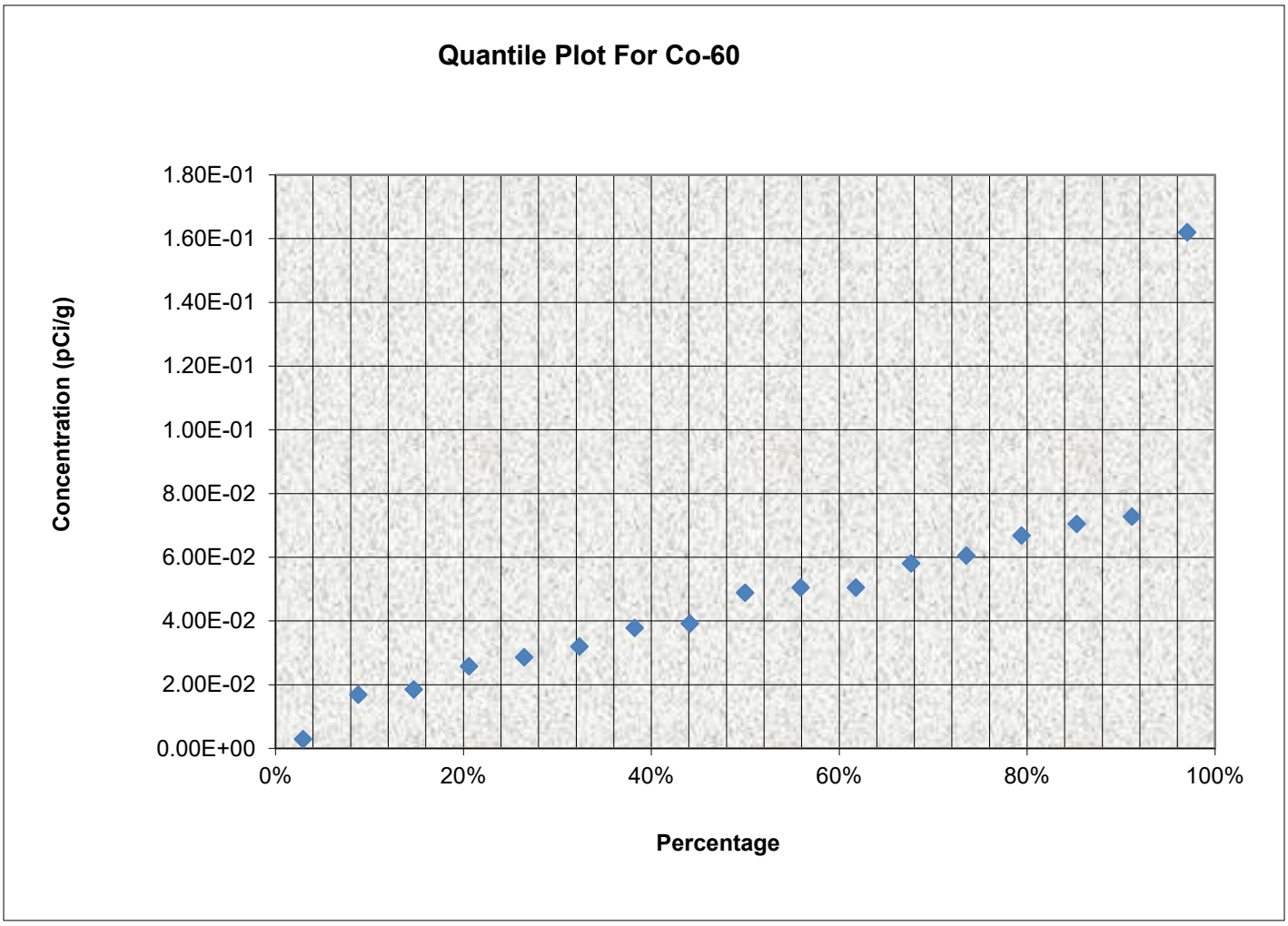


QUANTILE PLOT FOR Co-60

Survey Unit: 12107K

Survey Unit Name: Subsurface Soil - FHB/Car Shed Excavation

Mean: 4.95E-02 pCi/g

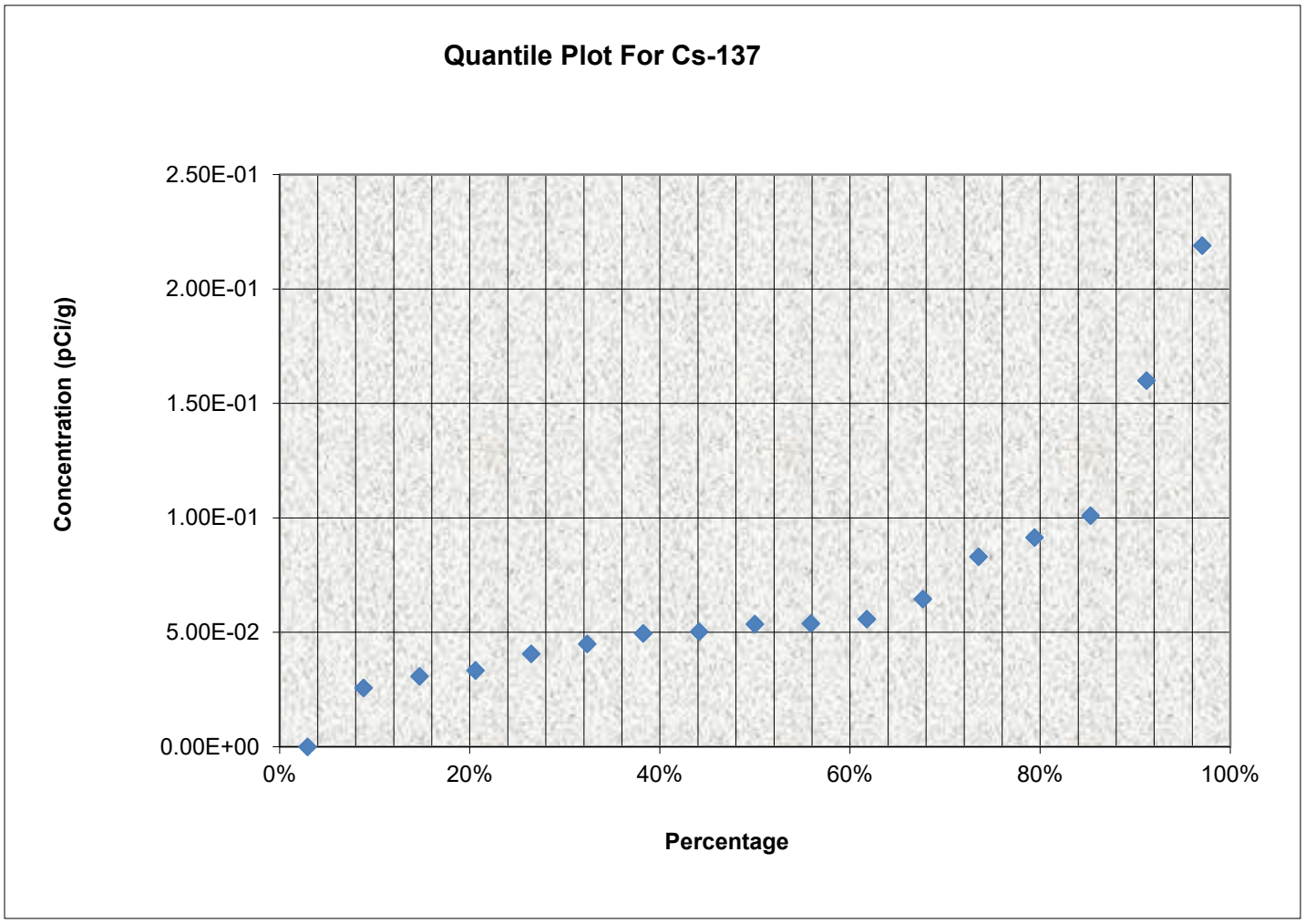


QUANTILE PLOT FOR Cs-137

Survey Unit: 12107K

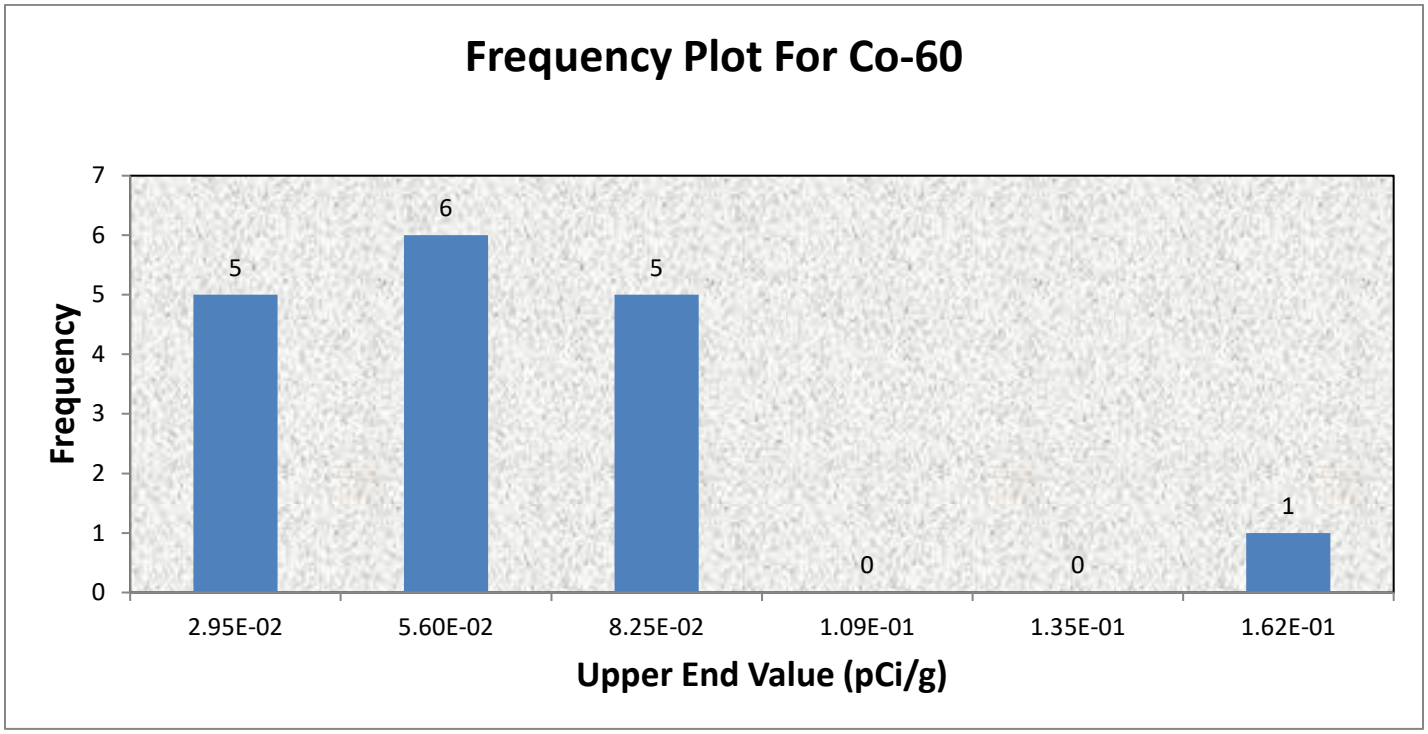
Survey Unit Name: Subsurface Soil - FHB/Car Shed Excavation

Mean: 6.81E-02 pCi/g



HISTOGRAM FOR Co-60

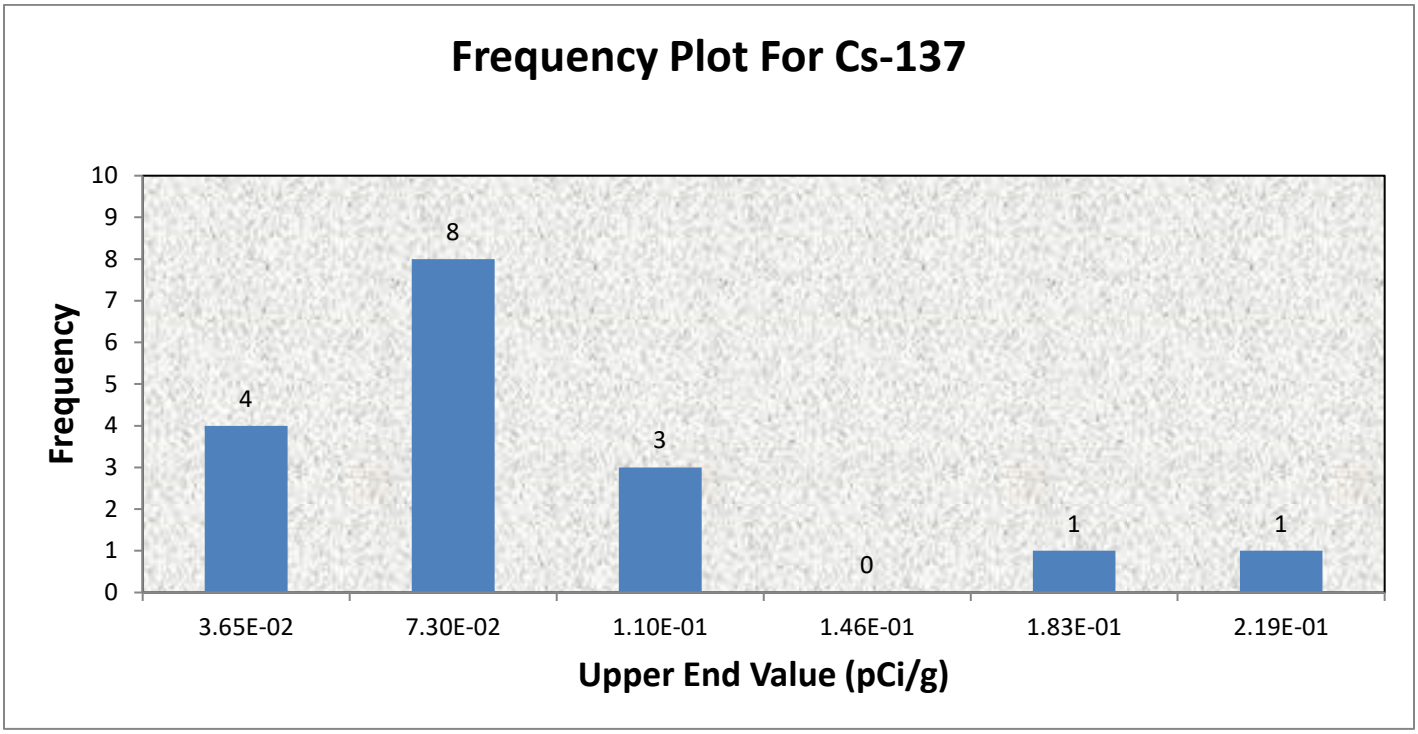
Survey Unit:	12107K	
Survey Unit Name:	Subsurface Soil - FHB/Car Shed Excavation	
Mean:	4.95E-02	pCi/g
Median:	4.89E-02	pCi/g
ST DEV:	0.035	
Skew:	2.029	



Upper Value	Observation Frequency	Observation %
2.95E-02	5	29%
5.60E-02	6	35%
8.25E-02	5	29%
1.09E-01	0	0%
1.35E-01	0	0%
1.62E-01	1	6%
TOTAL	17	100%

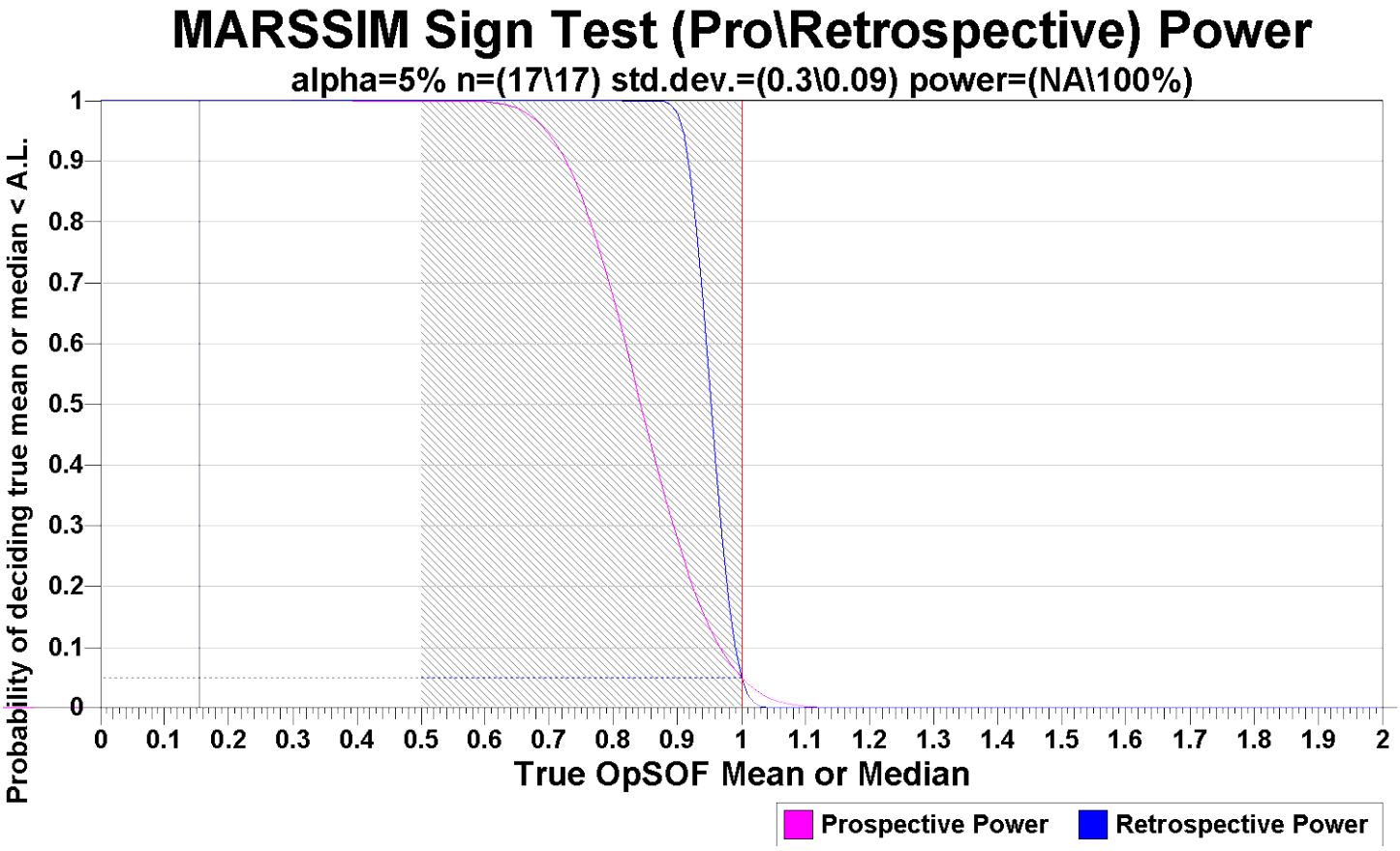
HISTOGRAM FOR Cs-137

Survey Unit:	12107K	
Survey Unit Name:	Subsurface Soil - FHB/Car Shed Excavation	
Mean:	6.81E-02	pCi/g
Median:	5.36E-02	pCi/g
ST DEV:	0.053	
Skew:	1.792	



Upper Value	Observation Frequency	Observation %
3.65E-02	4	24%
7.30E-02	8	47%
1.10E-01	3	18%
1.46E-01	0	0%
1.83E-01	1	6%
2.19E-01	1	6%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Area 12107K



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 26-Jul-18-10001
L1-12107K-FSGS-001SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10001
Sample Description	: L1-12107K-FSGS-001SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.591E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:47:00PM
Acquisition Started	: 7/26/2018 8:35:29AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 8/9/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48719
Fill Height	: 1591.40 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 8:50:32AM

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

DATA VERIFIED 7/26/18 1200
T Graham

Analysis Report for 26-Jul-18-10001

L1-12107K-FSGS-001SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.69	474 -	481	477.57	1.01E+02	19.65	1.31E+02	1.05
2	295.12	585 -	594	590.30	8.39E+01	13.98	4.91E+01	1.28
3	352.00	699 -	708	703.95	1.17E+02	13.57	2.96E+01	1.10
4	583.23	1160 -	1171	1166.06	5.49E+01	10.40	2.11E+01	1.17
5	609.23	1214 -	1223	1218.03	9.53E+01	11.42	1.57E+01	1.69
6	661.53	1318 -	1328	1322.60	3.86E+01	10.14	2.64E+01	0.62
7	1460.73	2915 -	2927	2921.52	4.58E+02	21.78	6.41E+00	1.87

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.51E+00	5.48E-01
Cs-137	0.99	661.66	*	85.10	5.36E-02	1.44E-02
Tl-208	1.00	583.19	*	85.00	7.01E-02	1.39E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.40E-01	2.96E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.34E-01	3.14E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 26-Jul-18-10001

L1-12107K-FSGS-001SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	3.12E-01	5.76E-02
		351.93	*	35.60	2.55E-01	3.59E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	8.51E+00	5.48E-01	
	Cs-137	0.998	5.36E-02	1.44E-02	
	Tl-208	1.000	7.01E-02	1.39E-02	
X	Bi-211	0.870			
	Pb-212	0.999	1.40E-01	2.96E-02	
	Bi-214	0.999	2.34E-01	3.14E-02	
	Pb-214	0.999	2.71E-01	3.05E-02	

Analysis Report for 26-Jul-18-10001

L1-12107K-FSGS-001SB

? = 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 26-Jul-18-10001

L1-12107K-FSGS-001SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 8:50:32AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.01E-02	4.76E-02	4.76E-02
	BE-7	477.60		10.44	4.38E-02	3.13E-01	3.13E-01
+	K-40	1460.82	*	10.66	8.51E+00	3.12E-01	3.12E-01
	Co-60	1173.23		99.85	3.92E-02	5.56E-02	7.15E-02
		1332.49		99.98	1.98E-02		5.56E-02
	Nb-94	702.65		99.81	-2.88E-03	3.69E-02	3.69E-02
		871.09		99.89	-4.89E-03		3.86E-02
	Ag-108m	79.13		6.60	6.30E-01	3.24E-02	1.15E+00
		433.94		90.50	-8.69E-03		3.24E-02
		614.28		89.80	-2.17E-02		5.31E-02
		722.94		90.80	2.22E-02		5.34E-02
	Sb-125	176.31		6.84	-2.60E-01	1.10E-01	4.25E-01
		380.45		1.52	8.55E-01		2.16E+00
		427.87		29.60	4.39E-02		1.10E-01
		463.36		10.49	1.23E-01		3.59E-01
		600.60		17.65	-8.67E-02		1.80E-01
		606.71		4.98	-6.81E-01		1.28E+00
		635.95		11.22	1.69E-01		3.67E-01
		671.44		1.79	-1.82E-01		2.03E+00

Analysis Report for 26-Jul-18-10001

L1-12107K-FSGS-001SB

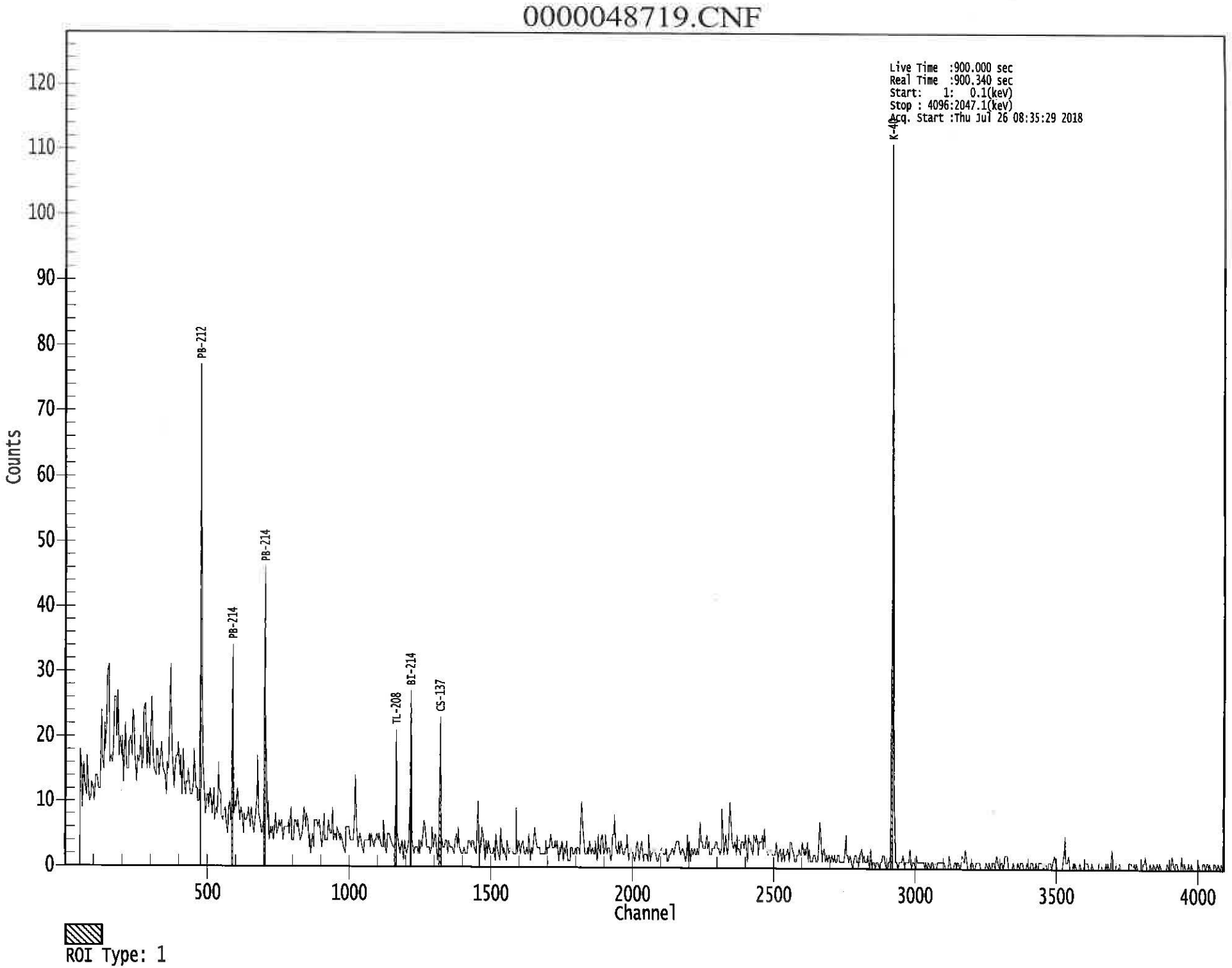
	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	6.94E-01	7.19E-02	2.68E+00
		81.00		32.90	-1.91E-01		1.78E-01
		276.40		7.16	1.76E-01		4.17E-01
		302.85		18.34	9.26E-02		1.83E-01
		356.01		62.05	-4.00E-02		7.19E-02
		383.85		8.94	-3.18E-02		3.51E-01
	Cs-134	475.36		1.48	-1.74E+00	5.05E-02	2.09E+00
		563.25		8.34	-1.38E-01		3.82E-01
		569.33		15.37	-4.53E-02		2.15E-01
		604.72		97.62	-6.23E-02		5.60E-02
		795.86		85.46	2.22E-02		5.05E-02
		801.95		8.69	-2.12E-01		4.42E-01
		1038.61		0.99	2.04E+00		4.66E+00
		1167.97		1.79	4.52E-02		3.53E+00
		1365.19		3.02	-5.36E-02		1.30E+00
+	Cs-137	661.66	*	85.10	5.36E-02	4.17E-02	4.17E-02
	Eu-152	121.78		28.67	9.46E-03	1.12E-01	1.12E-01
		244.70		7.61	5.90E-02		5.08E-01
		295.94		0.45	-1.42E+00		9.41E+00
		344.28		26.60	-1.07E-01		1.21E-01
		367.79		0.86	2.52E-01		3.74E+00
		411.12		2.24	1.09E-01		1.51E+00
		443.96		2.83	-3.90E-01		1.25E+00
		488.68		0.42	-8.77E-01		7.28E+00
		563.99		0.49	7.34E-01		6.77E+00
		586.26		0.46	-1.17E+00		1.11E+01
		678.62		0.47	3.16E+00		8.54E+00
		688.67		0.86	-7.55E-01		4.58E+00
		719.35		0.28	-1.00E+01		1.36E+01
		778.90		12.96	-1.46E-01		2.77E-01
		810.45		0.32	-3.10E+00		1.13E+01
		867.37		4.26	-1.01E-01		9.91E-01
		919.33		0.43	-7.96E+00		1.01E+01
		964.08		14.65	7.93E-03		3.30E-01
		1085.87		10.24	-3.43E-02		4.83E-01
		1089.74		1.73	-2.07E+00		2.39E+00
		1112.07		13.69	-1.43E-01		3.67E-01
		1212.95		1.43	-1.60E+00		4.50E+00
		1249.94		0.19	1.67E+01		2.94E+01
		1299.14		1.63	9.35E-02		3.27E+00
		1408.01		21.07	1.26E-01		2.23E-01
		1457.64		0.50	-5.90E+00		4.20E+01
		1528.10		0.28	3.64E+00		9.89E+00
	Eu-154	123.07		40.40	5.40E-04	7.87E-02	7.87E-02
		247.93		6.89	-1.45E-01		4.54E-01
		591.76		4.95	-9.42E-02		6.36E-01
		692.42		1.78	9.25E-02		2.25E+00
		723.30		20.06	1.87E-01		2.46E-01
		756.80		4.52	-1.59E-01		8.31E-01
		873.18		12.08	-3.52E-02		2.97E-01
		996.29		10.48	-9.19E-02		4.02E-01

Analysis Report for 26-Jul-18-10001

L1-12107K-FSGS-001SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	9.46E-02	7.87E-02	2.47E-01
	1274.43	34.80	-9.04E-02		1.26E-01
	1596.48	1.80	-5.01E-01		1.72E+00
Eu-155	45.30	1.31	1.73E+00	1.72E-01	1.08E+01
	60.01	1.22	-6.22E+00		1.17E+01
	86.55	30.70	-3.34E-03		1.72E-01
	105.31	21.10	7.23E-02		1.87E-01
Ra-226	186.21	3.64	8.51E-01	1.05E+00	1.05E+00
Pa-231	27.36	10.30	6.02E-01	1.16E+00	1.16E+00
	283.69	1.70	-2.08E-01		1.73E+00
	300.07	2.47	-1.06E+00		1.28E+00
	302.65	2.20	7.71E-01		1.52E+00
	330.06	1.40	3.72E-01		2.27E+00
U-235	143.76	10.96	1.23E-01	6.66E-02	2.95E-01
	163.33	5.08	1.53E-01		6.93E-01
	185.71	57.20	4.22E-02		6.66E-02
	202.11	1.08	7.54E-01		3.17E+00
	205.31	5.01	3.43E-02		6.84E-01
Am-241	59.54	35.90	-1.17E-01	4.08E-01	4.08E-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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Live Time :900.000 sec
Real Time :900.340 sec
Start: 1: 0.1(keV)
Stop : 4096:2047.1(keV)
Acq. Start :Thu Jul 26 08:35:29 2018
PB-212
PB-214
PB-214
TL-208
BI-214
CS-137
K-40
Counts
Channel
ROI Type: 1

Apex-Gamma

Analysis Report for 26-Jul-18-10003

L1-12107K-FSGS-002SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10003
Sample Description	: L1-12107K-FSGS-002SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.581E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:20:00PM
Acquisition Started	: 7/26/2018 8:35:43AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 3/12/2018
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	: install
Sample Number	: 48721
Fill Height	: 1580.85 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

JJ. Welch 7.26.18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 8:51:01AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VERIFIED 7/26/18 1200

T Graham / C

Analysis Report for 26-Jul-18-10003

L1-12107K-FSGS-002SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.97	737 -	752	744.62	5.74E+01	16.15	6.76E+01	0.34
2	238.65	947 -	960	955.07	1.27E+02	18.38	7.67E+01	0.88
3	295.21	1174 -	1187	1181.08	6.00E+01	12.05	3.10E+01	0.46
4	338.50	1349 -	1361	1354.06	3.98E+01	11.08	3.12E+01	1.03
5	351.87	1401 -	1414	1407.47	8.91E+01	12.43	2.39E+01	1.09
6	583.32	2327 -	2340	2332.62	5.60E+01	9.75	1.40E+01	0.61
7	609.29	2428 -	2445	2436.42	8.44E+01	10.28	6.60E+00	1.77
8	661.67	2638 -	2653	2645.88	3.49E+01	9.15	1.61E+01	0.37
9	911.16	3636 -	3649	3643.67	2.85E+01	7.58	1.05E+01	0.35
10	1460.95	5831 -	5856	5844.18	3.76E+02	20.08	6.48E+00	1.93

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.79E+00	5.36E-01
Cs-137	1.00	661.66	*	85.10	5.38E-02	1.45E-02
Tl-208	0.99	583.19	*	85.00	7.95E-02	1.47E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.98E-01	3.28E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.30E-01	3.13E-02

Analysis Report for 26-Jul-18-10003

L1-12107K-FSGS-002SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.48E-01	5.37E-02
		351.93	*	35.60	2.15E-01	3.47E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	9.56E-01	2.80E-01
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.96E-01	8.58E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.79E-01	4.81E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	6.08E-02	1.78E-02
		202.11		1.08		
		205.31		5.01		

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

Analysis Report for 26-Jul-18-10003

L1-12107K-FSGS-002SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	7.79E+00	5.36E-01	
	Cs-137	1.000	5.38E-02	1.45E-02	
	Tl-208	0.997	7.95E-02	1.47E-02	
X	Bi-211	0.903			
	Pb-212	1.000	1.98E-01	3.28E-02	
	Bi-214	1.000	2.30E-01	3.13E-02	
	Pb-214	1.000	2.25E-01	2.91E-02	
?	Ra-226	0.991	9.56E-01	2.80E-01	
	Ac-228	0.999	2.07E-01	4.20E-02	
?	~~U-235~~ Ra-226	~~0.992~~	~~6.08E-02~~	~~1.78E-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

JPM 7-26-18

U-235 only 1 Peak

Analysis Report for 26-Jul-18-10003

L1-12107K-FSGS-002SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 8:51:01AM
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	4.77E-02	5.05E-02	5.05E-02
	BE-7	477.60		10.44	-1.08E-01	3.44E-01	3.44E-01
+	K-40	1460.82	*	10.66	7.79E+00	4.29E-01	4.29E-01
	Co-60	1173.23		99.85	5.81E-02	5.84E-02	7.86E-02
		1332.49		99.98	2.84E-02		5.84E-02
	Nb-94	702.65		99.81	7.14E-03	4.38E-02	4.38E-02
		871.09		99.89	-1.11E-02		4.43E-02
	Ag-108m	79.13		6.60	9.54E-01	4.25E-02	1.55E+00
		433.94		90.50	-1.65E-02		4.25E-02
		614.28		89.80	-8.73E-03		7.07E-02
		722.94		90.80	3.06E-02		5.47E-02
	Sb-125	176.31		6.84	4.98E-01	1.31E-01	5.38E-01
		380.45		1.52	-3.25E-01		2.30E+00
		427.87		29.60	4.62E-02		1.31E-01
		463.36		10.49	1.80E-01		4.17E-01
		600.60		17.65	1.45E-03		2.21E-01
		606.71		4.98	2.31E+00		1.33E+00
		635.95		11.22	-1.68E-01		3.83E-01
		671.44		1.79	7.51E-01		2.25E+00

Analysis Report for 26-Jul-18-10003

L1-12107K-FSGS-002SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	1.04E+00	7.63E-02	3.72E+00
		81.00		32.90	-5.04E-01		2.49E-01
		276.40		7.16	-1.76E-02		5.04E-01
		302.85		18.34	-7.85E-02		2.09E-01
		356.01		62.05	-3.43E-02		7.63E-02
		383.85		8.94	-8.18E-02		4.28E-01
	Cs-134	475.36		1.48	-2.03E-01	5.68E-02	2.32E+00
		563.25		8.34	-2.51E-01		4.59E-01
		569.33		15.37	-1.01E-01		2.35E-01
		604.72		97.62	-2.12E-02		6.26E-02
		795.86		85.46	6.75E-02		5.68E-02
		801.95		8.69	-1.96E-01		5.06E-01
		1038.61		0.99	2.61E+00		5.91E+00
		1167.97		1.79	1.94E+00		4.37E+00
		1365.19		3.02	-1.57E-01		1.36E+00
+	Cs-137	661.66	*	85.10	5.38E-02	4.09E-02	4.09E-02
	Eu-152	121.78		28.67	-4.64E-02	1.19E-01	1.37E-01
		244.70		7.61	1.10E-01		5.24E-01
		295.94		0.45	4.28E+00		1.05E+01
		344.28		26.60	-3.43E-02		1.19E-01
		367.79		0.86	-5.46E-01		3.96E+00
		411.12		2.24	-1.75E+00		1.56E+00
		443.96		2.83	-9.27E-01		1.17E+00
		488.68		0.42	2.97E+00		9.23E+00
		563.99		0.49	-8.21E-01		7.71E+00
		586.26		0.46	1.43E+01		1.28E+01
		678.62		0.47	1.21E+00		8.60E+00
		688.67		0.86	-2.85E-01		4.77E+00
		719.35		0.28	-1.09E+01		1.40E+01
		778.90		12.96	-1.12E-02		3.98E-01
		810.45		0.32	-3.59E+00		1.40E+01
		867.37		4.26	-8.21E-01		1.10E+00
		919.33		0.43	-1.25E+01		1.09E+01
		964.08		14.65	5.62E-01		4.76E-01
		1085.87		10.24	-2.40E-02		6.01E-01
		1089.74		1.73	-1.01E+00		3.86E+00
		1112.07		13.69	-3.07E-01		3.97E-01
		1212.95		1.43	-1.23E+00		4.73E+00
		1249.94		0.19	-1.61E+01		3.28E+01
		1299.14		1.63	-1.33E+00		3.36E+00
		1408.01		21.07	4.20E-02		1.92E-01
		1457.64		0.50	1.65E+02		4.28E+01
		1528.10		0.28	-5.37E+00		1.64E+01
	Eu-154	123.07		40.40	3.37E-02	9.69E-02	9.69E-02
		247.93		6.89	-4.06E-02		4.79E-01
		591.76		4.95	-5.61E-01		6.85E-01
		692.42		1.78	-8.79E-01		2.50E+00
		723.30		20.06	1.37E-01		2.48E-01
		756.80		4.52	5.01E-01		9.63E-01
		873.18		12.08	-3.03E-01		3.67E-01
		996.29		10.48	2.13E-01		5.18E-01

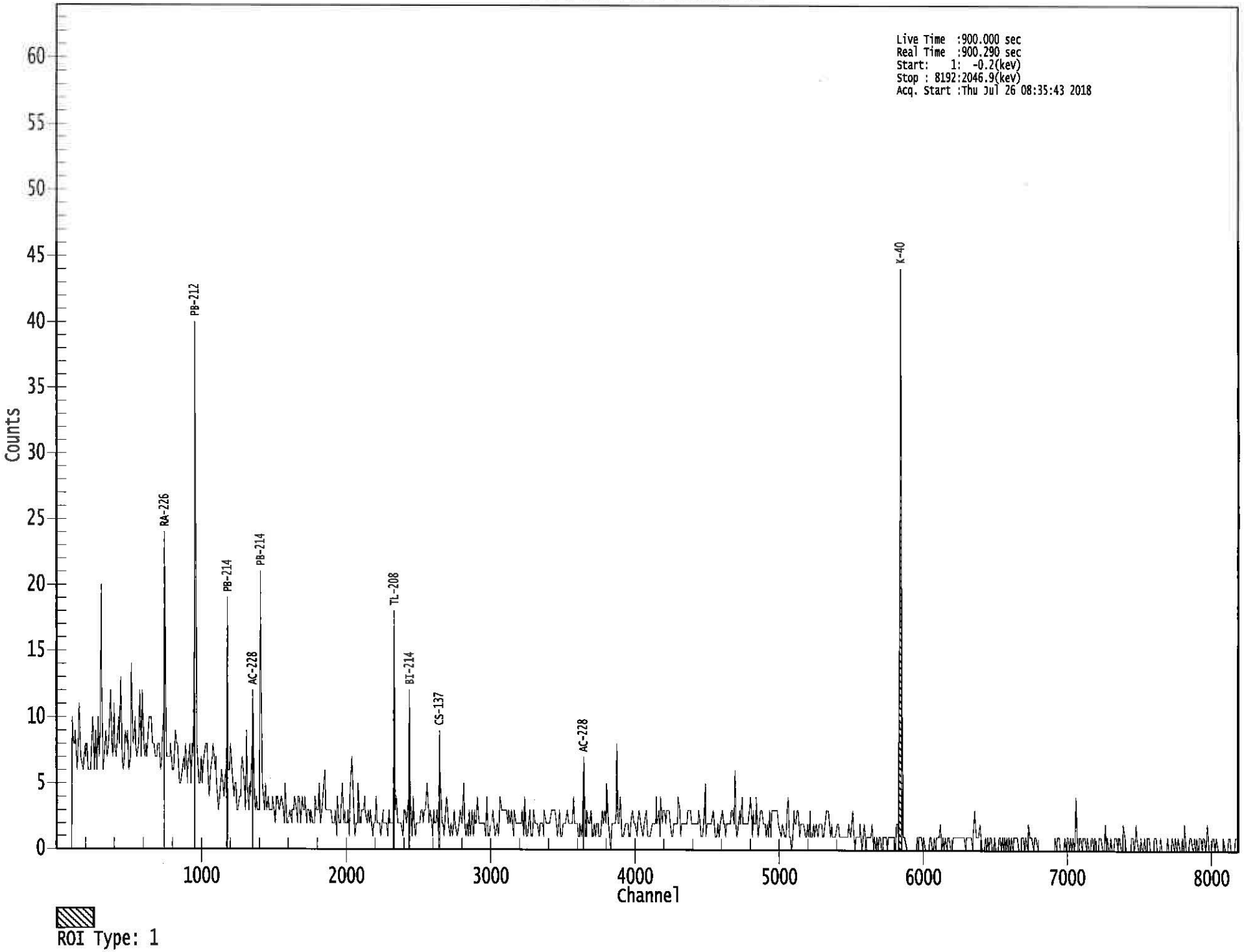
Analysis Report for 26-Jul-18-10003

L1-12107K-FSGS-002SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	-9.87E-02	9.69E-02	3.18E-01
		1274.43		34.80	-9.41E-02		1.60E-01
		1596.48		1.80	1.23E+00		2.74E+00
	Eu-155	45.30		1.31	-4.23E-01	2.24E-01	2.04E+01
		60.01		1.22	-4.66E+00		2.17E+01
		86.55		30.70	1.27E-02		2.24E-01
		105.31		21.10	1.11E-01		2.26E-01
+	Ra-226	186.21	*	3.64	9.56E-01	8.54E-01	8.54E-01
	Pa-231	27.36		10.30	1.71E+00	1.65E+00	2.31E+00
		283.69		1.70	9.23E-01		2.14E+00
		300.07		2.47	-2.77E-01		1.65E+00
		302.65		2.20	5.05E-01		1.77E+00
		330.06		1.40	3.48E-01		2.71E+00
+	U-235	143.76		10.96	1.36E-04	5.43E-02	3.56E-01
		163.33		5.08	-1.67E-01		6.78E-01
		185.71	*	57.20	6.08E-02		5.43E-02
		202.11		1.08	-2.15E-01		3.33E+00
		205.31		5.01	-2.14E-01		7.50E-01
	Am-241	59.54		35.90	-4.73E-01	7.41E-01	7.41E-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

0000048721.CNF



Apex-Gamma

Analysis Report for 26-Jul-18-10002
L1-12107K-FQGS-002SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10002
Sample Description	: L1-12107K-FQGS-002SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.697E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:20:00PM
Acquisition Started	: 7/26/2018 8:35:36AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 12/23/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48720
Fill Height	: 1696.66 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

J. Welch 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 8:50:40AM
Peak Analysis From Channel : 120
Peak Analysis To Channel : 8192

DATA VERIFIED 7/26/18 1200
JGraham / 7/26/18

Analysis Report for 26-Jul-18-10002

L1-12107K-FQGS-002SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.76	949 -	962	955.15	1.35E+02	20.30	9.81E+01	1.07
2	295.24	1174 -	1188	1180.85	7.14E+01	12.29	2.76E+01	1.03
3	351.94	1400 -	1414	1407.48	9.06E+01	13.41	3.04E+01	1.05
4	583.10	2327 -	2337	2331.60	4.04E+01	8.10	1.06E+01	0.50
5	609.41	2429 -	2444	2436.82	5.90E+01	9.11	8.00E+00	1.01
6	911.24	3639 -	3650	3643.91	2.98E+01	5.71	1.23E+00	0.90
7	1460.83	5832 -	5854	5843.17	3.67E+02	19.97	8.46E+00	1.22

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	8.89E+00	6.19E-01
Tl-208	0.99	583.19	*	85.00	6.59E-02	1.38E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.37E-01	4.05E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.85E-01	3.07E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 26-Jul-18-10002

L1-12107K-FQGS-002SB

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	3.34E-01	6.34E-02
		351.93	*	35.60	2.49E-01	4.19E-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	2.16E-01	4.25E-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 26-Jul-18-10002

L1-12107K-FQGS-002SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	8.89E+00	6.19E-01	
	Tl-208	0.999	6.59E-02	1.38E-02	
X	Bi-211	0.887			
	Pb-212	0.997	2.37E-01	4.05E-02	
	Bi-214	0.999	1.85E-01	3.07E-02	
	Pb-214	1.000	2.75E-01	3.49E-02	
	Ac-228	1.000	2.16E-01	4.25E-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 26-Jul-18-10002

L1-12107K-FQGS-002SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 8:50:40AM
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	5.89E-02	6.19E-02	6.19E-02
	BE-7	477.60		10.44	-1.48E-01	4.10E-01	4.10E-01
+	K-40	1460.82	*	10.66	8.89E+00	5.38E-01	5.38E-01
	Co-60	1173.23		99.85	4.80E-03	7.03E-02	7.78E-02
		1332.49		99.98	4.08E-02		7.03E-02
	Nb-94	702.65		99.81	-4.98E-03	4.88E-02	5.41E-02
		871.09		99.89	-6.03E-03		4.88E-02
	Ag-108m	79.13		6.60	-1.00E-01	4.25E-02	1.90E+00
		433.94		90.50	-2.40E-03		4.25E-02
		614.28		89.80	4.40E-03		6.79E-02
		722.94		90.80	-3.54E-02		5.52E-02
	Sb-125	176.31		6.84	-4.95E-02	1.14E-01	6.10E-01
		380.45		1.52	-6.89E-02		2.46E+00
		427.87		29.60	-1.78E-01		1.14E-01
		463.36		10.49	-9.32E-02		4.27E-01
		600.60		17.65	-6.84E-02		2.34E-01
		606.71		4.98	1.44E+00		1.38E+00
		635.95		11.22	-2.20E-01		3.94E-01
		671.44		1.79	1.66E+00		2.80E+00

Analysis Report for 26-Jul-18-10002

L1-12107K-FQGS-002SB

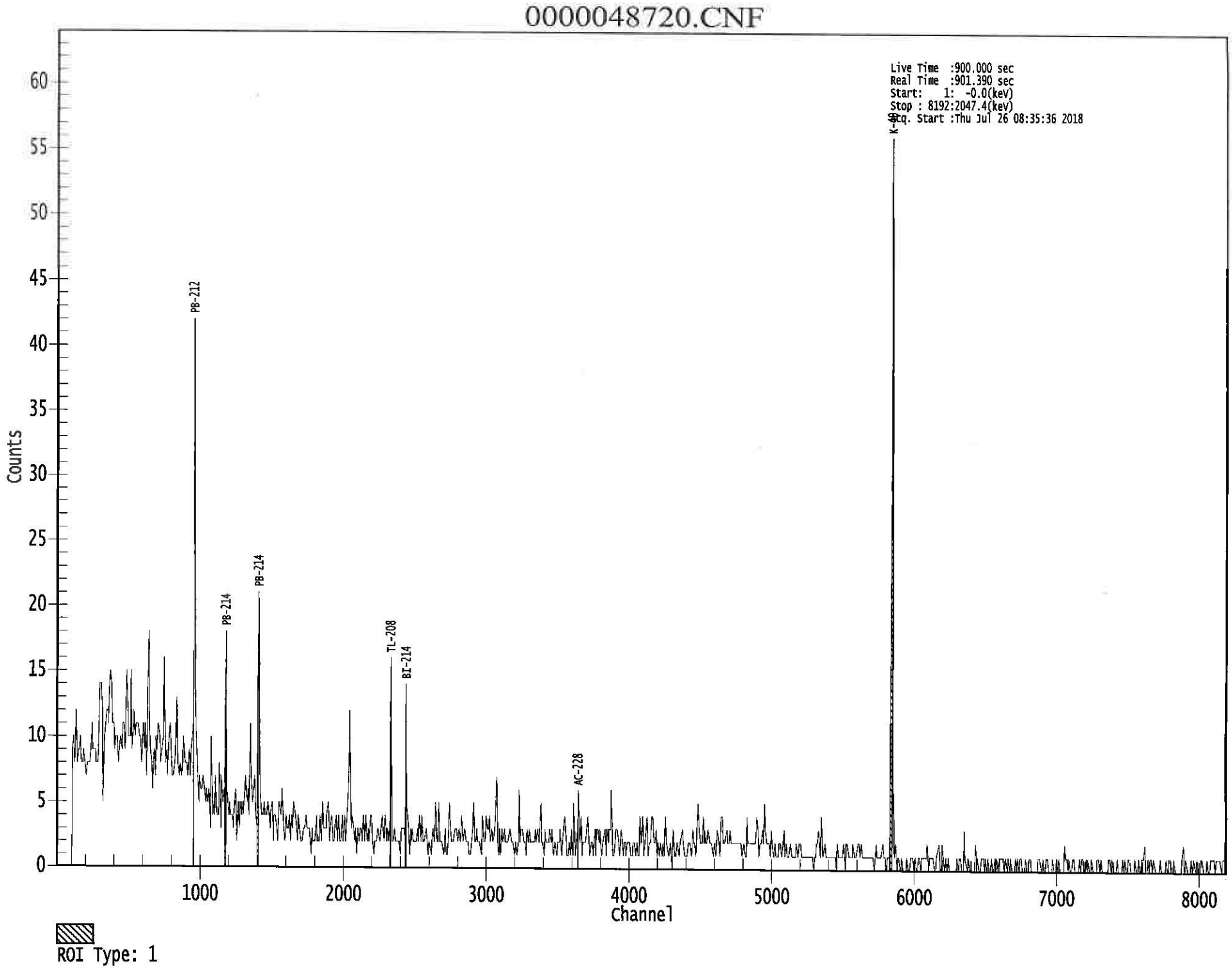
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-4.49E+00	8.48E-02	4.27E+00
	81.00	32.90	-3.41E-01		2.99E-01
	276.40	7.16	1.62E-01		5.41E-01
	302.85	18.34	5.74E-02		2.06E-01
	356.01	62.05	-1.05E-02		8.48E-02
	383.85	8.94	-2.48E-01		3.99E-01
Cs-134	475.36	1.48	-1.91E-01	6.09E-02	3.03E+00
	563.25	8.34	-2.35E-01		4.88E-01
	569.33	15.37	4.44E-02		3.02E-01
	604.72	97.62	1.71E-02		6.14E-02
	795.86	85.46	7.28E-04		6.09E-02
	801.95	8.69	-7.32E-01		5.12E-01
	1038.61	0.99	-6.08E-01		6.79E+00
	1167.97	1.79	5.65E-01		4.15E+00
	1365.19	3.02	-6.11E-02		1.59E+00
Cs-137	661.66	85.10	4.37E-03	6.65E-02	6.65E-02
Eu-152	121.78	28.67	9.78E-02	1.57E-01	1.77E-01
	244.70	7.61	-5.25E-01		6.05E-01
	295.94	0.45	6.54E+00		1.08E+01
	344.28	26.60	4.56E-02		1.57E-01
	367.79	0.86	2.30E-01		4.97E+00
	411.12	2.24	4.72E-01		1.89E+00
	443.96	2.83	-2.90E-01		1.29E+00
	488.68	0.42	2.93E+00		1.03E+01
	563.99	0.49	-2.76E-01		8.74E+00
	586.26	0.46	1.23E+01		1.31E+01
	678.62	0.47	-2.45E+00		9.05E+00
	688.67	0.86	1.28E+00		5.35E+00
	719.35	0.28	-9.81E+00		1.48E+01
	778.90	12.96	-2.56E-02		4.32E-01
	810.45	0.32	4.31E+00		1.89E+01
	867.37	4.26	1.03E-01		1.24E+00
	919.33	0.43	1.06E+01		1.30E+01
	964.08	14.65	7.98E-02		4.94E-01
	1085.87	10.24	6.07E-01		6.43E-01
	1089.74	1.73	1.27E+00		3.81E+00
	1112.07	13.69	2.23E-01		4.27E-01
	1212.95	1.43	-1.83E-01		5.28E+00
	1249.94	0.19	1.78E+01		3.72E+01
	1299.14	1.63	9.83E-01		3.92E+00
	1408.01	21.07	2.98E-03		2.41E-01
	1457.64	0.50	1.93E+02		4.94E+01
	1528.10	0.28	1.96E+00		1.56E+01
Eu-154	123.07	40.40	8.53E-02	1.24E-01	1.24E-01
	247.93	6.89	5.52E-02		6.22E-01
	591.76	4.95	4.95E-02		8.37E-01
	692.42	1.78	-2.08E+00		2.63E+00
	723.30	20.06	5.80E-02		2.59E-01
	756.80	4.52	-2.23E-01		1.13E+00
	873.18	12.08	5.03E-02		4.18E-01
	996.29	10.48	6.91E-02		5.28E-01

Analysis Report for 26-Jul-18-10002

L1-12107K-FQGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	1.30E-01	1.24E-01	3.14E-01
	1274.43	34.80	1.09E-01		1.93E-01
	1596.48	1.80	-9.63E-02		1.49E+00
Eu-155	45.30	1.31	5.23E+00	2.77E-01	3.30E+01
	60.01	1.22	1.02E+01		3.75E+01
	86.55	30.70	6.35E-02		2.86E-01
	105.31	21.10	-2.04E-02		2.77E-01
Ra-226	186.21	3.64	5.94E-02	1.16E+00	1.16E+00
Pa-231	27.36	10.30	3.67E+00	1.45E+00	3.58E+00
	283.69	1.70	1.38E+00		2.44E+00
	300.07	2.47	1.20E-01		1.45E+00
	302.65	2.20	7.94E-01		1.73E+00
	330.06	1.40	1.92E+00		3.11E+00
U-235	143.76	10.96	2.18E-01	7.42E-02	4.12E-01
	163.33	5.08	-2.59E-01		8.53E-01
	185.71	57.20	4.36E-02		7.42E-02
	202.11	1.08	-5.97E-01		3.80E+00
	205.31	5.01	-4.45E-01		7.92E-01
Am-241	59.54	35.90	4.86E-01	1.34E+00	1.34E+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


0000048720.CNF
Live Time :900.000 sec
Real Time :901.390 sec
Start: 1: -0.0(kev)
Stop : 8192:2047.4(kev)
Acq. Start :Thu Jul 26 08:35:36 2018
PB-212
PB-214
PB-214
TL-208
BI-214
AC-228
K-40
Counts
Channel
ROI Type: 1

Apex-Gamma

Analysis Report for 26-Jul-18-10004
L1-12107K-FSGS-003SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10004
Sample Description	: L1-12107K-FSGS-003SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.756E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:30:00PM
Acquisition Started	: 7/26/2018 9:00:38AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 8/9/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48723
Fill Height	: 1756.16 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 9:15:40AM

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

DATA VERIFIED 7/26/18 1200
T Graham

Analysis Report for 26-Jul-18-10004

L1-12107K-FSGS-003SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.69	475 -	482	477.56	1.67E+02	20.29	1.17E+02	1.15
2	338.41	672 -	680	676.80	4.10E+01	10.85	3.60E+01	1.40
3	351.97	698 -	708	703.89	1.33E+02	15.63	4.68E+01	1.27
4	583.31	1160 -	1171	1166.23	8.31E+01	11.32	1.79E+01	1.37
5	609.19	1213 -	1223	1217.96	8.92E+01	12.20	2.38E+01	1.22
6	911.14	1816 -	1828	1821.73	5.04E+01	9.18	1.26E+01	1.09
7	969.09	1933 -	1943	1937.65	2.66E+01	9.96	2.74E+01	1.52
8	1460.71	2914 -	2928	2921.48	5.11E+02	22.73	1.86E+00	2.20
9	1764.09	3525 -	3534	3529.03	1.69E+01	4.39	1.06E+00	0.78

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.28E+00	5.77E-01
Tl-208	0.99	583.19	*	85.00	1.04E-01	1.55E-02
Bi-211	0.87	351.07	*	13.02	7.80E-01	1.11E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.29E-01	3.35E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.15E-01	3.21E-02
		768.36		4.89		

Analysis Report for 26-Jul-18-10004

L1-12107K-FSGS-003SB

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	2.47E-01	6.46E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.85E-01	4.05E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.70E-01	7.47E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.78E-01	5.20E-02
		964.77		4.99		
		968.97	*	15.80	2.49E-01	9.40E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 26-Jul-18-10004

L1-12107K-FSGS-003SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.998	9.28E+00	5.77E-01	
	Tl-208	0.997	1.04E-01	1.55E-02	
?	Bi-211	0.878	7.80E-01	1.11E-01	
	Pb-212	1.000	2.29E-01	3.35E-02	
	Bi-214	0.995	2.21E-01	2.88E-02	
?	Pb-214	0.513	2.85E-01	4.05E-02	
	Ac-228	0.999	2.71E-01	3.89E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 26-Jul-18-10004
L1-12107K-FSGS-003SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 9:15:40AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.08E-02	5.14E-02	5.14E-02
	BE-7	477.60		10.44	-1.36E-02	3.36E-01	3.36E-01
+	K-40	1460.82	*	10.66	9.28E+00	1.94E-01	1.94E-01
	Co-60	1173.23		99.85	1.69E-02	4.86E-02	6.79E-02
		1332.49		99.98	1.00E-02		4.86E-02
	Nb-94	702.65		99.81	7.25E-03	3.57E-02	3.57E-02
		871.09		99.89	1.64E-02		4.15E-02
	Ag-108m	79.13		6.60	5.76E-01	3.29E-02	1.21E+00
		433.94		90.50	-7.03E-03		3.29E-02
		614.28		89.80	-4.66E-02		4.95E-02
		722.94		90.80	-1.94E-02		4.58E-02
	Sb-125	176.31		6.84	-1.23E-01	9.65E-02	5.11E-01
		380.45		1.52	1.00E+00		2.27E+00
		427.87		29.60	4.41E-03		9.65E-02
		463.36		10.49	1.56E-01		3.47E-01
		600.60		17.65	-2.25E-02		2.37E-01
		606.71		4.98	3.25E-02		1.29E+00
		635.95		11.22	8.27E-02		3.10E-01
		671.44		1.79	-2.04E-01		2.09E+00

Analysis Report for 26-Jul-18-10004

L1-12107K-FSGS-003SB

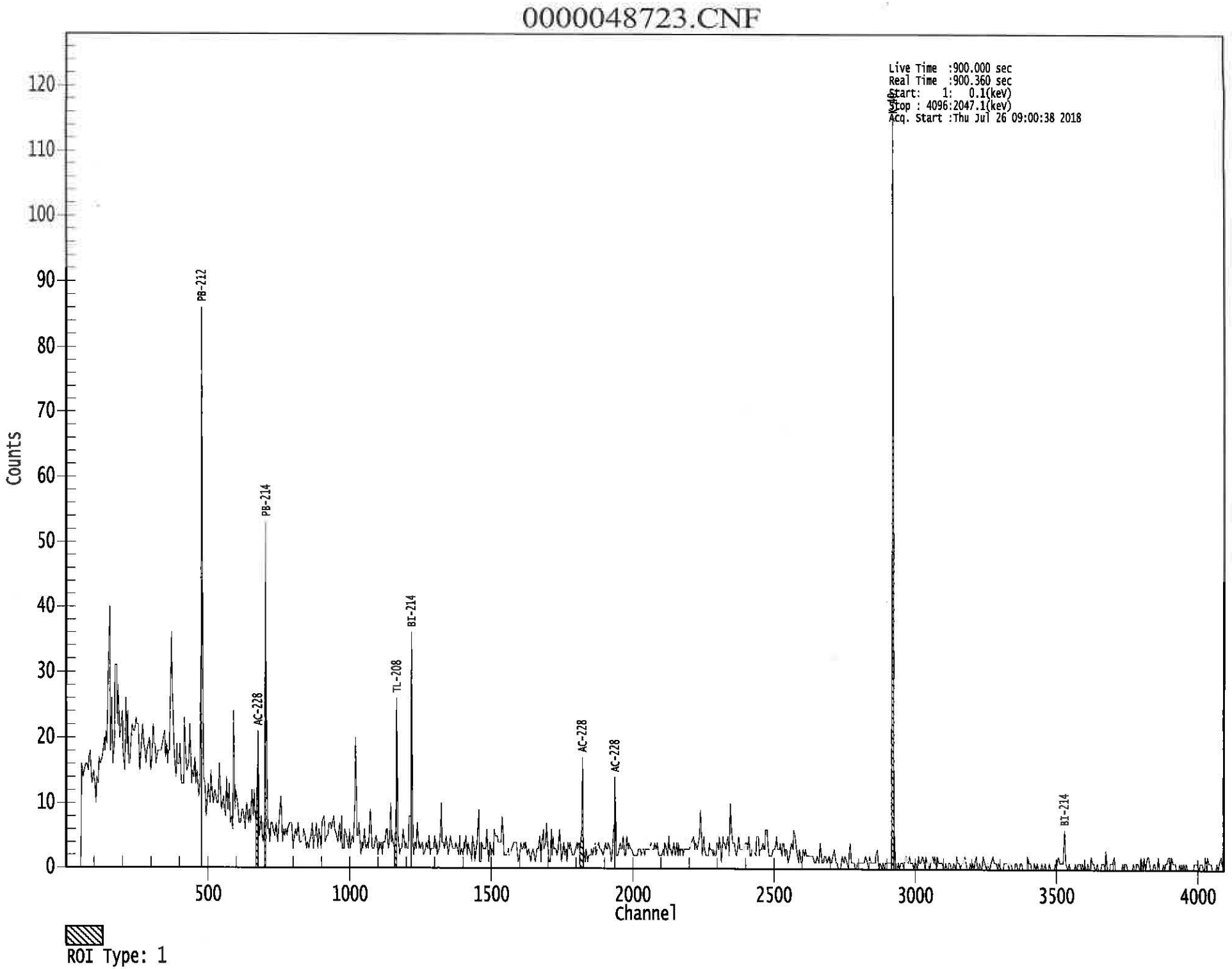
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	1.20E+00	7.60E-02	2.88E+00
	81.00	32.90	-1.78E-01		1.92E-01
	276.40	7.16	8.10E-02		4.56E-01
	302.85	18.34	-8.55E-03		1.78E-01
	356.01	62.05	-4.99E-02		7.60E-02
	383.85	8.94	-2.12E-01		3.20E-01
Cs-134	475.36	1.48	5.80E-01	4.58E-02	2.43E+00
	563.25	8.34	2.76E-01		4.43E-01
	569.33	15.37	-1.47E-01		2.32E-01
	604.72	97.62	-6.18E-03		5.87E-02
	795.86	85.46	-2.61E-02		4.58E-02
	801.95	8.69	-1.39E-01		4.46E-01
	1038.61	0.99	1.74E+00		5.48E+00
	1167.97	1.79	-1.45E+00		3.39E+00
	1365.19	3.02	-8.78E-02		1.00E+00
Cs-137	661.66	85.10	4.95E-02	5.85E-02	5.85E-02
Eu-152	121.78	28.67	2.18E-02	1.14E-01	1.27E-01
	244.70	7.61	-2.63E-01		4.78E-01
	295.94	0.45	6.63E+00		9.18E+00
	344.28	26.60	-1.31E-01		1.14E-01
	367.79	0.86	2.04E-01		3.70E+00
	411.12	2.24	2.19E-01		1.41E+00
	443.96	2.83	-2.70E-01		1.07E+00
	488.68	0.42	-2.95E+00		7.92E+00
	563.99	0.49	5.11E+00		7.67E+00
	586.26	0.46	-4.05E+00		1.22E+01
	678.62	0.47	-2.27E-01		7.99E+00
	688.67	0.86	-1.47E+00		4.03E+00
	719.35	0.28	-1.86E+00		1.30E+01
	778.90	12.96	-2.53E-02		2.47E-01
	810.45	0.32	-1.23E+00		1.28E+01
	867.37	4.26	4.54E-01		1.02E+00
	919.33	0.43	-2.18E+00		8.66E+00
	964.08	14.65	-4.09E-02		3.94E-01
	1085.87	10.24	1.87E-01		4.92E-01
	1089.74	1.73	-2.76E-01		2.76E+00
	1112.07	13.69	-3.79E-01		3.92E-01
	1212.95	1.43	-1.94E+00		3.88E+00
	1249.94	0.19	7.58E+00		2.95E+01
	1299.14	1.63	-1.16E+00		2.89E+00
	1408.01	21.07	1.45E-01		2.13E-01
	1457.64	0.50	-3.07E+00		4.30E+01
	1528.10	0.28	-2.93E+00		1.17E+01
Eu-154	123.07	40.40	2.62E-02	9.20E-02	9.20E-02
	247.93	6.89	2.89E-02		4.87E-01
	591.76	4.95	-1.79E-01		7.54E-01
	692.42	1.78	-3.84E-01		1.96E+00
	723.30	20.06	-5.16E-03		2.21E-01
	756.80	4.52	-6.96E-02		9.38E-01
	873.18	12.08	5.72E-03		3.29E-01
	996.29	10.48	-9.42E-02		4.50E-01

Analysis Report for 26-Jul-18-10004

L1-12107K-FSGS-003SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-4.56E-02	9.20E-02	2.53E-01
	1274.43	34.80	-1.01E-01		1.52E-01
	1596.48	1.80	-4.17E-01		1.43E+00
Eu-155	45.30	1.31	-4.10E+00	1.87E-01	1.16E+01
	60.01	1.22	-3.26E+00		1.30E+01
	86.55	30.70	3.04E-02		1.89E-01
	105.31	21.10	3.57E-02		1.87E-01
Ra-226	186.21	3.64	3.66E-01	1.03E+00	1.03E+00
Pa-231	27.36	10.30	1.05E+00	1.20E+00	1.20E+00
	283.69	1.70	-4.06E-01		1.90E+00
	300.07	2.47	-1.14E+00		1.44E+00
	302.65	2.20	-7.13E-02		1.48E+00
	330.06	1.40	1.38E+00		2.50E+00
U-235	143.76	10.96	-6.34E-02	6.60E-02	2.79E-01
	163.33	5.08	-1.29E-01		6.67E-01
	185.71	57.20	2.64E-02		6.60E-02
	202.11	1.08	1.50E-01		3.16E+00
	205.31	5.01	-4.61E-01		6.68E-01
Am-241	59.54	35.90	-2.32E-02	4.63E-01	4.63E-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


0000048723.CNF
Live Time :900.000 sec
Real Time :900.360 sec
Start: 1: 0.1(kev)
Stop : 4096:2047.1(kev)
Acq. Start :Thu Jul 26 09:00:38 2018
PB-212
PB-214
AC-228
TL-208
BI-214
AC-228
AC-228
BI-214
Counts
Channel
ROI Type: 1

Apex-Gamma

Analysis Report for 26-Jul-18-10005

L1-12107K-FSGS-004SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10005
Sample Description	: L1-12107K-FSGS-004SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.601E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:41:00PM
Acquisition Started	: 7/26/2018 9:00:44AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 12/23/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48724
Fill Height	: 1601.03 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 9:15:48AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VERIFIED 7/26/18 1200

J Graham / C

Analysis Report for 26-Jul-18-10005

L1-12107K-FSGS-004SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.74	949 -	962	955.05	1.18E+02	17.85	7.13E+01	0.93
2	295.42	1174 -	1190	1181.57	7.47E+01	12.90	2.93E+01	1.00
3	352.11	1399 -	1414	1408.18	8.02E+01	14.12	3.98E+01	0.62
4	583.22	2326 -	2340	2332.11	5.66E+01	8.48	5.40E+00	0.92
5	609.24	2429 -	2442	2436.13	6.23E+01	10.38	1.57E+01	0.66
6	1460.58	5831 -	5853	5842.15	3.29E+02	18.75	5.74E+00	1.42

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.10E+00	5.80E-01
Tl-208	1.00	583.19	*	85.00	9.35E-02	1.51E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.09E-01	3.59E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.98E-01	3.51E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		

Analysis Report for 26-Jul-18-10005

L1-12107K-FSGS-004SB

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	3.53E-01	6.72E-02
		351.93	*	35.60	2.23E-01	4.31E-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	0.991	8.10E+00	5.80E-01	
Tl-208	1.000	9.35E-02	1.51E-02	
Pb-212	0.998	2.09E-01	3.59E-02	
Bi-214	1.000	1.98E-01	3.51E-02	
Pb-214	0.995	2.61E-01	3.63E-02	

Analysis Report for 26-Jul-18-10005

L1-12107K-FSGS-004SB

? = 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 26-Jul-18-10005
L1-12107K-FSGS-004SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 9:15:48AM
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	4.37E-02	5.53E-02	5.53E-02
	BE-7	477.60		10.44	2.35E-01	4.15E-01	4.15E-01
+	K-40	1460.82	*	10.66	8.10E+00	4.65E-01	4.65E-01
	Co-60	1173.23		99.85	-5.64E-03	5.95E-02	7.56E-02
		1332.49		99.98	4.89E-02		5.95E-02
	Nb-94	702.65		99.81	-4.48E-02	4.65E-02	4.65E-02
		871.09		99.89	2.76E-03		4.86E-02
	Ag-108m	79.13		6.60	2.43E+00	3.95E-02	2.03E+00
		433.94		90.50	-1.48E-02		3.95E-02
		614.28		89.80	-6.04E-02		6.87E-02
		722.94		90.80	3.41E-02		6.88E-02
	Sb-125	176.31		6.84	1.86E-01	1.30E-01	6.14E-01
		380.45		1.52	-4.47E-01		2.49E+00
		427.87		29.60	-9.69E-02		1.30E-01
		463.36		10.49	3.17E-01		4.36E-01
		600.60		17.65	6.66E-02		2.47E-01
		606.71		4.98	2.00E+00		1.46E+00
		635.95		11.22	-4.93E-02		3.30E-01
		671.44		1.79	1.92E+00		2.59E+00

Analysis Report for 26-Jul-18-10005

L1-12107K-FSGS-004SB

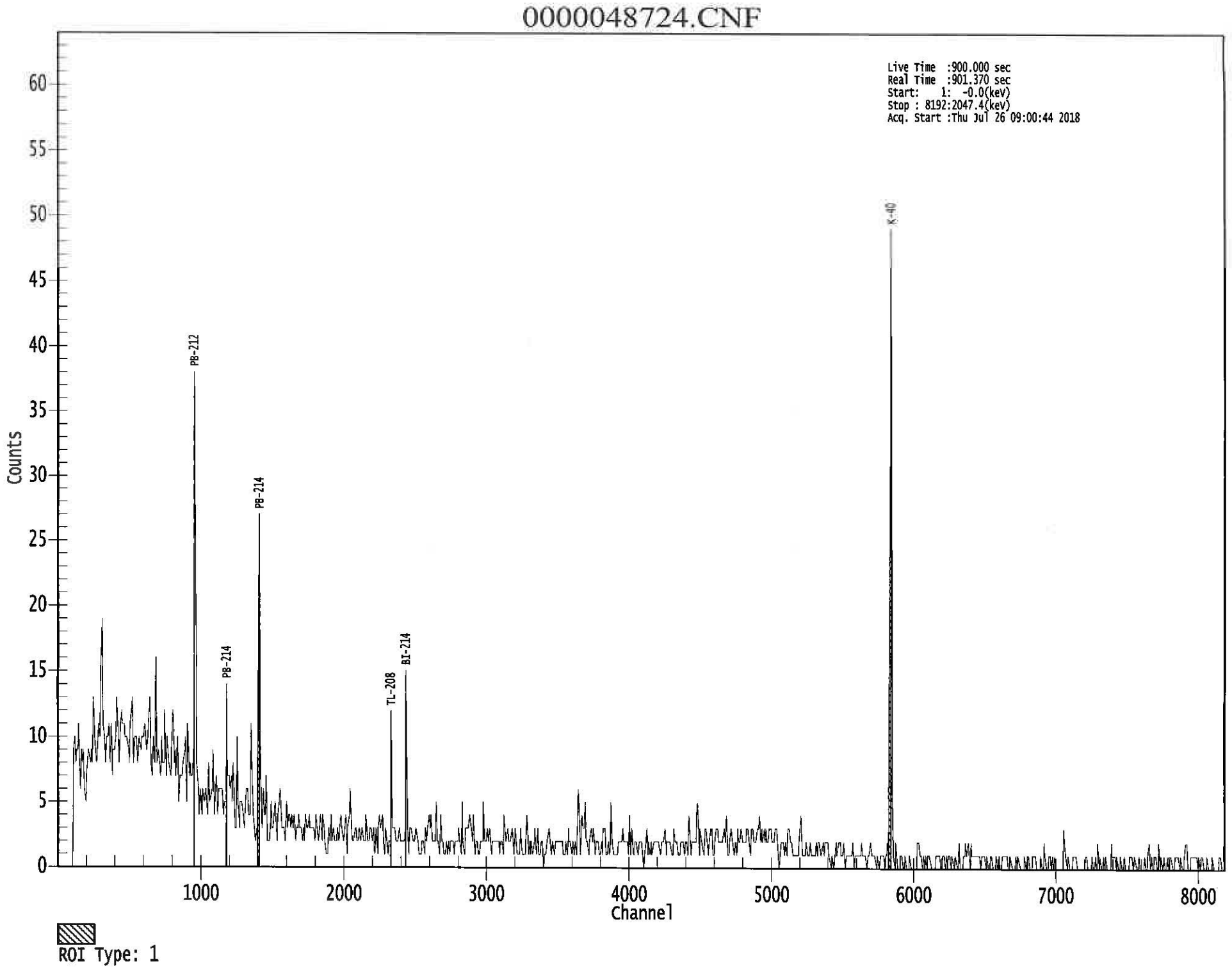
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	1.74E+00	9.44E-02	4.71E+00
	81.00	32.90	-4.05E-01		3.15E-01
	276.40	7.16	1.75E-01		5.58E-01
	302.85	18.34	2.07E-01		2.34E-01
	356.01	62.05	8.03E-03		9.44E-02
	383.85	8.94	-5.10E-01		4.16E-01
Cs-134	475.36	1.48	2.19E+00	6.51E-02	2.87E+00
	563.25	8.34	-9.14E-02		5.21E-01
	569.33	15.37	-1.11E-01		2.77E-01
	604.72	97.62	-2.77E-02		6.51E-02
	795.86	85.46	4.84E-02		7.04E-02
	801.95	8.69	-2.79E-02		6.18E-01
	1038.61	0.99	-3.98E+00		5.32E+00
	1167.97	1.79	-7.56E-01		3.97E+00
	1365.19	3.02	-5.56E-01		1.55E+00
Cs-137	661.66	85.10	3.33E-02	5.84E-02	5.84E-02
Eu-152	121.78	28.67	-2.97E-02	1.29E-01	1.58E-01
	244.70	7.61	7.09E-02		5.80E-01
	295.94	0.45	7.95E+00		1.11E+01
	344.28	26.60	-4.11E-02		1.29E-01
	367.79	0.86	5.20E-01		4.15E+00
	411.12	2.24	4.40E-01		1.94E+00
	443.96	2.83	1.09E+00		1.44E+00
	488.68	0.42	-4.92E+00		8.75E+00
	563.99	0.49	3.42E+00		9.28E+00
	586.26	0.46	-2.16E+00		1.41E+01
	678.62	0.47	2.64E+00		8.54E+00
	688.67	0.86	2.42E+00		4.74E+00
	719.35	0.28	9.96E+00		2.19E+01
	778.90	12.96	5.93E-02		3.54E-01
	810.45	0.32	1.91E+00		1.44E+01
	867.37	4.26	-1.10E+00		1.16E+00
	919.33	0.43	2.29E+00		1.38E+01
	964.08	14.65	-1.48E-01		4.16E-01
	1085.87	10.24	-1.18E-01		5.40E-01
	1089.74	1.73	2.79E+00		3.55E+00
	1112.07	13.69	-4.32E-01		4.82E-01
	1212.95	1.43	-5.62E+00		5.23E+00
	1249.94	0.19	4.65E+00		3.93E+01
	1299.14	1.63	3.39E+00		4.31E+00
	1408.01	21.07	2.72E-02		2.60E-01
	1457.64	0.50	1.70E+02		4.78E+01
	1528.10	0.28	4.82E+00		1.31E+01
Eu-154	123.07	40.40	1.95E-02	1.14E-01	1.14E-01
	247.93	6.89	1.36E-01		5.31E-01
	591.76	4.95	3.53E-01		8.95E-01
	692.42	1.78	-9.37E-01		2.21E+00
	723.30	20.06	5.58E-03		3.06E-01
	756.80	4.52	1.48E-01		1.05E+00
	873.18	12.08	-4.00E-02		4.02E-01
	996.29	10.48	-1.07E-01		5.53E-01

Analysis Report for 26-Jul-18-10005

L1-12107K-FSGS-004SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	3.22E-02	1.14E-01	3.34E-01
	1274.43	34.80	-2.49E-01		1.87E-01
	1596.48	1.80	2.50E+00		3.45E+00
Eu-155	45.30	1.31	1.24E+01	2.86E-01	3.19E+01
	60.01	1.22	-9.26E-01		3.37E+01
	86.55	30.70	1.02E-01		2.86E-01
	105.31	21.10	1.15E-02		2.97E-01
Ra-226	186.21	3.64	7.43E-01	1.18E+00	1.18E+00
Pa-231	27.36	10.30	1.89E+00	1.64E+00	3.61E+00
	283.69	1.70	4.63E-01		2.41E+00
	300.07	2.47	-1.14E+00		1.64E+00
	302.65	2.20	2.23E-01		1.89E+00
	330.06	1.40	1.10E+00		2.97E+00
U-235	143.76	10.96	1.42E-01	7.67E-02	4.09E-01
	163.33	5.08	-3.23E-01		8.08E-01
	185.71	57.20	5.64E-02		7.67E-02
	202.11	1.08	-1.22E+00		3.89E+00
	205.31	5.01	-3.83E-01		8.08E-01
Am-241	59.54	35.90	-4.28E-01	1.19E+00	1.19E+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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Live Time :900.000 sec
Real Time :901.370 sec
Start: 1: -0.0(keV)
Stop : 8192:2047.4(keV)
Acq. Start :Thu Jul 26 09:00:44 2018
PB-212
PB-214
PB-214
TL-208
BI-214
K-40
Counts
Channel
ROI Type: 1

Apex-Gamma

Analysis Report for 26-Jul-18-10006
L1-12107K-FSGS-005SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10006
Sample Description	: L1-12107K-FSGS-005SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.555E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:45:00PM
Acquisition Started	: 7/26/2018 9:00:50AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 12/15/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48725
Fill Height	: 1554.89 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 9:16:02AM

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

DATA VERIFIED 7/26/18 1200

Analysis Report for 26-Jul-18-10006

L1-12107K-FSGS-005SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.21	305 -	313	309.38	3.19E+01	13.61	7.11E+01	0.31
2	238.74	948 -	960	954.53	1.21E+02	16.49	5.69E+01	1.10
3	295.59	1176 -	1185	1181.63	3.25E+01	9.12	2.25E+01	0.75
4	338.42	1347 -	1357	1352.77	2.95E+01	8.29	1.65E+01	0.59
5	352.08	1400 -	1412	1407.32	8.64E+01	12.91	3.06E+01	0.67
6	583.28	2324 -	2336	2331.25	4.59E+01	7.34	3.06E+00	0.60
7	609.17	2429 -	2442	2434.73	5.57E+01	10.44	1.83E+01	1.11
8	661.47	2636 -	2651	2643.79	6.20E+01	10.20	1.40E+01	0.36
9	1460.47	5827 -	5851	5839.81	4.33E+02	21.42	6.28E+00	1.40

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	9.66E+00	6.36E-01
Cs-137	0.99	661.66	*	85.10	1.01E-01	1.77E-02
Tl-208	0.99	583.19	*	85.00	6.89E-02	1.18E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.92E-01	3.04E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.24E-01	9.86E-02

Analysis Report for 26-Jul-18-10006

L1-12107K-FSGS-005SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.61E-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		
		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	1.39E-01	4.04E-02
		351.93	*	35.60	2.17E-01	3.68E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	3.96E-01	1.75E-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	2.27E-01	6.65E-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 26-Jul-18-10006

L1-12107K-FSGS-005SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.980	9.66E+00	6.36E-01	
	Cs-137	0.995	1.01E-01	1.77E-02	
	Tl-208	0.999	6.89E-02	1.18E-02	
	Pb-212	0.998	1.92E-01	3.04E-02	
?	Pb212-XR	0.999	2.24E-01	9.86E-02	
	Bi-214	0.999	1.61E-01	3.16E-02	
	Pb-214	0.992	1.81E-01	2.72E-02	
?	Pb214-XR	0.999	3.96E-01	1.75E-01	
	Ac-228	1.000	2.27E-01	6.65E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 26-Jul-18-10006
L1-12107K-FSGS-005SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 9:16:02AM
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	5.00E-02	5.02E-02	5.02E-02
	BE-7	477.60		10.44	1.08E-01	3.27E-01	3.27E-01
+	K-40	1460.82	*	10.66	9.66E+00	4.51E-01	4.51E-01
	Co-60	1173.23		99.85	6.68E-02	7.29E-02	7.93E-02
		1332.49		99.98	5.83E-02		7.29E-02
	Nb-94	702.65		99.81	7.07E-03	4.23E-02	4.23E-02
		871.09		99.89	4.18E-03		4.33E-02
	Ag-108m	79.13		6.60	-5.54E-01	4.33E-02	1.07E+00
		433.94		90.50	-1.61E-02		4.33E-02
		614.28		89.80	-9.69E-03		5.70E-02
		722.94		90.80	3.33E-02		5.46E-02
	Sb-125	176.31		6.84	5.35E-02	1.19E-01	4.69E-01
		380.45		1.52	-3.36E-01		2.14E+00
		427.87		29.60	-1.71E-01		1.19E-01
		463.36		10.49	2.17E-01		3.88E-01
		600.60		17.65	-3.25E-02		1.91E-01
		606.71		4.98	1.87E+00		1.29E+00
		635.95		11.22	-2.35E-01		3.67E-01
		671.44		1.79	-2.97E-01		2.29E+00

Analysis Report for 26-Jul-18-10006

L1-12107K-FSGS-005SB

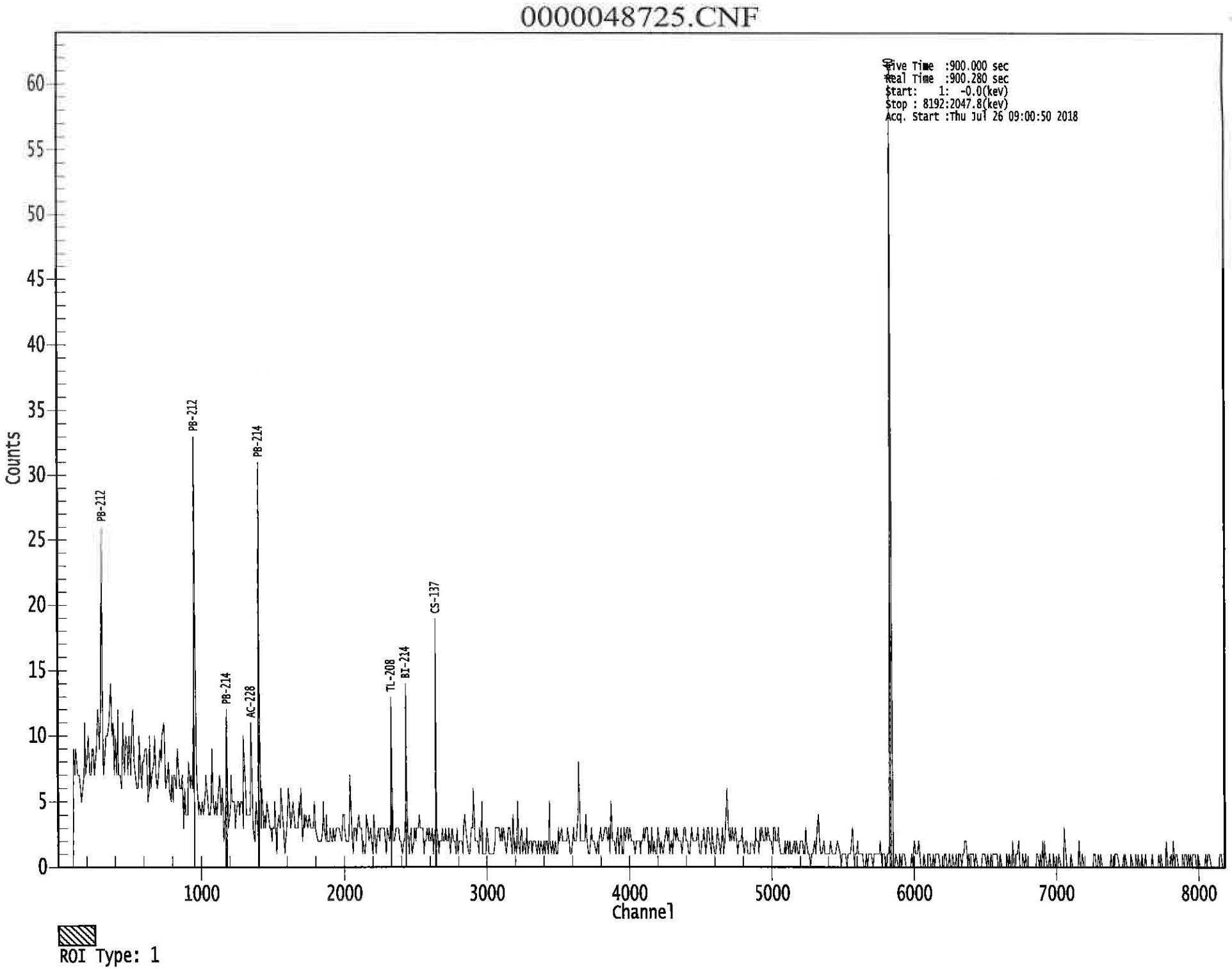
	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	-1.60E+00	7.28E-02	2.56E+00
		81.00		32.90	-2.33E-01		1.69E-01
		276.40		7.16	-7.63E-02		4.71E-01
		302.85		18.34	1.40E-01		1.92E-01
		356.01		62.05	-5.86E-02		7.28E-02
		383.85		8.94	-4.13E-01		3.58E-01
	Cs-134	475.36		1.48	-1.08E+00	5.21E-02	2.18E+00
		563.25		8.34	-1.91E-01		3.94E-01
		569.33		15.37	2.89E-02		2.19E-01
		604.72		97.62	-3.59E-02		5.48E-02
		795.86		85.46	-4.01E-03		5.21E-02
		801.95		8.69	1.11E-01		5.15E-01
		1038.61		0.99	2.60E-02		4.83E+00
		1167.97		1.79	1.54E+00		4.15E+00
		1365.19		3.02	6.75E-01		1.29E+00
+	Cs-137	661.66	*	85.10	1.01E-01	4.07E-02	4.07E-02
	Eu-152	121.78		28.67	-3.46E-02	1.15E-01	1.15E-01
		244.70		7.61	9.45E-02		4.73E-01
		295.94		0.45	2.57E+00		8.88E+00
		344.28		26.60	2.99E-02		1.28E-01
		367.79		0.86	2.11E+00		3.97E+00
		411.12		2.24	1.51E-01		1.73E+00
		443.96		2.83	-1.23E+00		1.27E+00
		488.68		0.42	2.28E+00		8.81E+00
		563.99		0.49	1.90E+00		6.93E+00
		586.26		0.46	-7.58E+00		1.17E+01
		678.62		0.47	1.59E+00		9.36E+00
		688.67		0.86	-1.66E+00		4.77E+00
		719.35		0.28	-1.74E+00		1.49E+01
		778.90		12.96	5.29E-02		3.49E-01
		810.45		0.32	-1.06E+01		1.18E+01
		867.37		4.26	-1.25E-01		9.52E-01
		919.33		0.43	1.28E+01		1.29E+01
		964.08		14.65	1.27E-01		5.01E-01
		1085.87		10.24	2.94E-01		6.22E-01
		1089.74		1.73	-2.21E+00		3.37E+00
		1112.07		13.69	2.70E-02		4.61E-01
		1212.95		1.43	4.62E-01		4.39E+00
		1249.94		0.19	-5.70E+00		3.87E+01
		1299.14		1.63	-6.64E-01		3.80E+00
		1408.01		21.07	-1.58E-01		1.81E-01
		1457.64		0.50	2.10E+02		4.91E+01
		1528.10		0.28	3.50E+00		1.09E+01
	Eu-154	123.07		40.40	-2.89E-02	7.88E-02	7.88E-02
		247.93		6.89	-3.09E-01		4.35E-01
		591.76		4.95	2.38E-01		7.81E-01
		692.42		1.78	-2.02E+00		2.24E+00
		723.30		20.06	1.51E-01		2.47E-01
		756.80		4.52	-4.96E-01		7.43E-01
		873.18		12.08	-7.35E-02		3.92E-01
		996.29		10.48	2.28E-01		5.10E-01

Analysis Report for 26-Jul-18-10006

L1-12107K-FSGS-005SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-7.92E-02	7.88E-02	2.75E-01
	1274.43	34.80	-2.49E-02		1.57E-01
	1596.48	1.80	-4.09E+00		1.93E+00
Eu-155	45.30	1.31	-5.50E+00	1.84E-01	1.12E+01
	60.01	1.22	-5.85E+00		1.13E+01
	86.55	30.70	6.66E-02		1.84E-01
	105.31	21.10	3.67E-02		1.95E-01
Ra-226	186.21	3.64	1.60E-01	9.19E-01	9.19E-01
Pa-231	27.36	10.30	1.09E+00	1.18E+00	1.18E+00
	283.69	1.70	-6.15E-01		1.94E+00
	300.07	2.47	-1.65E+00		1.40E+00
	302.65	2.20	1.17E+00		1.61E+00
	330.06	1.40	1.35E+00		2.67E+00
U-235	143.76	10.96	1.01E-01	5.82E-02	2.93E-01
	163.33	5.08	1.81E-02		6.01E-01
	185.71	57.20	-9.51E-03		5.82E-02
	202.11	1.08	-3.41E-01		2.85E+00
	205.31	5.01	-4.94E-01		6.13E-01
Am-241	59.54	35.90	-3.25E-01	3.86E-01	3.86E-01

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


0000048725.CNF
Live Time :900.000 sec
Real Time :900.280 sec
Start: 1: -0.0(keV)
Stop : 8192:2047.8(keV)
Acq. Start :Thu Jul 26 09:00:50 2018
Counts
Channel
PB-212
PB-212
PB-214
PB-214
AC-228
TL-208
BI-214
CS-137
ROI Type: 1

Apex-Gamma

Analysis Report for 26-Jul-18-10007

L1-12107K-FSGS-006SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10007
Sample Description	: L1-12107K-FSGS-006SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.577E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 1:37:00PM
Acquisition Started	: 7/26/2018 9:23:00AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 3/12/2018
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	: install
Sample Number	: 48730
Fill Height	: 1576.92 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 9:38:11AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VERIFIED 7/26/18 1200

J Graham / CJ

Analysis Report for 26-Jul-18-10007

L1-12107K-FSGS-006SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.69	947 -	961	955.25	1.52E+02	17.92	5.89E+01	1.18
2	295.16	1174 -	1187	1180.86	4.82E+01	12.23	3.68E+01	0.40
3	352.02	1401 -	1414	1408.06	9.40E+01	13.08	2.80E+01	1.32
4	583.14	2325 -	2336	2331.86	5.11E+01	8.56	8.89E+00	1.01
5	609.43	2430 -	2447	2437.00	8.34E+01	11.07	1.16E+01	1.16
6	911.12	3638 -	3650	3643.53	3.45E+01	7.19	6.50E+00	0.78
7	1461.09	5832 -	5856	5844.74	4.02E+02	21.27	1.24E+01	1.82

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	8.34E+00	5.71E-01
Tl-208	1.00	583.19	*	85.00	7.26E-02	1.29E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.37E-01	3.38E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.28E-01	3.32E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 26-Jul-18-10007

L1-12107K-FSGS-006SB

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	1.99E-01	5.30E-02
		351.93	*	35.60	2.27E-01	3.65E-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	2.16E-01	4.60E-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 26-Jul-18-10007

L1-12107K-FSGS-006SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.988	8.34E+00	5.71E-01	
	Tl-208	1.000	7.26E-02	1.29E-02	
X	Bi-211	0.867			
	Pb-212	0.999	2.37E-01	3.38E-02	
	Bi-214	0.999	2.28E-01	3.32E-02	
	Pb-214	0.999	2.18E-01	3.01E-02	
	Ac-228	1.000	2.16E-01	4.60E-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 26-Jul-18-10007

L1-12107K-FSGS-006SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 9:38:11AM
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	5.73E-02	5.18E-02	5.18E-02
	BE-7	477.60		10.44	3.12E-01	3.80E-01	3.80E-01
+	K-40	1460.82	*	10.66	8.34E+00	5.62E-01	5.62E-01
	Co-60	1173.23		99.85	5.05E-02	5.03E-02	6.26E-02
		1332.49		99.98	-4.01E-03		5.03E-02
	Nb-94	702.65		99.81	-4.22E-04	4.22E-02	4.22E-02
		871.09		99.89	-2.21E-02		4.22E-02
	Ag-108m	79.13		6.60	-4.84E-01	4.32E-02	1.60E+00
		433.94		90.50	-2.70E-02		4.32E-02
		614.28		89.80	-3.47E-03		7.59E-02
		722.94		90.80	3.11E-02		5.47E-02
	Sb-125	176.31		6.84	-4.93E-01	1.28E-01	4.86E-01
		380.45		1.52	-1.56E+00		2.17E+00
		427.87		29.60	-3.35E-02		1.28E-01
		463.36		10.49	2.88E-02		3.54E-01
		600.60		17.65	-1.03E-01		2.21E-01
		606.71		4.98	2.40E+00		1.40E+00
		635.95		11.22	3.37E-01		3.74E-01
		671.44		1.79	-4.72E-01		2.16E+00

Analysis Report for 26-Jul-18-10007

L1-12107K-FSGS-006SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	1.45E+00	8.17E-02	3.95E+00
	81.00	32.90	-5.22E-01		2.62E-01
	276.40	7.16	4.75E-02		5.49E-01
	302.85	18.34	1.94E-01		2.22E-01
	356.01	62.05	-8.32E-02		8.17E-02
	383.85	8.94	-1.73E-02		3.55E-01
Cs-134	475.36	1.48	-1.05E+00	5.12E-02	2.56E+00
	563.25	8.34	2.69E-01		4.97E-01
	569.33	15.37	-7.27E-02		2.77E-01
	604.72	97.62	-5.42E-03		6.29E-02
	795.86	85.46	-6.85E-02		5.12E-02
	801.95	8.69	-2.40E-01		5.21E-01
	1038.61	0.99	3.38E+00		5.71E+00
	1167.97	1.79	-2.94E+00		3.27E+00
	1365.19	3.02	-1.57E-01		1.36E+00
Cs-137	661.66	85.10	9.14E-02	6.89E-02	6.89E-02
Eu-152	121.78	28.67	5.42E-02	1.36E-01	1.36E-01
	244.70	7.61	1.42E-01		5.17E-01
	295.94	0.45	5.58E+00		1.04E+01
	344.28	26.60	-7.45E-02		1.39E-01
	367.79	0.86	2.66E+00		4.06E+00
	411.12	2.24	4.35E-01		1.77E+00
	443.96	2.83	2.26E-01		1.47E+00
	488.68	0.42	3.64E+00		8.97E+00
	563.99	0.49	1.04E+01		8.69E+00
	586.26	0.46	1.94E+01		1.23E+01
	678.62	0.47	-3.01E+00		8.83E+00
	688.67	0.86	2.01E+00		5.21E+00
	719.35	0.28	-1.66E+01		1.53E+01
	778.90	12.96	-1.04E-01		3.08E-01
	810.45	0.32	4.53E+00		1.44E+01
	867.37	4.26	-2.31E-02		9.86E-01
	919.33	0.43	-1.93E+01		1.04E+01
	964.08	14.65	1.38E-02		4.55E-01
	1085.87	10.24	6.85E-02		4.58E-01
	1089.74	1.73	1.71E-01		2.61E+00
	1112.07	13.69	-1.01E-01		4.03E-01
	1212.95	1.43	1.70E-01		4.15E+00
	1249.94	0.19	-2.23E+01		3.24E+01
	1299.14	1.63	5.25E-01		3.42E+00
	1408.01	21.07	6.54E-02		1.99E-01
	1457.64	0.50	1.85E+02		4.48E+01
	1528.10	0.28	-6.09E-01		1.10E+01
Eu-154	123.07	40.40	2.42E-02	9.38E-02	9.38E-02
	247.93	6.89	-2.74E-01		4.92E-01
	591.76	4.95	1.54E-01		7.90E-01
	692.42	1.78	7.68E-01		2.47E+00
	723.30	20.06	1.27E-01		2.50E-01
	756.80	4.52	-9.16E-02		9.51E-01
	873.18	12.08	2.05E-01		3.68E-01
	996.29	10.48	9.01E-02		4.84E-01

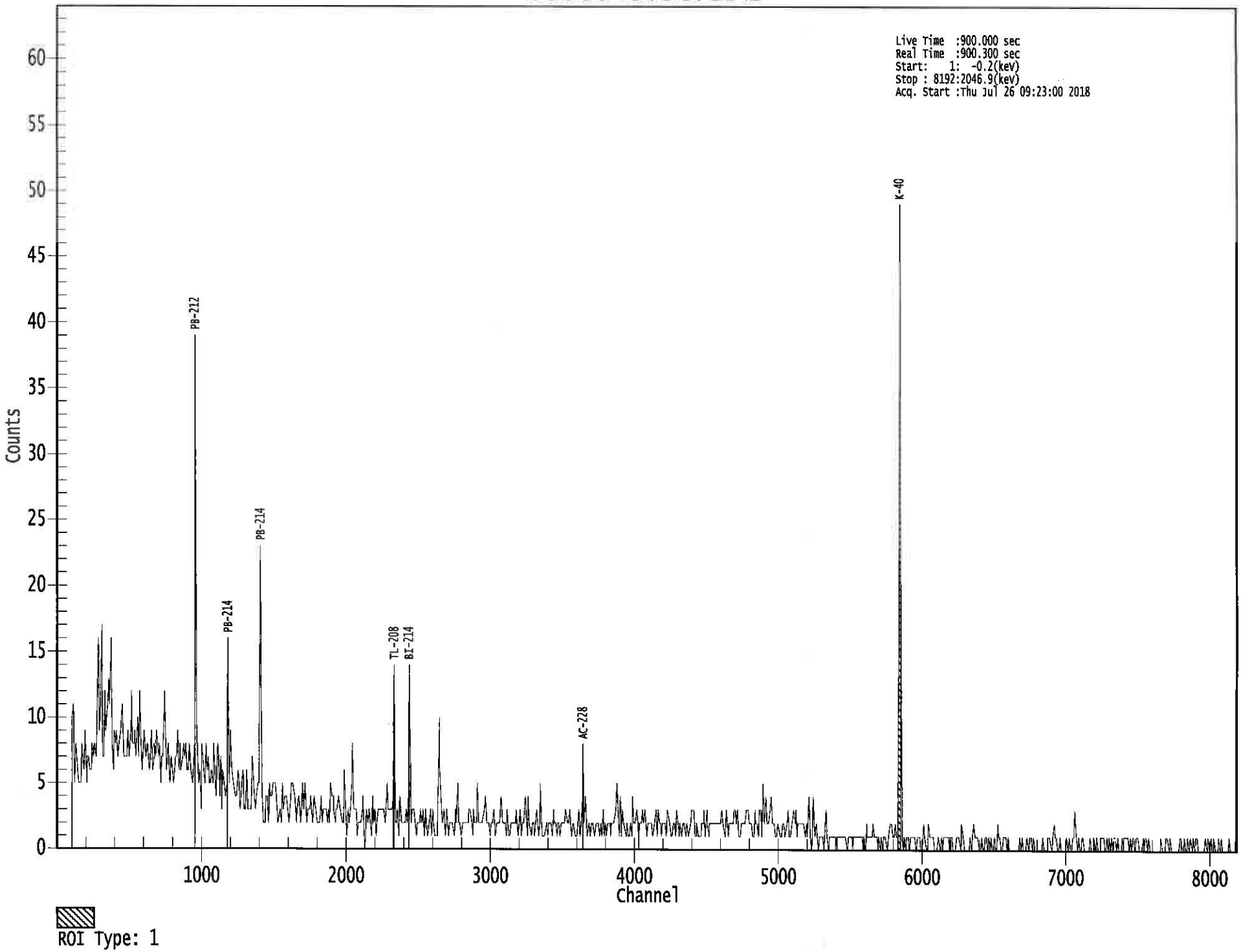
Analysis Report for 26-Jul-18-10007

L1-12107K-FSGS-006SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	2.55E-02	9.38E-02	2.92E-01
	1274.43	34.80	-2.72E-01		1.49E-01
	1596.48	1.80	1.32E+00		2.38E+00
Eu-155	45.30	1.31	-9.91E+00	2.23E-01	1.94E+01
	60.01	1.22	-1.22E+01		2.02E+01
	86.55	30.70	-2.14E-01		2.32E-01
	105.31	21.10	-1.85E-02		2.23E-01
Ra-226	186.21	3.64	3.44E-01	1.05E+00	1.05E+00
Pa-231	27.36	10.30	3.39E+00	1.78E+00	2.51E+00
	283.69	1.70	-2.41E+00		2.02E+00
	300.07	2.47	1.19E-01		1.78E+00
	302.65	2.20	2.06E+00		1.86E+00
	330.06	1.40	1.01E+00		2.50E+00
U-235	143.76	10.96	-7.68E-02	6.75E-02	3.40E-01
	163.33	5.08	2.46E-01		6.78E-01
	185.71	57.20	5.82E-02		6.75E-02
	202.11	1.08	1.59E-01		3.21E+00
	205.31	5.01	2.50E-01		7.46E-01
Am-241	59.54	35.90	1.10E-01	7.38E-01	7.38E-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

0000048730.CNF



Apex-Gamma

Analysis Report for 26-Jul-18-10008

L1-12107K-FSGS-007SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10008
Sample Description	: L1-12107K-FSGS-007SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.623E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:00:00PM
Acquisition Started	: 7/26/2018 9:22:20AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 8/9/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48727
Fill Height	: 1622.63 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

J.R. McNeil 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 9:37:23AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VERIFIED 7/26/18 1200

J Graham / C

Analysis Report for 26-Jul-18-10008

L1-12107K-FSGS-007SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.63	474 -	481	477.44	1.53E+02	19.11	1.04E+02	1.19
2	295.23	586 -	595	590.52	5.66E+01	13.94	6.04E+01	1.14
3	351.96	698 -	708	703.87	1.21E+02	14.94	4.26E+01	1.42
4	583.20	1160 -	1171	1166.00	6.06E+01	10.45	1.94E+01	1.15
5	609.43	1212 -	1224	1218.44	9.80E+01	12.69	2.40E+01	1.47
6	911.33	1817 -	1826	1822.10	3.96E+01	9.40	2.14E+01	0.65
7	969.09	1933 -	1943	1937.65	2.72E+01	8.13	1.58E+01	1.11
8	1460.66	2914 -	2928	2921.38	4.65E+02	21.82	3.75E+00	1.74

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	8.61E+00	5.50E-01
Tl-208	1.00	583.19	*	85.00	7.71E-02	1.41E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.13E-01	3.16E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.40E-01	3.42E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 26-Jul-18-10008

L1-12107K-FSGS-007SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.10E-01	5.43E-02
		351.93	*	35.60	2.63E-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	2.22E-01	5.36E-02
		964.77		4.99		
		968.97	*	15.80	2.59E-01	7.84E-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 26-Jul-18-10008

L1-12107K-FSGS-007SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.996	8.61E+00	5.50E-01	
	Tl-208	1.000	7.71E-02	1.41E-02	
X	Bi-211	0.880			
	Pb-212	1.000	2.13E-01	3.16E-02	
	Bi-214	0.999	2.40E-01	3.42E-02	
	Pb-214	1.000	2.45E-01	3.15E-02	
	Ac-228	0.999	2.34E-01	4.43E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 26-Jul-18-10008

L1-12107K-FSGS-007SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 9:37:23AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.31E-02	5.19E-02	5.19E-02
	BE-7	477.60		10.44	2.12E-02	3.31E-01	3.31E-01
+	K-40	1460.82	*	10.66	8.61E+00	2.59E-01	2.59E-01
	Co-60	1173.23		99.85	-2.10E-02	5.04E-02	5.59E-02
		1332.49		99.98	1.85E-02		5.04E-02
	Nb-94	702.65		99.81	1.35E-03	3.78E-02	3.78E-02
		871.09		99.89	1.25E-02		4.10E-02
	Ag-108m	79.13		6.60	8.77E-02	3.75E-02	1.14E+00
		433.94		90.50	1.49E-02		3.75E-02
		614.28		89.80	1.64E-05		5.50E-02
		722.94		90.80	-1.22E-02		4.11E-02
	Sb-125	176.31		6.84	1.78E-02	9.55E-02	5.13E-01
		380.45		1.52	-1.18E+00		2.07E+00
		427.87		29.60	-8.98E-03		9.55E-02
		463.36		10.49	2.04E-01		3.41E-01
		600.60		17.65	7.58E-04		1.90E-01
		606.71		4.98	1.06E-01		1.33E+00
		635.95		11.22	-2.17E-02		3.51E-01
		671.44		1.79	6.80E-01		2.23E+00

Analysis Report for 26-Jul-18-10008

L1-12107K-FSGS-007SB

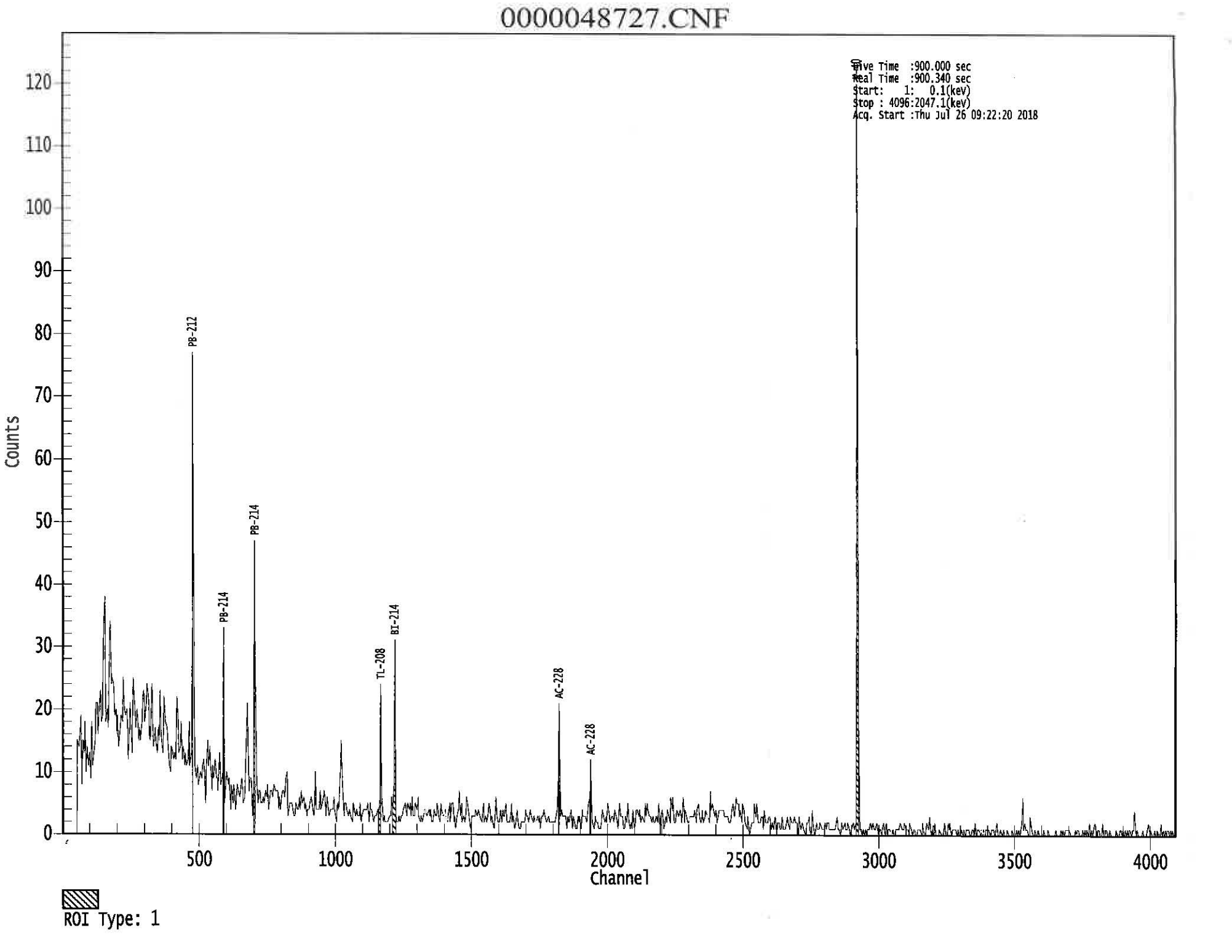
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-1.93E-01	7.35E-02	2.69E+00
	81.00	32.90	-2.44E-01		1.84E-01
	276.40	7.16	-1.31E-01		4.49E-01
	302.85	18.34	1.13E-01		1.73E-01
	356.01	62.05	-3.49E-02		7.35E-02
	383.85	8.94	3.67E-01		3.99E-01
Cs-134	475.36	1.48	-1.01E+00	4.91E-02	2.24E+00
	563.25	8.34	4.16E-02		4.36E-01
	569.33	15.37	-4.95E-02		2.17E-01
	604.72	97.62	1.82E-03		5.55E-02
	795.86	85.46	3.04E-02		4.91E-02
	801.95	8.69	-3.00E-01		4.19E-01
	1038.61	0.99	1.76E+00		4.57E+00
	1167.97	1.79	-1.43E+00		3.00E+00
	1365.19	3.02	-1.02E-01		1.17E+00
Cs-137	661.66	85.10	-1.45E-03	4.26E-02	4.26E-02
Eu-152	121.78	28.67	-9.96E-02	9.97E-02	9.97E-02
	244.70	7.61	-1.30E-01		4.52E-01
	295.94	0.45	6.82E+00		8.81E+00
	344.28	26.60	-1.28E-01		1.24E-01
	367.79	0.86	2.70E-01		3.81E+00
	411.12	2.24	-3.89E-02		1.49E+00
	443.96	2.83	-3.39E-01		1.05E+00
	488.68	0.42	1.72E-01		8.03E+00
	563.99	0.49	-1.42E+00		7.16E+00
	586.26	0.46	-1.40E+00		1.14E+01
	678.62	0.47	8.71E-01		7.81E+00
	688.67	0.86	-2.09E+00		4.66E+00
	719.35	0.28	-7.04E-01		1.30E+01
	778.90	12.96	-9.36E-02		3.19E-01
	810.45	0.32	9.39E+00		1.43E+01
	867.37	4.26	-5.15E-01		8.34E-01
	919.33	0.43	1.29E+00		1.09E+01
	964.08	14.65	-5.17E-02		3.63E-01
	1085.87	10.24	1.72E-01		5.19E-01
	1089.74	1.73	1.81E+00		3.22E+00
	1112.07	13.69	-3.55E-02		3.70E-01
	1212.95	1.43	5.70E-01		4.22E+00
	1249.94	0.19	1.33E+01		3.25E+01
	1299.14	1.63	5.98E-01		3.15E+00
	1408.01	21.07	-1.43E-02		1.71E-01
	1457.64	0.50	-7.18E+00		4.19E+01
	1528.10	0.28	-7.27E+00		9.84E+00
Eu-154	123.07	40.40	-7.34E-03	7.45E-02	7.45E-02
	247.93	6.89	7.08E-02		4.37E-01
	591.76	4.95	9.99E-02		6.03E-01
	692.42	1.78	-8.44E-02		2.36E+00
	723.30	20.06	6.34E-02		1.96E-01
	756.80	4.52	-9.83E-02		9.09E-01
	873.18	12.08	1.40E-01		3.44E-01
	996.29	10.48	-5.39E-02		4.45E-01

Analysis Report for 26-Jul-18-10008

L1-12107K-FSGS-007SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-8.35E-02	7.45E-02	2.38E-01
	1274.43	34.80	4.06E-02		1.73E-01
	1596.48	1.80	-7.89E-01		2.03E+00
Eu-155	45.30	1.31	-7.65E-01	1.85E-01	1.10E+01
	60.01	1.22	7.24E-01		1.31E+01
	86.55	30.70	6.21E-02		1.88E-01
	105.31	21.10	4.23E-02		1.85E-01
Ra-226	186.21	3.64	8.36E-01	1.04E+00	1.04E+00
Pa-231	27.36	10.30	4.42E-01	1.11E+00	1.11E+00
	283.69	1.70	-7.10E-01		1.92E+00
	300.07	2.47	-1.90E-01		1.16E+00
	302.65	2.20	9.41E-01		1.44E+00
	330.06	1.40	3.06E-01		2.28E+00
U-235	143.76	10.96	-3.27E-02	6.62E-02	2.72E-01
	163.33	5.08	3.83E-01		6.96E-01
	185.71	57.20	4.97E-02		6.62E-02
	202.11	1.08	2.25E-01		2.94E+00
	205.31	5.01	-3.64E-01		6.23E-01
Am-241	59.54	35.90	2.93E-02	4.61E-01	4.61E-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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Live Time :900.000 sec
Real Time :900.340 sec
Start: 1: 0.1(keV)
Stop : 4096:2047.1(keV)
Acq. Start :Thu Jul 26 09:22:20 2018
PB-212
PB-214
PB-214
TL-208
BI-214
AC-228
AC-228
Counts
Channel
ROI Type: 1

Apex-Gamma

Analysis Report for 26-Jul-18-10009
L1-12107K-FSGS-008SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10009
Sample Description	: L1-12107K-FSGS-008SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.609E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:23:00PM
Acquisition Started	: 7/26/2018 9:22:26AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 12/23/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48728
Fill Height	: 1608.85 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

J.C. Welch 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 9:37:31AM

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

DATA VERIFIED 7/26/18 1300
J Graham

Analysis Report for 26-Jul-18-10009

L1-12107K-FSGS-008SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.03	741 -	748	744.39	3.08E+01	11.46	4.92E+01	0.42
2	238.68	946 -	960	954.81	1.25E+02	17.06	5.81E+01	1.19
3	295.27	1174 -	1189	1180.98	6.52E+01	11.57	2.28E+01	0.84
4	352.00	1401 -	1414	1407.72	8.70E+01	12.37	2.40E+01	0.76
5	609.17	2430 -	2443	2435.86	4.56E+01	10.10	2.04E+01	0.52
6	661.59	2640 -	2653	2645.48	3.10E+01	8.50	1.50E+01	1.46
7	911.27	3638 -	3651	3644.03	3.51E+01	6.96	4.94E+00	0.55
8	1120.40	4475 -	4486	4480.71	1.87E+01	6.08	7.30E+00	1.37
9	1460.74	5831 -	5854	5842.78	3.73E+02	19.31	0.00E+00	1.69

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.17E+00	6.19E-01
Cs-137	0.99	661.66	*	85.10	5.57E-02	1.56E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.21E-01	3.51E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.45E-01	3.32E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 26-Jul-18-10009

L1-12107K-FSGS-008SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29	*	14.92	2.73E-01	8.95E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	3.08E-01	5.99E-02
		351.93	*	35.60	2.41E-01	3.93E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	5.83E-01	2.22E-01
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.58E-01	5.24E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.98	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.71E-02	1.41E-02
		202.11		1.08		
		205.31		5.01		

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

Analysis Report for 26-Jul-18-10009

L1-12107K-FSGS-008SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	9.17E+00	6.19E-01	
	Cs-137	0.999	5.57E-02	1.56E-02	
X	Bi-211	0.872			
	Pb-212	1.000	2.21E-01	3.51E-02	
	Bi-214	0.998	1.60E-01	3.11E-02	
	Pb-214	1.000	2.61E-01	3.29E-02	
?	Ra-226	0.995	5.83E-01	2.22E-01	
	Ac-228	1.000	2.58E-01	5.24E-02	
?	~~U-235~~ Ra-226	~~0.989~~	~~3.71E-02~~	~~1.41E-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

TW 7-26-18

U-235 only 1 peak

Analysis Report for 26-Jul-18-10009

L1-12107K-FSGS-008SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 9:37:31AM
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	6.56E-02	6.23E-02	6.23E-02
	BE-7	477.60		10.44	2.45E-01	4.23E-01	4.23E-01
+	K-40	1460.82	*	10.66	9.17E+00	7.07E-02	7.07E-02
	Co-60	1173.23		99.85	7.05E-02	5.94E-02	8.35E-02
		1332.49		99.98	2.16E-02		5.94E-02
	Nb-94	702.65		99.81	-2.74E-02	4.51E-02	4.51E-02
		871.09		99.89	2.89E-02		5.60E-02
	Ag-108m	79.13		6.60	8.20E-01	4.52E-02	1.87E+00
		433.94		90.50	-2.29E-02		4.52E-02
		614.28		89.80	-2.71E-02		6.01E-02
		722.94		90.80	4.44E-03		6.63E-02
	Sb-125	176.31		6.84	-5.04E-02	1.43E-01	5.98E-01
		380.45		1.52	9.85E-02		2.65E+00
		427.87		29.60	-8.46E-02		1.43E-01
		463.36		10.49	9.59E-02		4.35E-01
		600.60		17.65	-6.43E-03		2.33E-01
		606.71		4.98	1.72E+00		1.39E+00
		635.95		11.22	2.96E-01		4.41E-01
		671.44		1.79	1.30E+00		2.48E+00

Analysis Report for 26-Jul-18-10009

L1-12107K-FSGS-008SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	1.22E+00	8.00E-02	4.47E+00
		81.00		32.90	-1.13E-01		3.16E-01
		276.40		7.16	-1.93E-01		5.75E-01
		302.85		18.34	1.66E-01		2.15E-01
		356.01		62.05	-4.81E-02		8.00E-02
		383.85		8.94	7.94E-02		4.40E-01
	Cs-134	475.36		1.48	9.90E-01	5.81E-02	2.95E+00
		563.25		8.34	5.01E-02		5.76E-01
		569.33		15.37	1.98E-01		3.36E-01
		604.72		97.62	-3.17E-02		6.46E-02
		795.86		85.46	2.67E-02		5.81E-02
		801.95		8.69	-3.00E-02		4.76E-01
		1038.61		0.99	-6.88E+00		5.83E+00
		1167.97		1.79	-2.42E+00		4.16E+00
		1365.19		3.02	-2.27E-01		1.49E+00
+	Cs-137	661.66	*	85.10	5.57E-02	4.43E-02	4.43E-02
	Eu-152	121.78		28.67	-9.56E-02	1.45E-01	1.47E-01
		244.70		7.61	2.65E-01		6.18E-01
		295.94		0.45	-4.13E-01		1.01E+01
		344.28		26.60	-2.81E-02		1.45E-01
		367.79		0.86	5.88E-01		4.23E+00
		411.12		2.24	-1.22E+00		1.81E+00
		443.96		2.83	5.65E-01		1.60E+00
		488.68		0.42	1.54E-01		1.04E+01
		563.99		0.49	1.03E+01		1.03E+01
		586.26		0.46	-4.93E+00		1.23E+01
		678.62		0.47	-1.73E+00		8.69E+00
		688.67		0.86	1.89E+00		5.93E+00
		719.35		0.28	2.28E+00		1.83E+01
		778.90		12.96	-7.89E-02		4.11E-01
		810.45		0.32	2.42E+00		1.61E+01
		867.37		4.26	-8.82E-01		1.22E+00
		919.33		0.43	4.03E+00		1.22E+01
		964.08		14.65	1.49E-01		5.43E-01
		1085.87		10.24	1.36E-01		6.08E-01
		1089.74		1.73	-3.90E+00		3.44E+00
		1112.07		13.69	-8.32E-02		4.62E-01
		1212.95		1.43	2.70E+00		4.62E+00
		1249.94		0.19	1.12E+01		3.50E+01
		1299.14		1.63	8.70E-01		3.90E+00
		1408.01		21.07	3.93E-02		2.67E-01
		1457.64		0.50	1.94E+02		4.99E+01
		1528.10		0.28	2.89E+00		1.08E+01
	Eu-154	123.07		40.40	-6.54E-02	1.04E-01	1.04E-01
		247.93		6.89	1.44E-01		5.99E-01
		591.76		4.95	-1.72E-01		8.71E-01
		692.42		1.78	2.68E+00		3.26E+00
		723.30		20.06	1.23E-01		3.03E-01
		756.80		4.52	-4.98E-01		1.08E+00
		873.18		12.08	3.81E-03		4.70E-01
		996.29		10.48	2.89E-02		5.08E-01

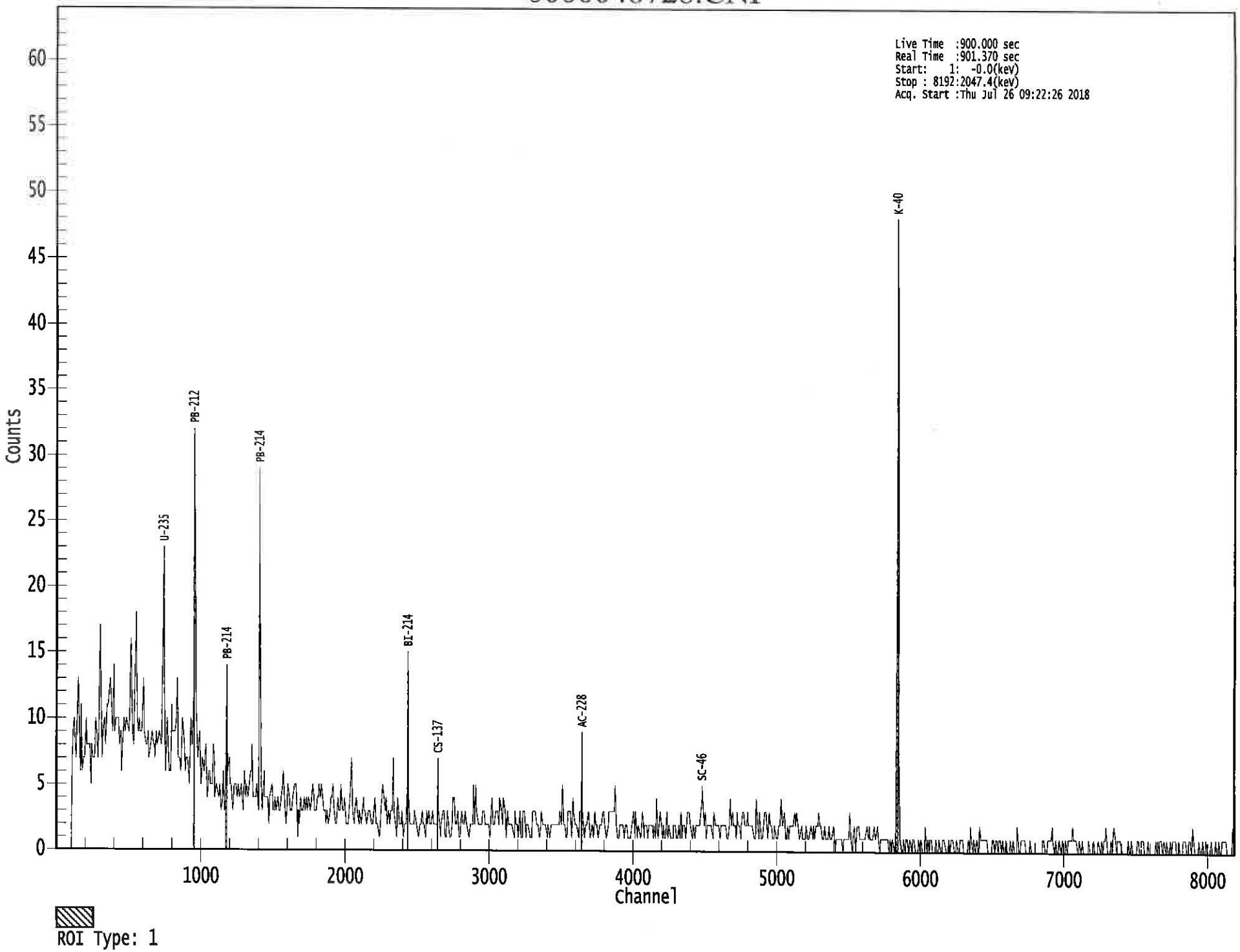
Analysis Report for 26-Jul-18-10009

L1-12107K-FSGS-008SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	1.87E-02	1.04E-01	3.33E-01
		1274.43		34.80	-4.95E-02		1.83E-01
		1596.48		1.80	-4.42E+00		2.28E+00
	Eu-155	45.30		1.31	-2.02E-01	2.72E-01	3.09E+01
		60.01		1.22	-3.84E+00		3.08E+01
		86.55		30.70	-9.54E-02		2.72E-01
		105.31		21.10	8.62E-02		2.99E-01
+	Ra-226	186.21	*	3.64	5.83E-01	6.98E-01	6.98E-01
	Pa-231	27.36		10.30	1.74E+00	1.52E+00	3.49E+00
		283.69		1.70	-9.40E-01		2.14E+00
		300.07		2.47	1.76E-01		1.52E+00
		302.65		2.20	1.42E+00		1.79E+00
		330.06		1.40	5.04E-01		2.95E+00
+	U-235	143.76		10.96	-5.82E-02	4.44E-02	4.10E-01
		163.33		5.08	-2.63E-01		7.82E-01
		185.71	*	57.20	3.71E-02		4.44E-02
		202.11		1.08	1.67E+00		3.88E+00
		205.31		5.01	4.26E-01		8.52E-01
	Am-241	59.54		35.90	4.19E-01	1.12E+00	1.12E+00

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

0000048728.CNF



Apex-Gamma

Analysis Report for 26-Jul-18-10010
L1-12107K-FSGS-009SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10010
Sample Description	: L1-12107K-FSGS-009SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.335E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:32:00PM
Acquisition Started	: 7/26/2018 9:22:32AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 12/15/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48729
Fill Height	: 1334.55 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

JW 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 9:37:52AM

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

DATA VERIFIED 7/26/18 1200
T Graham

Analysis Report for 26-Jul-18-10010

L1-12107K-FSGS-009SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.87	296 -	317	300.04	3.04E+01	10.35	5.49E+01	0.69
m	2	77.51	296 -	317	310.55	5.08E+01	14.42	6.97E+01	0.70
	3	238.74	947 -	960	954.56	1.51E+02	17.40	5.51E+01	1.06
	4	295.27	1176 -	1186	1180.36	4.00E+01	10.02	2.50E+01	0.45
	5	352.07	1399 -	1414	1407.28	1.10E+02	13.29	2.21E+01	1.01
	6	583.21	2322 -	2336	2330.97	5.96E+01	9.00	7.41E+00	0.38
	7	609.22	2430 -	2440	2434.94	7.12E+01	10.09	1.28E+01	1.10
	8	1460.39	5826 -	5851	5839.49	3.53E+02	19.86	9.73E+00	1.99

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.82	*	10.66	8.29E+00	5.89E-01
Tl-208	1.00	583.19	*	85.00	9.31E-02	1.51E-02
Bi-211	0.85	351.07	*	13.02	7.82E-01	1.14E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.47E-01	3.48E-02
		300.09		3.30		
Pb212-XR	0.98	74.82	*	10.28	3.96E-01	1.41E-01
		77.11	*	17.10	3.60E-01	1.09E-01
		87.35		3.97		

Analysis Report for 26-Jul-18-10010

L1-12107K-FSGS-009SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.98	89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.14E-01	3.30E-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	1.76E-01	4.64E-02
		351.93	*	35.60	2.86E-01	4.15E-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	0.970	8.29E+00	5.89E-01	
Tl-208	1.000	9.31E-02	1.51E-02	
Bi-211	0.853	3.00E-01	1.70E-01	
Pb-212	0.998	2.47E-01	3.48E-02	

Analysis Report for 26-Jul-18-10010

L1-12107K-FSGS-009SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	Pb212-XR	0.987	3.73E-01	8.60E-02	
	Bi-214	0.999	2.14E-01	3.30E-02	
	Pb-214	0.998	1.76E-01	4.64E-02	
X	Pb214-XR	0.987			

? = 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 26-Jul-18-10010

L1-12107K-FSGS-009SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 9:37:52AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.38E-02	5.26E-02	5.26E-02
	BE-7	477.60		10.44	1.46E-01	4.07E-01	4.07E-01
+	K-40	1460.82	*	10.66	8.29E+00	5.79E-01	5.79E-01
	Co-60	1173.23		99.85	-4.88E-02	6.26E-02	6.79E-02
		1332.49		99.98	2.86E-02		6.26E-02
	Nb-94	702.65		99.81	1.12E-02	4.54E-02	4.54E-02
		871.09		99.89	1.31E-02		4.95E-02
	Ag-108m	79.13		6.60	5.24E-01	4.09E-02	1.15E+00
		433.94		90.50	-8.94E-04		4.09E-02
		614.28		89.80	-1.14E-01		6.42E-02
		722.94		90.80	-1.98E-02		5.23E-02
	Sb-125	176.31		6.84	1.52E-01	1.33E-01	4.56E-01
		380.45		1.52	2.58E-01		2.10E+00
		427.87		29.60	5.29E-02		1.33E-01
		463.36		10.49	-7.66E-02		3.96E-01
		600.60		17.65	2.26E-01		2.37E-01
		606.71		4.98	2.33E+00		1.46E+00
		635.95		11.22	-9.69E-02		3.55E-01
		671.44		1.79	-1.42E+00		2.24E+00

Analysis Report for 26-Jul-18-10010

L1-12107K-FSGS-009SB

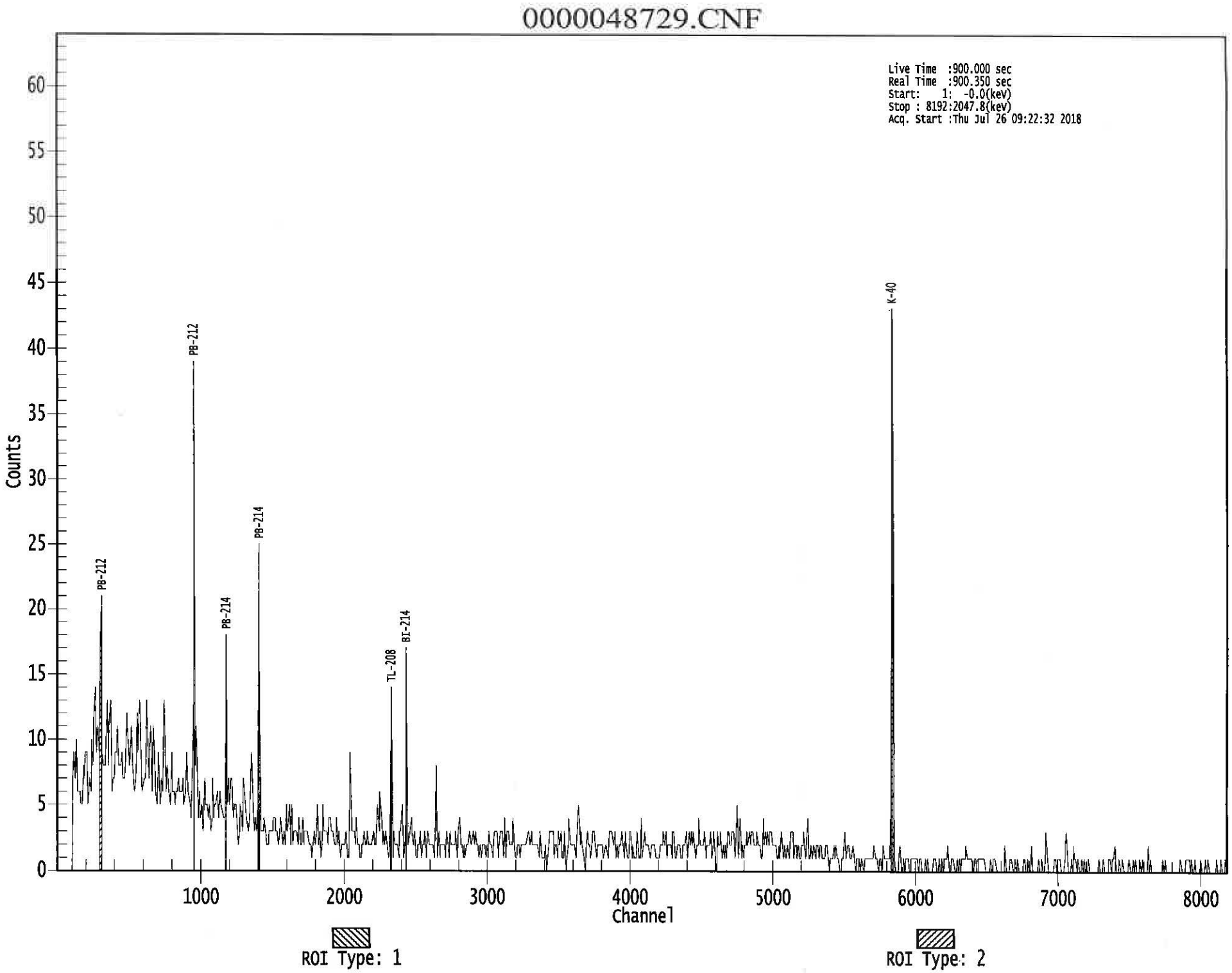
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	9.93E-01	7.21E-02	2.80E+00
	81.00	32.90	1.27E-02		1.79E-01
	276.40	7.16	-1.05E-01		4.84E-01
	302.85	18.34	-1.31E-01		1.98E-01
	356.01	62.05	-2.08E-02		7.21E-02
	383.85	8.94	-1.10E-01		3.71E-01
Cs-134	475.36	1.48	3.21E-01	5.69E-02	2.81E+00
	563.25	8.34	-1.31E-01		5.34E-01
	569.33	15.37	2.76E-02		2.52E-01
	604.72	97.62	-1.09E-01		6.54E-02
	795.86	85.46	1.47E-02		5.69E-02
	801.95	8.69	-7.53E-02		4.83E-01
	1038.61	0.99	3.08E+00		5.90E+00
	1167.97	1.79	1.92E+00		3.78E+00
	1365.19	3.02	-1.59E+00		1.42E+00
Cs-137	661.66	85.10	5.03E-02	6.21E-02	6.21E-02
Eu-152	121.78	28.67	5.29E-02	1.26E-01	1.26E-01
	244.70	7.61	4.97E-01		5.32E-01
	295.94	0.45	4.57E+00		9.79E+00
	344.28	26.60	9.31E-02		1.31E-01
	367.79	0.86	-3.24E-01		3.47E+00
	411.12	2.24	4.18E-01		1.58E+00
	443.96	2.83	-9.62E-01		1.16E+00
	488.68	0.42	2.83E+00		8.38E+00
	563.99	0.49	-3.16E+00		8.78E+00
	586.26	0.46	-1.04E+01		1.33E+01
	678.62	0.47	-4.91E+00		8.40E+00
	688.67	0.86	2.07E+00		5.21E+00
	719.35	0.28	5.94E-01		1.63E+01
	778.90	12.96	1.57E-01		3.86E-01
	810.45	0.32	5.21E+00		1.53E+01
	867.37	4.26	-8.65E-02		1.08E+00
	919.33	0.43	1.55E+00		1.01E+01
	964.08	14.65	9.86E-02		4.45E-01
	1085.87	10.24	2.12E-01		5.61E-01
	1089.74	1.73	-1.09E+00		3.22E+00
	1112.07	13.69	-1.39E-01		4.59E-01
	1212.95	1.43	2.36E+00		5.43E+00
	1249.94	0.19	-1.13E+00		3.79E+01
	1299.14	1.63	-3.08E-01		3.92E+00
	1408.01	21.07	1.04E-01		1.99E-01
	1457.64	0.50	1.72E+02		4.71E+01
	1528.10	0.28	2.76E+00		1.03E+01
Eu-154	123.07	40.40	1.90E-02	8.80E-02	8.80E-02
	247.93	6.89	-1.91E-01		4.85E-01
	591.76	4.95	-9.78E-01		6.45E-01
	692.42	1.78	3.75E-01		2.42E+00
	723.30	20.06	8.34E-02		2.43E-01
	756.80	4.52	3.53E-01		9.44E-01
	873.18	12.08	-1.78E-01		4.16E-01
	996.29	10.48	-2.40E-01		5.42E-01

Analysis Report for 26-Jul-18-10010

L1-12107K-FSGS-009SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	2.89E-01	8.80E-02	3.17E-01
	1274.43	34.80	-1.23E-01		1.92E-01
	1596.48	1.80	-6.09E-01		2.18E+00
Eu-155	45.30	1.31	1.02E+01	1.95E-01	1.18E+01
	60.01	1.22	5.79E+00		1.17E+01
	86.55	30.70	3.65E-02		1.95E-01
	105.31	21.10	-1.22E-02		1.96E-01
Ra-226	186.21	3.64	2.24E-01	9.81E-01	9.81E-01
Pa-231	27.36	10.30	3.73E-02	1.07E+00	1.07E+00
	283.69	1.70	5.94E-01		2.07E+00
	300.07	2.47	-3.05E-01		1.55E+00
	302.65	2.20	-1.30E+00		1.64E+00
	330.06	1.40	-4.93E-01		2.38E+00
U-235	143.76	10.96	-2.02E-02	6.33E-02	3.23E-01
	163.33	5.08	-5.25E-02		6.68E-01
	185.71	57.20	2.21E-02		6.33E-02
	202.11	1.08	7.95E-01		2.97E+00
	205.31	5.01	3.30E-02		6.09E-01
Am-241	59.54	35.90	-1.06E-01	3.90E-01	3.90E-01

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


0000048729.CNF
Live Time :900.000 sec
Real Time :900.350 sec
Start: 1: -0.0(keV)
Stop : 8192:2047.8(keV)
Acq. Start :Thu Jul 26 09:22:32 2018
Counts
Channel
PB-212
PB-212
PB-214
PB-214
TL-208
BI-214
K-40
ROI Type: 1
ROI Type: 2

Apex-Gamma

Analysis Report for 26-Jul-18-10011
L1-12107K-FSGS-010SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10011
Sample Description	: L1-12107K-FSGS-010SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.667E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:40:00PM
Acquisition Started	: 7/26/2018 9:43:05AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 8/9/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48731
Fill Height	: 1667.16 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

J. Welch 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 9:58:08AM

DATA VERIFIED 7/26/18 1200

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

J Groban / C

Analysis Report for 26-Jul-18-10011

L1-12107K-FSGS-010SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.65	473 -	481	477.48	1.41E+02	20.83	1.33E+02	1.26
2	295.23	585 -	593	590.52	5.99E+01	13.31	5.51E+01	1.27
3	351.96	698 -	708	703.86	9.93E+01	15.99	6.37E+01	1.18
4	583.22	1160 -	1171	1166.04	7.14E+01	11.33	2.26E+01	1.78
5	609.52	1214 -	1224	1218.62	5.93E+01	11.94	3.47E+01	1.27
6	661.62	1320 -	1328	1322.78	1.59E+02	14.89	2.77E+01	0.89
7	1173.20	2340 -	2350	2346.00	1.06E+02	12.95	2.58E+01	2.04
8	1332.38	2659 -	2671	2664.58	7.99E+01	11.40	1.91E+01	1.69
9	1460.66	2913 -	2928	2921.37	5.35E+02	23.39	4.00E+00	1.99

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.83E+00	6.06E-01
Co-60	0.99	1173.23	*	99.85	1.80E-01	2.30E-02
		1332.49	*	99.98	1.46E-01	2.17E-02
Cs-137	1.00	661.66	*	85.10	2.19E-01	2.43E-02
Tl-208	1.00	583.19	*	85.00	9.04E-02	1.53E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.95E-01	3.28E-02
		300.09		3.30		

Analysis Report for 26-Jul-18-10011

L1-12107K-FSGS-010SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	609.32	*	45.49	1.45E-01	3.03E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.21E-01	5.22E-02
		351.93	*	35.60	2.14E-01	3.85E-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	0.996	9.83E+00	6.06E-01	
	Co-60	0.999	1.62E-01	1.58E-02	
	Cs-137	1.000	2.19E-01	2.43E-02	
	Tl-208	1.000	9.04E-02	1.53E-02	
X	Bi-211	0.881			

Analysis Report for 26-Jul-18-10011

L1-12107K-FSGS-010SB

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
Pb-212	1.000	1.95E-01	3.28E-02	
Bi-214	0.997	1.45E-01	3.03E-02	
Pb-214	1.000	2.17E-01	3.10E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 26-Jul-18-10011

L1-12107K-FSGS-010SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 9:58:08AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.43E-02	5.39E-02	5.39E-02
	BE-7	477.60		10.44	8.44E-02	3.60E-01	3.60E-01
+	K-40	1460.82	*	10.66	9.83E+00	2.69E-01	2.69E-01
+	Co-60	1173.23	*	99.85	1.80E-01	4.93E-02	4.99E-02
		1332.49	*	99.98	1.46E-01		4.93E-02
	Nb-94	702.65		99.81	-1.06E-02	4.00E-02	4.00E-02
		871.09		99.89	2.79E-02		4.80E-02
	Ag-108m	79.13		6.60	3.03E-01	4.01E-02	1.23E+00
		433.94		90.50	-2.68E-04		4.01E-02
		614.28		89.80	-2.54E-03		5.54E-02
		722.94		90.80	-1.76E-02		4.37E-02
	Sb-125	176.31		6.84	1.99E-01	1.28E-01	5.41E-01
		380.45		1.52	7.43E-01		2.36E+00
		427.87		29.60	-2.12E-02		1.28E-01
		463.36		10.49	2.36E-03		3.39E-01
		600.60		17.65	3.83E-02		2.53E-01
		606.71		4.98	-2.08E-01		1.28E+00
		635.95		11.22	1.99E-02		3.74E-01
		671.44		1.79	-1.75E+00		1.83E+00

Analysis Report for 26-Jul-18-10011

L1-12107K-FSGS-010SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	1.04E+00	7.54E-02	2.92E+00
		81.00		32.90	-2.07E-01		2.01E-01
		276.40		7.16	3.38E-01		5.13E-01
		302.85		18.34	2.31E-02		1.90E-01
		356.01		62.05	-2.37E-02		7.54E-02
		383.85		8.94	-9.34E-02		3.90E-01
	Cs-134	475.36		1.48	1.74E-01	5.52E-02	2.49E+00
		563.25		8.34	2.06E-01		5.25E-01
		569.33		15.37	3.49E-02		2.84E-01
		604.72		97.62	-2.65E-02		5.52E-02
		795.86		85.46	9.64E-03		5.62E-02
		801.95		8.69	-1.50E-01		5.56E-01
		1038.61		0.99	-3.13E+00		4.88E+00
		1167.97		1.79	-1.86E+00		5.13E+00
		1365.19		3.02	-1.43E-01		1.40E+00
+	Cs-137	661.66	*	85.10	2.19E-01	4.07E-02	4.07E-02
	Eu-152	121.78		28.67	1.67E-02	1.19E-01	1.19E-01
		244.70		7.61	6.96E-02		5.21E-01
		295.94		0.45	-3.29E+00		9.00E+00
		344.28		26.60	-2.39E-02		1.48E-01
		367.79		0.86	7.41E-02		3.87E+00
		411.12		2.24	5.06E-02		1.61E+00
		443.96		2.83	7.70E-02		1.29E+00
		488.68		0.42	1.69E+00		1.04E+01
		563.99		0.49	4.66E+00		9.04E+00
		586.26		0.46	-1.64E+00		1.21E+01
		678.62		0.47	4.31E+00		8.92E+00
		688.67		0.86	-1.12E+00		4.19E+00
		719.35		0.28	2.07E+00		1.47E+01
		778.90		12.96	-2.05E-01		3.09E-01
		810.45		0.32	-3.51E+00		1.35E+01
		867.37		4.26	-3.82E-01		1.10E+00
		919.33		0.43	-1.35E+00		1.08E+01
		964.08		14.65	-7.75E-02		4.11E-01
		1085.87		10.24	-2.16E-01		5.10E-01
		1089.74		1.73	-1.05E+00		2.91E+00
		1112.07		13.69	-3.65E-02		4.05E-01
		1212.95		1.43	1.30E+00		4.49E+00
		1249.94		0.19	-1.58E+01		2.87E+01
		1299.14		1.63	2.34E+00		4.04E+00
		1408.01		21.07	5.98E-02		2.00E-01
		1457.64		0.50	-1.09E+00		4.46E+01
		1528.10		0.28	-1.80E-01		1.05E+01
	Eu-154	123.07		40.40	-4.22E-03	8.26E-02	8.26E-02
		247.93		6.89	-2.04E-01		5.07E-01
		591.76		4.95	-5.14E-01		6.95E-01
		692.42		1.78	-3.53E-01		2.14E+00
		723.30		20.06	-1.00E-01		1.95E-01
		756.80		4.52	-1.94E-01		9.15E-01
		873.18		12.08	3.14E-02		3.80E-01
		996.29		10.48	1.86E-01		5.20E-01

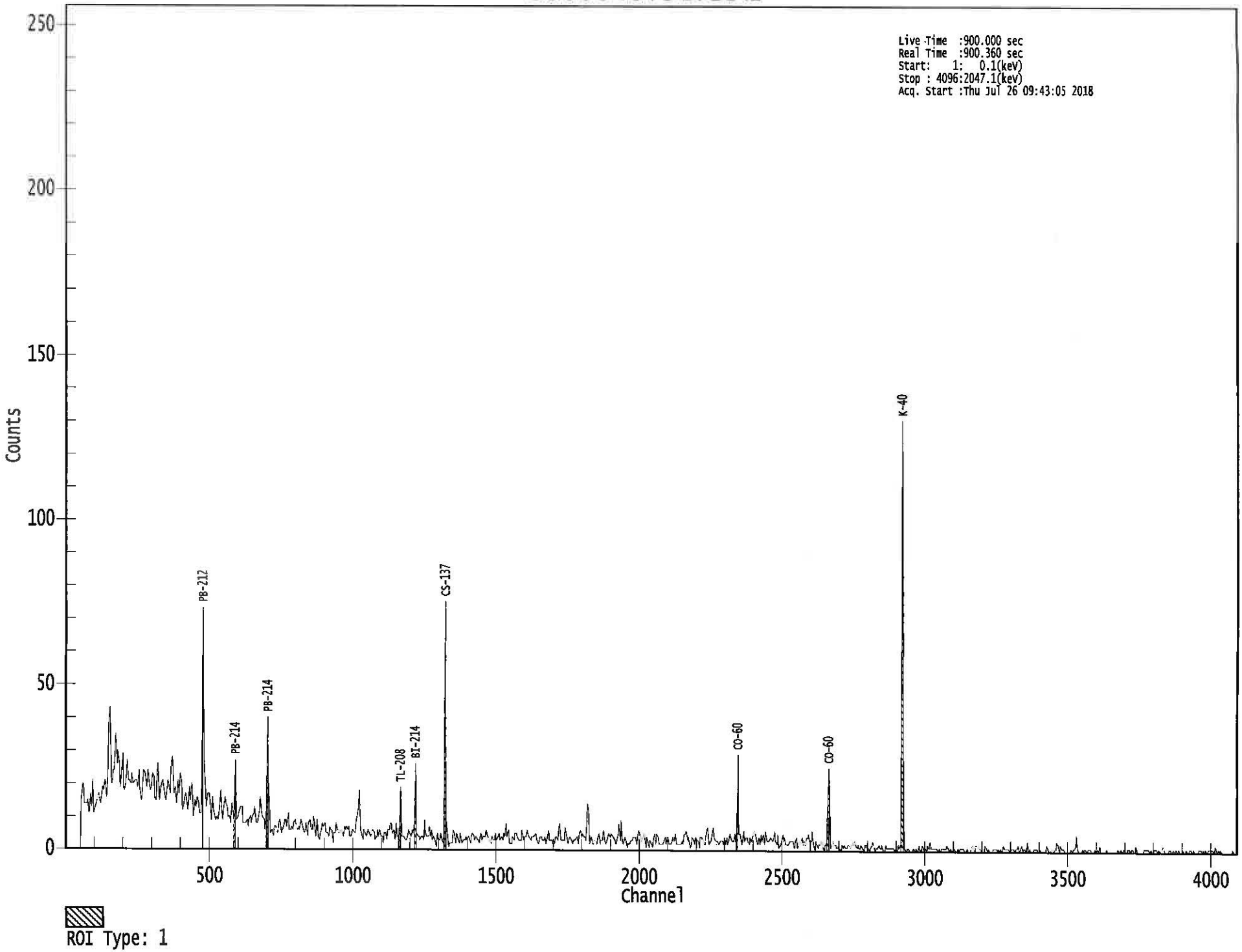
Analysis Report for 26-Jul-18-10011

L1-12107K-FSGS-010SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	7.66E-02	8.26E-02	3.22E-01
	1274.43	34.80	-3.02E-02		1.51E-01
	1596.48	1.80	-9.90E-01		1.81E+00
Eu-155	45.30	1.31	6.94E+00	1.99E-01	1.22E+01
	60.01	1.22	-6.91E+00		1.28E+01
	86.55	30.70	5.97E-02		1.99E-01
	105.31	21.10	1.00E-01		2.01E-01
Ra-226	186.21	3.64	8.03E-01	1.11E+00	1.11E+00
Pa-231	27.36	10.30	8.17E-01	1.27E+00	1.27E+00
	283.69	1.70	-8.93E-02		1.94E+00
	300.07	2.47	-1.58E+00		1.38E+00
	302.65	2.20	1.92E-01		1.58E+00
	330.06	1.40	6.23E-01		2.75E+00
U-235	143.76	10.96	2.35E-02	7.09E-02	3.10E-01
	163.33	5.08	2.14E-01		7.67E-01
	185.71	57.20	4.78E-02		7.09E-02
	202.11	1.08	1.44E+00		3.40E+00
	205.31	5.01	-3.31E-01		6.92E-01
Am-241	59.54	35.90	-9.33E-02	4.52E-01	4.52E-01

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

0000048731.CNF



Apex-Gamma

Analysis Report for 26-Jul-18-10012
L1-12107K-FSGS-011SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10012
Sample Description	: L1-12107K-FSGS-011SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.394E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 1:53:00PM
Acquisition Started	: 7/26/2018 9:43:11AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 12/23/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48732
Fill Height	: 1393.61 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

J.P. Welch 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 9:58:15AM

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

DATA VERIFIED 7/26/18 1200

T Graham / C Jo

Analysis Report for 26-Jul-18-10012

L1-12107K-FSGS-011SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.61	948 -	961	954.52	1.20E+02	18.92	8.50E+01	0.87
2	295.05	1176 -	1186	1180.10	6.25E+01	11.13	2.45E+01	1.01
3	352.03	1402 -	1416	1407.84	7.95E+01	12.81	2.85E+01	1.23
4	583.39	2326 -	2338	2332.75	4.05E+01	8.86	1.45E+01	0.82
5	609.37	2430 -	2443	2436.63	8.24E+01	12.03	2.26E+01	1.29
6	1120.19	4474 -	4486	4479.87	2.01E+01	6.39	7.93E+00	0.64
7	1460.78	5832 -	5855	5842.95	3.84E+02	20.20	6.00E+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	1.00	1460.82	*	10.66	9.86E+00	6.73E-01
Tl-208	0.99	583.19	*	85.00	6.93E-02	1.57E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.19E-01	3.88E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.72E-01	4.29E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	3.06E-01	9.82E-02

Analysis Report for 26-Jul-18-10012

L1-12107K-FSGS-011SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	3.04E-01	5.94E-02
		351.93	*	35.60	2.28E-01	4.10E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	9.86E+00	6.73E-01	
	Tl-208	0.994	6.93E-02	1.57E-02	
X	Bi-211	0.863			
	Pb-212	1.000	2.19E-01	3.88E-02	
	Bi-214	1.000	2.77E-01	3.93E-02	
	Pb-214	0.998	2.52E-01	3.37E-02	

Analysis Report for 26-Jul-18-10012

L1-12107K-FSGS-011SB

? = 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 26-Jul-18-10012

L1-12107K-FSGS-011SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 9:58:15AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.89E-02	5.84E-02	5.84E-02
	BE-7	477.60		10.44	1.59E-01	4.38E-01	4.38E-01
+	K-40	1460.82	*	10.66	9.86E+00	5.02E-01	5.02E-01
	Co-60	1173.23		99.85	2.58E-02	5.31E-02	7.97E-02
		1332.49		99.98	-1.15E-02		5.31E-02
	Nb-94	702.65		99.81	4.58E-03	5.11E-02	5.11E-02
		871.09		99.89	5.09E-03		5.66E-02
	Ag-108m	79.13		6.60	8.28E-01	3.81E-02	2.08E+00
		433.94		90.50	-1.61E-02		3.81E-02
		614.28		89.80	-3.20E-02		7.86E-02
		722.94		90.80	-2.44E-02		6.37E-02
	Sb-125	176.31		6.84	2.34E-01	1.37E-01	6.07E-01
		380.45		1.52	-1.27E+00		2.47E+00
		427.87		29.60	-6.60E-02		1.37E-01
		463.36		10.49	2.30E-01		4.69E-01
		600.60		17.65	8.18E-02		2.60E-01
		606.71		4.98	3.30E+00		1.75E+00
		635.95		11.22	3.10E-02		4.19E-01
		671.44		1.79	-5.98E-01		2.49E+00

Analysis Report for 26-Jul-18-10012

L1-12107K-FSGS-011SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-8.27E-01	8.54E-02	4.86E+00
	81.00	32.90	-2.67E-01		3.34E-01
	276.40	7.16	-9.36E-02		6.02E-01
	302.85	18.34	-1.31E-01		2.06E-01
	356.01	62.05	-1.48E-02		8.54E-02
	383.85	8.94	-1.13E-01		4.39E-01
Cs-134	475.36	1.48	-1.22E+00	6.58E-02	3.06E+00
	563.25	8.34	8.05E-03		5.40E-01
	569.33	15.37	2.50E-01		3.43E-01
	604.72	97.62	-2.18E-02		7.77E-02
	795.86	85.46	2.04E-02		6.58E-02
	801.95	8.69	-1.67E-01		6.34E-01
	1038.61	0.99	-5.54E+00		5.54E+00
	1167.97	1.79	1.53E+00		4.24E+00
	1365.19	3.02	6.20E-01		1.80E+00
Cs-137	661.66	85.10	4.06E-02	6.93E-02	6.93E-02
Eu-152	121.78	28.67	4.19E-02	1.40E-01	1.64E-01
	244.70	7.61	5.39E-01		6.86E-01
	295.94	0.45	1.00E+01		1.17E+01
	344.28	26.60	-6.75E-02		1.40E-01
	367.79	0.86	6.12E-01		4.73E+00
	411.12	2.24	-5.16E-01		1.89E+00
	443.96	2.83	2.57E-02		1.43E+00
	488.68	0.42	-1.91E+00		1.03E+01
	563.99	0.49	2.58E+00		9.51E+00
	586.26	0.46	-7.63E+00		1.41E+01
	678.62	0.47	3.86E+00		9.35E+00
	688.67	0.86	-3.10E+00		5.37E+00
	719.35	0.28	5.58E+00		1.98E+01
	778.90	12.96	2.81E-01		3.99E-01
	810.45	0.32	7.92E+00		1.58E+01
	867.37	4.26	1.40E-01		1.32E+00
	919.33	0.43	4.10E+00		1.49E+01
	964.08	14.65	-5.98E-03		5.82E-01
	1085.87	10.24	-4.50E-01		6.14E-01
	1089.74	1.73	-4.73E-01		3.76E+00
	1112.07	13.69	-3.91E-01		4.19E-01
	1212.95	1.43	1.65E+00		6.18E+00
	1249.94	0.19	-2.44E+01		3.53E+01
	1299.14	1.63	2.48E-01		4.57E+00
	1408.01	21.07	-1.25E-01		2.71E-01
	1457.64	0.50	2.09E+02		5.36E+01
	1528.10	0.28	8.05E+00		1.65E+01
Eu-154	123.07	40.40	-7.71E-02	1.16E-01	1.16E-01
	247.93	6.89	8.42E-02		6.08E-01
	591.76	4.95	-4.40E-01		9.16E-01
	692.42	1.78	-1.29E+00		2.60E+00
	723.30	20.06	6.50E-02		2.92E-01
	756.80	4.52	5.20E-01		1.01E+00
	873.18	12.08	7.15E-02		4.82E-01
	996.29	10.48	1.70E-01		5.93E-01

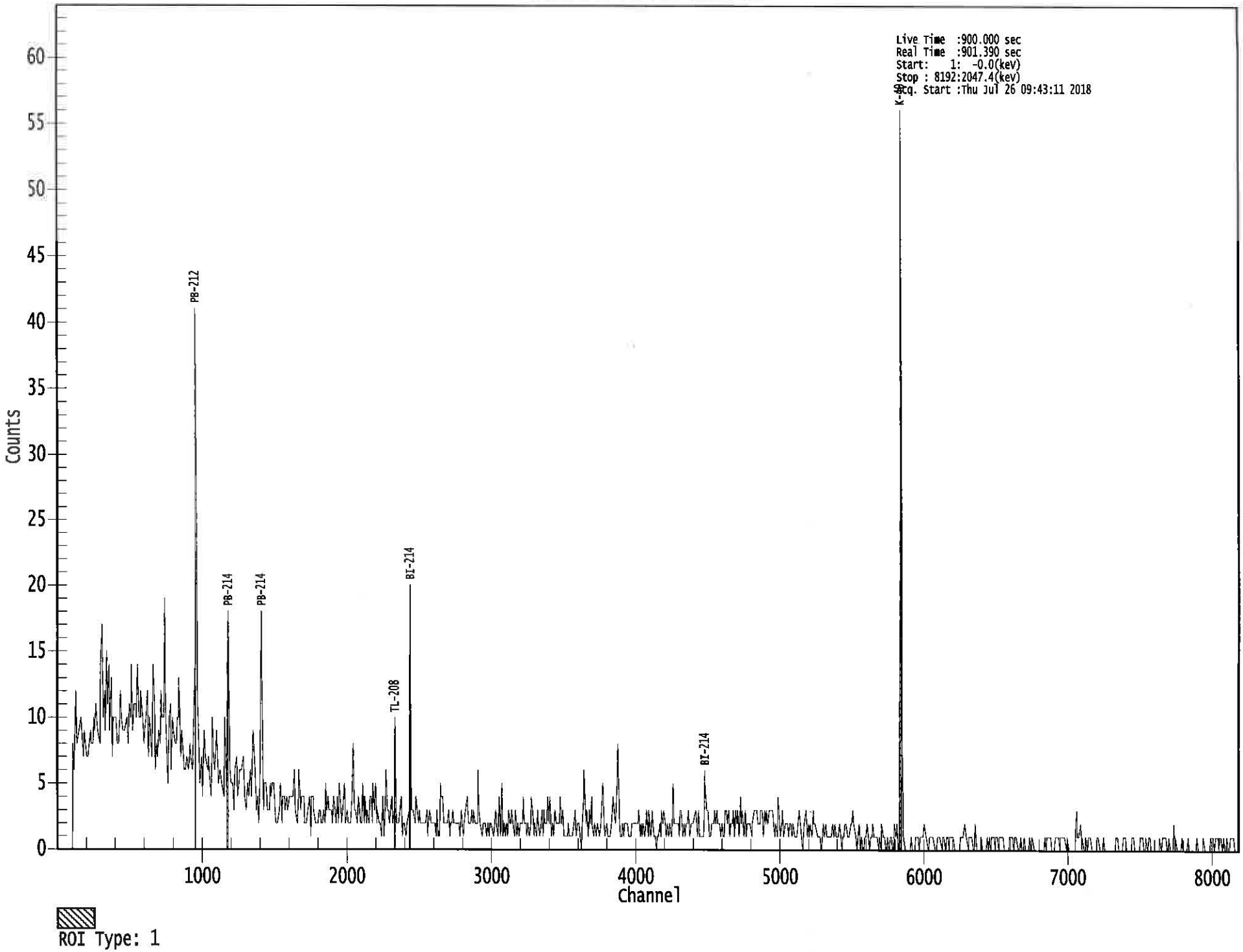
Analysis Report for 26-Jul-18-10012

L1-12107K-FSGS-011SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-2.27E-01	1.16E-01	2.92E-01
	1274.43	34.80	-2.19E-02		1.77E-01
	1596.48	1.80	-2.06E+00		1.58E+00
Eu-155	45.30	1.31	2.20E+01	2.83E-01	3.28E+01
	60.01	1.22	-1.32E+01		3.15E+01
	86.55	30.70	1.41E-02		3.03E-01
	105.31	21.10	8.11E-03		2.83E-01
Ra-226	186.21	3.64	1.74E+00	1.36E+00	1.36E+00
Pa-231	27.36	10.30	2.24E+00	1.67E+00	3.47E+00
	283.69	1.70	-5.83E-01		2.20E+00
	300.07	2.47	1.56E-01		1.67E+00
	302.65	2.20	-8.43E-01		1.72E+00
	330.06	1.40	7.97E-01		2.99E+00
U-235	143.76	10.96	-3.99E-01	8.61E-02	3.87E-01
	163.33	5.08	-5.37E-01		8.05E-01
	185.71	57.20	9.35E-02		8.61E-02
	202.11	1.08	-1.66E-01		3.87E+00
	205.31	5.01	-2.01E-01		8.52E-01
Am-241	59.54	35.90	6.48E-01	1.17E+00	1.17E+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

0000048732.CNF



Apex-Gamma

Analysis Report for 26-Jul-18-10013
L1-12107K-FSGS-012SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10013
Sample Description	: L1-12107K-FSGS-012SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.535E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:04:00PM
Acquisition Started	: 7/26/2018 9:43:18AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 12/15/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48733
Fill Height	: 1534.50 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

J.P. Welch 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 9:58:33AM

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

DATA VERIFIED 7/26/18 1200
T Graham / C

Analysis Report for 26-Jul-18-10013

L1-12107K-FSGS-012SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.19	306 -	315	309.29	3.65E+01	14.53	7.45E+01	0.65
2	238.88	949 -	962	955.11	1.36E+02	18.18	7.03E+01	1.19
3	295.31	1174 -	1186	1180.54	7.21E+01	11.84	2.59E+01	0.68
4	352.04	1400 -	1415	1407.15	1.04E+02	13.61	2.73E+01	1.17
5	609.16	2426 -	2443	2434.67	9.33E+01	11.77	1.37E+01	1.07
6	1460.44	5827 -	5851	5839.71	4.09E+02	21.45	1.25E+01	2.23

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.82	*	10.66	9.16E+00	6.24E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.15E-01	3.37E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.58E-01	1.06E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.70E-01	3.77E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 26-Jul-18-10013

L1-12107K-FSGS-012SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	3.08E-01	5.62E-02
		351.93	*	35.60	2.61E-01	4.01E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	4.54E-01	1.88E-01
		87.35		2.24		
		89.78		0.82		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.977	9.16E+00	6.24E-01	
X	Bi-211	0.861			
	Pb-212	0.991	2.15E-01	3.37E-02	
?	Pb212-XR	0.999	2.58E-01	1.06E-01	

Analysis Report for 26-Jul-18-10013

L1-12107K-FSGS-012SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	Bi-214	0.998	2.70E-01	3.77E-02	
	Pb-214	0.999	2.77E-01	3.27E-02	
?	Pb214-XR	0.999	4.54E-01	1.88E-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 26-Jul-18-10013

L1-12107K-FSGS-012SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 9:58:33AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.63E-02	5.07E-02	5.07E-02
	BE-7	477.60		10.44	8.52E-02	3.28E-01	3.28E-01
+	K-40	1460.82	*	10.66	9.16E+00	6.10E-01	6.10E-01
	Co-60	1173.23		99.85	2.94E-03	4.50E-02	6.97E-02
		1332.49		99.98	-1.58E-02		4.50E-02
	Nb-94	702.65		99.81	-8.76E-03	3.84E-02	3.84E-02
		871.09		99.89	-2.30E-02		4.74E-02
	Ag-108m	79.13		6.60	-2.90E-01	3.90E-02	1.13E+00
		433.94		90.50	-2.52E-02		3.90E-02
		614.28		89.80	1.90E-02		6.51E-02
		722.94		90.80	4.62E-02		5.59E-02
	Sb-125	176.31		6.84	1.44E-02	1.16E-01	4.39E-01
		380.45		1.52	8.71E-01		2.36E+00
		427.87		29.60	-1.04E-01		1.16E-01
		463.36		10.49	1.07E-01		3.37E-01
		600.60		17.65	-4.20E-02		2.34E-01
		606.71		4.98	-1.65E-01		1.50E+00
		635.95		11.22	-6.73E-02		3.63E-01
		671.44		1.79	-1.12E+00		2.00E+00

Analysis Report for 26-Jul-18-10013

L1-12107K-FSGS-012SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-8.53E-01	7.08E-02	2.76E+00
	81.00	32.90	-1.09E-01		1.81E-01
	276.40	7.16	4.25E-02		4.60E-01
	302.85	18.34	-1.00E-02		1.83E-01
	356.01	62.05	-9.10E-03		7.08E-02
	383.85	8.94	-6.52E-04		3.74E-01
Cs-134	475.36	1.48	-1.96E-01	6.00E-02	2.09E+00
	563.25	8.34	2.19E-01		5.36E-01
	569.33	15.37	1.42E-01		2.75E-01
	604.72	97.62	-6.72E-03		6.73E-02
	795.86	85.46	6.19E-02		6.00E-02
	801.95	8.69	-1.90E-01		4.91E-01
	1038.61	0.99	1.78E+00		5.57E+00
	1167.97	1.79	-5.65E+00		3.52E+00
	1365.19	3.02	3.27E-01		1.66E+00
Cs-137	661.66	85.10	2.57E-02	4.78E-02	4.78E-02
Eu-152	121.78	28.67	-7.19E-02	1.15E-01	1.15E-01
	244.70	7.61	1.62E-02		4.89E-01
	295.94	0.45	7.96E+00		1.02E+01
	344.28	26.60	7.45E-03		1.30E-01
	367.79	0.86	-1.88E-01		3.44E+00
	411.12	2.24	2.89E-01		1.49E+00
	443.96	2.83	-1.11E+00		1.23E+00
	488.68	0.42	-9.26E+00		7.96E+00
	563.99	0.49	6.57E+00		9.27E+00
	586.26	0.46	1.09E+01		1.24E+01
	678.62	0.47	-9.97E+00		7.31E+00
	688.67	0.86	-1.36E+00		4.64E+00
	719.35	0.28	-4.59E+00		1.49E+01
	778.90	12.96	-1.44E-01		3.17E-01
	810.45	0.32	6.58E+00		1.34E+01
	867.37	4.26	-1.69E-01		1.21E+00
	919.33	0.43	-6.90E+00		9.46E+00
	964.08	14.65	4.33E-01		5.07E-01
	1085.87	10.24	-6.61E-01		5.02E-01
	1089.74	1.73	-5.02E-01		3.29E+00
	1112.07	13.69	4.65E-02		4.46E-01
	1212.95	1.43	6.19E-01		4.93E+00
	1249.94	0.19	1.95E+01		3.75E+01
	1299.14	1.63	-1.69E+00		3.21E+00
	1408.01	21.07	5.79E-02		2.56E-01
	1457.64	0.50	1.99E+02		4.84E+01
	1528.10	0.28	2.63E+00		9.82E+00
Eu-154	123.07	40.40	6.50E-03	8.59E-02	8.59E-02
	247.93	6.89	-4.76E-01		4.39E-01
	591.76	4.95	-9.36E-02		6.75E-01
	692.42	1.78	9.30E-01		2.39E+00
	723.30	20.06	1.23E-01		2.51E-01
	756.80	4.52	2.82E-01		1.04E+00
	873.18	12.08	-1.96E-01		4.11E-01
	996.29	10.48	-1.84E-01		5.20E-01

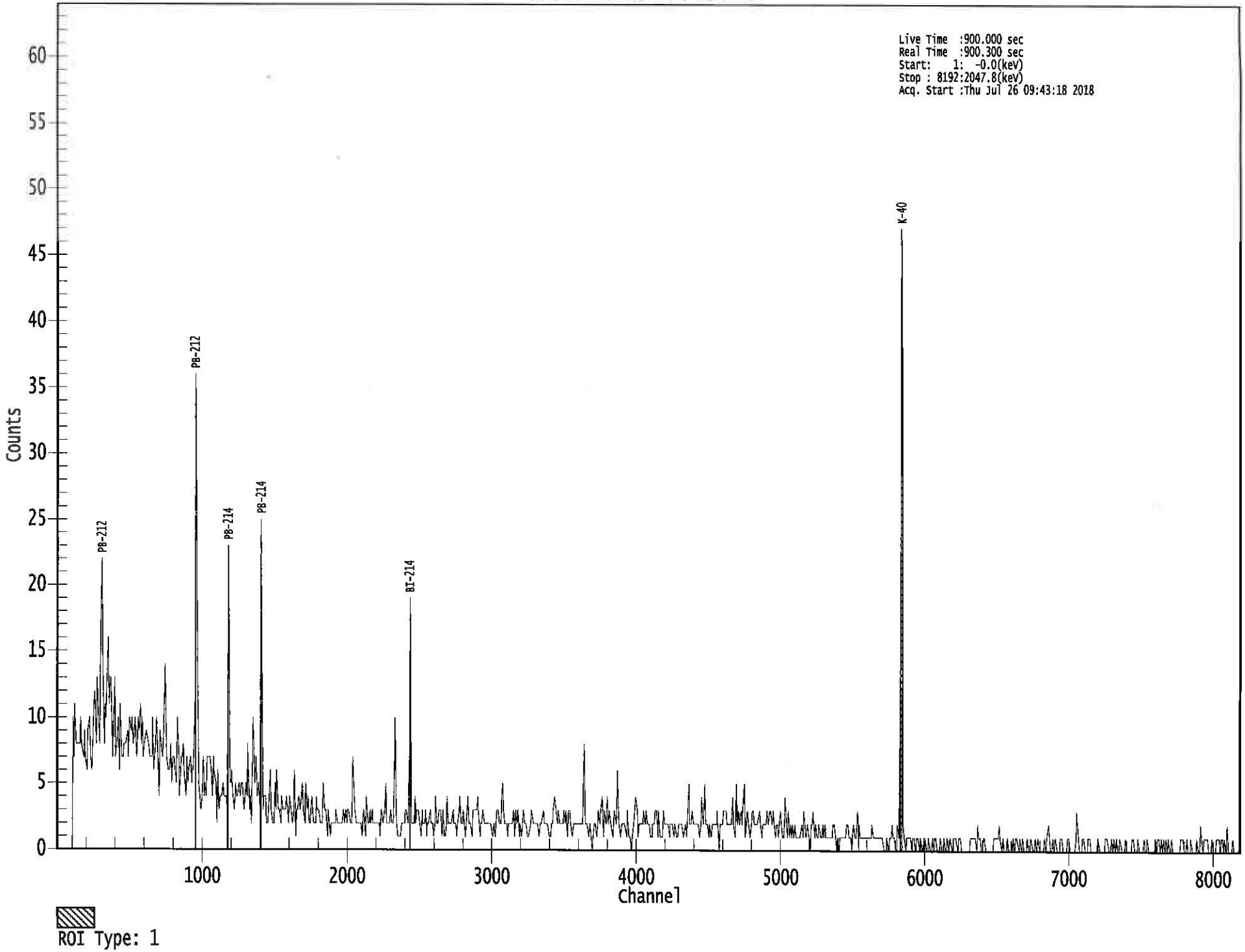
Analysis Report for 26-Jul-18-10013

L1-12107K-FSGS-012SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	6.99E-03	8.59E-02	3.25E-01
	1274.43	34.80	-1.01E-01		1.58E-01
	1596.48	1.80	7.48E-02		2.57E+00
Eu-155	45.30	1.31	-4.65E+00	1.81E-01	1.09E+01
	60.01	1.22	6.42E-02		1.18E+01
	86.55	30.70	1.39E-01		1.95E-01
	105.31	21.10	-5.16E-02		1.81E-01
Ra-226	186.21	3.64	1.09E+00	1.11E+00	1.11E+00
Pa-231	27.36	10.30	6.98E-01	1.30E+00	1.30E+00
	283.69	1.70	3.31E-02		1.75E+00
	300.07	2.47	-2.42E-01		1.36E+00
	302.65	2.20	-4.47E-02		1.52E+00
	330.06	1.40	-1.03E+00		2.46E+00
U-235	143.76	10.96	-1.86E-01	6.98E-02	3.40E-01
	163.33	5.08	2.84E-01		6.37E-01
	185.71	57.20	3.94E-02		6.98E-02
	202.11	1.08	8.80E-01		2.84E+00
	205.31	5.01	1.44E-02		6.24E-01
Am-241	59.54	35.90	4.52E-02	4.17E-01	4.17E-01

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

0000048733.CNF



Apex-Gamma

Analysis Report for 26-Jul-18-10014

L1-12107K-FSGS-013SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10014
Sample Description	: L1-12107K-FSGS-013SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.686E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:26:00PM
Acquisition Started	: 7/26/2018 9:43:26AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 3/12/2018
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	: install
Sample Number	: 48734
Fill Height	: 1686.20 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

J.P. Welch 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 9:58:30AM

DATA VERIFIED 7/26/18 1200

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

JBrodan

Analysis Report for 26-Jul-18-10014

L1-12107K-FSGS-013SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.07	741 -	750	745.00	3.41E+01	11.07	3.89E+01	0.53
2	238.58	950 -	959	954.81	1.22E+02	14.59	4.00E+01	1.16
3	295.36	1174 -	1187	1181.68	6.95E+01	12.28	2.95E+01	1.16
4	351.83	1402 -	1416	1407.32	5.79E+01	11.79	2.81E+01	0.78
5	583.34	2326 -	2338	2332.68	5.69E+01	8.84	8.09E+00	1.28
6	609.48	2428 -	2445	2437.20	9.54E+01	10.81	6.65E+00	0.80
7	661.51	2638 -	2651	2645.23	4.24E+01	8.92	1.36E+01	0.78
8	911.21	3636 -	3651	3643.88	3.49E+01	8.80	1.41E+01	0.40
9	1460.86	5831 -	5856	5843.81	4.22E+02	21.18	6.38E+00	2.20

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	8.61E+00	5.71E-01
Cs-137	0.99	661.66	*	85.10	6.45E-02	1.41E-02
Tl-208	0.99	583.19	*	85.00	7.98E-02	1.33E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.88E-01	2.72E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.57E-01	3.30E-02
		768.36		4.89		

Analysis Report for 26-Jul-18-10014

L1-12107K-FSGS-013SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.84E-01	5.52E-02
		351.93	*	35.60	1.38E-01	3.03E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	5.64E-01	1.89E-01
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.16E-01	5.52E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.98	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.59E-02	1.20E-02
		202.11		1.08		
		205.31		5.01		

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

Analysis Report for 26-Jul-18-10014

L1-12107K-FSGS-013SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	8.61E+00	5.71E-01	
	Cs-137	0.997	6.45E-02	1.41E-02	
	Tl-208	0.996	7.98E-02	1.33E-02	
X	Bi-211	0.912			
	Pb-212	1.000	1.88E-01	2.72E-02	
	Bi-214	0.998	2.57E-01	3.30E-02	
	Pb-214	0.998	1.72E-01	2.66E-02	
?	Ra-226	0.997	5.64E-01	1.89E-01	
	Ac-228	1.000	2.16E-01	5.52E-02	
?	~~U-235~~ Ra-226	~~0.986~~	~~3.59E-02~~	~~1.20E-02~~	

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

Errors quoted at 1.000sigma

JPW 7-26-18

U-235 only 1 peak

Analysis Report for 26-Jul-18-10014

L1-12107K-FSGS-013SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 9:58:30AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.00E-02	5.64E-02	5.64E-02
	BE-7	477.60		10.44	2.26E-01	3.95E-01	3.95E-01
+	K-40	1460.82	*	10.66	8.61E+00	4.17E-01	4.17E-01
	Co-60	1173.23		99.85	7.28E-02	5.93E-02	7.46E-02
		1332.49		99.98	4.44E-02		5.93E-02
	Nb-94	702.65		99.81	8.09E-03	3.93E-02	3.93E-02
		871.09		99.89	1.51E-02		3.93E-02
	Ag-108m	79.13		6.60	1.42E+00	3.60E-02	1.56E+00
		433.94		90.50	-9.20E-03		3.60E-02
		614.28		89.80	-4.82E-03		7.43E-02
		722.94		90.80	6.97E-03		4.53E-02
	Sb-125	176.31		6.84	2.66E-01	1.19E-01	5.08E-01
		380.45		1.52	1.52E+00		2.52E+00
		427.87		29.60	6.16E-02		1.19E-01
		463.36		10.49	3.13E-01		4.23E-01
		600.60		17.65	1.19E-01		2.10E-01
		606.71		4.98	1.99E+00		1.35E+00
		635.95		11.22	2.54E-01		3.69E-01
		671.44		1.79	-1.53E+00		2.00E+00

Analysis Report for 26-Jul-18-10014

L1-12107K-FSGS-013SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	1.90E+00	6.90E-02	3.70E+00
		81.00		32.90	-2.39E-01		2.53E-01
		276.40		7.16	-4.45E-01		4.92E-01
		302.85		18.34	8.65E-02		2.03E-01
		356.01		62.05	-3.23E-02		6.90E-02
		383.85		8.94	-2.81E-01		3.82E-01
	Cs-134	475.36		1.48	8.54E-02	4.67E-02	2.71E+00
		563.25		8.34	-1.52E-01		4.90E-01
		569.33		15.37	-4.01E-02		2.71E-01
		604.72		97.62	-2.23E-02		6.45E-02
		795.86		85.46	-2.63E-02		4.67E-02
		801.95		8.69	1.77E-01		5.21E-01
		1038.61		0.99	6.39E-01		4.96E+00
		1167.97		1.79	2.24E+00		3.98E+00
		1365.19		3.02	-6.31E-01		1.13E+00
+	Cs-137	661.66	*	85.10	6.45E-02	3.59E-02	3.59E-02
	Eu-152	121.78		28.67	4.15E-02	1.24E-01	1.43E-01
		244.70		7.61	-3.63E-01		4.66E-01
		295.94		0.45	1.26E+01		1.08E+01
		344.28		26.60	-8.47E-02		1.24E-01
		367.79		0.86	2.28E+00		3.95E+00
		411.12		2.24	3.41E-01		1.71E+00
		443.96		2.83	-3.17E-01		1.23E+00
		488.68		0.42	4.52E+00		8.67E+00
		563.99		0.49	2.80E+00		8.58E+00
		586.26		0.46	1.20E+01		1.24E+01
		678.62		0.47	1.10E+00		6.93E+00
		688.67		0.86	3.04E+00		4.64E+00
		719.35		0.28	3.45E-01		1.38E+01
		778.90		12.96	-1.43E-01		3.73E-01
		810.45		0.32	-2.90E+00		1.44E+01
		867.37		4.26	-1.27E+00		9.37E-01
		919.33		0.43	-2.11E+01		1.09E+01
		964.08		14.65	-4.32E-01		4.38E-01
		1085.87		10.24	-5.16E-01		5.16E-01
		1089.74		1.73	1.45E+00		3.19E+00
		1112.07		13.69	-7.52E-03		4.03E-01
		1212.95		1.43	-3.23E+00		4.94E+00
		1249.94		0.19	1.39E+01		3.47E+01
		1299.14		1.63	9.62E-01		3.25E+00
		1408.01		21.07	-3.44E-02		2.28E-01
		1457.64		0.50	1.85E+02		4.47E+01
		1528.10		0.28	9.98E-01		1.17E+01
	Eu-154	123.07		40.40	-2.21E-02	9.96E-02	9.96E-02
		247.93		6.89	8.87E-02		4.85E-01
		591.76		4.95	-5.31E-02		7.19E-01
		692.42		1.78	-8.82E-01		2.12E+00
		723.30		20.06	4.67E-02		2.08E-01
		756.80		4.52	-9.48E-01		8.83E-01
		873.18		12.08	2.03E-01		3.25E-01
		996.29		10.48	2.42E-02		4.48E-01

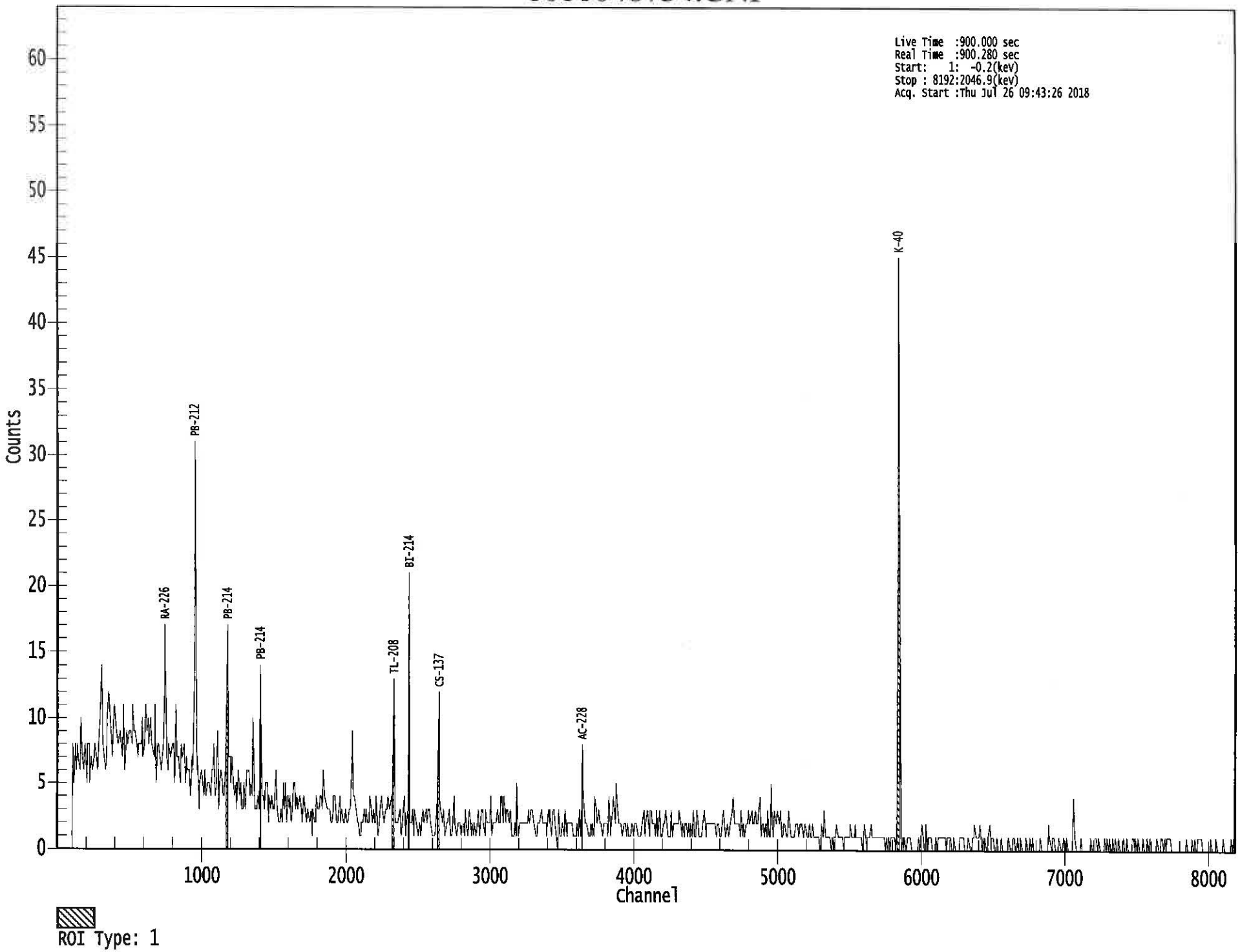
Analysis Report for 26-Jul-18-10014

L1-12107K-FSGS-013SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	4.25E-02	9.96E-02	2.75E-01
		1274.43		34.80	-8.16E-02		1.53E-01
		1596.48		1.80	2.45E-01		2.70E+00
	Eu-155	45.30		1.31	4.91E+00	2.25E-01	2.04E+01
		60.01		1.22	-8.21E+00		1.99E+01
		86.55		30.70	9.32E-02		2.27E-01
		105.31		21.10	-2.35E-02		2.25E-01
+	Ra-226	186.21	*	3.64	5.64E-01	5.75E-01	5.75E-01
	Pa-231	27.36		10.30	2.04E+00	1.64E+00	2.29E+00
		283.69		1.70	9.43E-01		2.08E+00
		300.07		2.47	-1.07E+00		1.64E+00
		302.65		2.20	5.32E-01		1.69E+00
		330.06		1.40	4.78E-01		2.77E+00
+	U-235	143.76		10.96	-3.09E-01	3.66E-02	3.32E-01
		163.33		5.08	-7.66E-02		6.78E-01
		185.71	*	57.20	3.59E-02		3.66E-02
		202.11		1.08	-6.20E-01		3.27E+00
		205.31		5.01	-2.35E-01		7.10E-01
	Am-241	59.54		35.90	-2.97E-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

0000048734.CNF



Apex-Gamma

Analysis Report for 26-Jul-18-10015
L1-12107K-FSGS-014SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10015
Sample Description	: L1-12107K-FSGS-014SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.653E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:34:00PM
Acquisition Started	: 7/26/2018 10:24:43AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 2700.0 seconds
Real Time	: 2701.1 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	: 8/9/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48742
Fill Height	: 1653.28 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

J.W. 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 11:21:49AM

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

DATA VERIFIED 7/26/18 1200
J Graham/C

Analysis Report for 26-Jul-18-10015
L1-12107K-FSGS-014SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.11	151 -	158	154.82	1.36E+02	31.36	4.16E+02	0.98
2	186.19	368 -	376	372.69	8.63E+01	28.35	3.36E+02	0.87
3	209.21	414 -	423	418.68	6.96E+01	26.67	2.84E+02	0.74
4	238.66	473 -	481	477.50	3.29E+02	35.58	4.26E+02	1.23
5	295.22	585 -	595	590.50	2.11E+02	25.87	1.93E+02	1.27
6	338.26	672 -	681	676.49	8.96E+01	22.66	1.87E+02	1.19
7	351.97	698 -	708	703.89	3.48E+02	26.54	1.50E+02	1.25
8	583.15	1160 -	1171	1165.91	2.00E+02	20.01	7.98E+01	1.47
9	609.23	1212 -	1223	1218.03	2.92E+02	21.45	6.75E+01	1.48
10	661.60	1316 -	1328	1322.72	1.81E+02	19.55	7.59E+01	1.52
11	911.09	1815 -	1826	1821.62	1.35E+02	17.02	6.15E+01	1.68
12	969.03	1934 -	1942	1937.52	4.78E+01	13.07	5.62E+01	1.14
13	1120.27	2234 -	2245	2240.09	5.78E+01	14.97	6.62E+01	1.51
14	1173.13	2340 -	2351	2345.87	7.42E+01	14.45	5.38E+01	1.61
15	1332.62	2660 -	2670	2665.06	3.88E+01	12.32	4.72E+01	0.98
16	1460.73	2913 -	2929	2921.51	1.51E+03	39.90	2.54E+01	2.06

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.28E+00	4.72E-01

Analysis Report for 26-Jul-18-10015

L1-12107K-FSGS-014SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Co-60	0.99	1173.23	*	99.85	4.19E-02	8.33E-03
		1332.49	*	99.98	2.38E-02	7.60E-03
Cs-137	0.99	661.66	*	85.10	8.30E-02	1.03E-02
Tl-208	1.00	583.19	*	85.00	8.46E-02	9.87E-03
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.52E-01	2.05E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	2.94E-01	7.43E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.82	609.32	*	45.49	2.37E-01	2.25E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.12E-01	5.57E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.60E-01	3.80E-02
		351.93	*	35.60	2.51E-01	2.77E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	5.18E-01	1.33E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	1.00	186.21	*	3.64	4.24E-01	1.43E-01
Ac-228	0.99	129.07		2.42		
		209.25	*	3.89	3.37E-01	1.32E-01
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.98E-01	5.27E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.52E-01	3.35E-02
		964.77		4.99		
		968.97	*	15.80	1.51E-01	4.19E-02
		1588.20		3.22		
U-235	0.97	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	2.70E-02	9.12E-03

Analysis Report for 26-Jul-18-10015

L1-12107K-FSGS-014SB

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
U-235	0.97	202.11 205.31	1.08 5.01		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	9.28E+00	4.72E-01	
	Co-60	0.998	3.20E-02	5.61E-03	
	Cs-137	0.999	8.30E-02	1.03E-02	
	Tl-208	1.000	8.46E-02	9.87E-03	
X	Bi-211	0.878			
	Pb-212	1.000	1.52E-01	2.05E-02	
?	Pb212-XR	1.000	2.94E-01	7.43E-02	
	Bi-214	0.823	2.33E-01	2.09E-02	
	Pb-214	1.000	2.54E-01	2.24E-02	
?	Pb214-XR	1.000	5.18E-01	1.33E-01	
?	Ra-226	1.000	4.24E-01	1.43E-01	
	Ac-228	0.999	2.14E-01	2.31E-02	
?	~~U-235~~ Ra-226	~~0.974~~	~~2.70E-02~~	~~9.12E-03~~	

? = 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

7-26-18

U-235 only 1 peak

Analysis Report for 26-Jul-18-10015

L1-12107K-FSGS-014SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 11:21:49AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.83E-02	2.84E-02	2.84E-02
	BE-7	477.60		10.44	4.88E-02	1.87E-01	1.87E-01
+	K-40	1460.82	*	10.66	9.28E+00	2.03E-01	2.03E-01
+	Co-60	1173.23	*	99.85	4.19E-02	2.38E-02	2.38E-02
		1332.49	*	99.98	2.38E-02		2.38E-02
	Nb-94	702.65		99.81	-1.40E-02	2.23E-02	2.23E-02
		871.09		99.89	-6.15E-03		2.37E-02
	Ag-108m	79.13		6.60	-1.30E-01	2.05E-02	6.13E-01
		433.94		90.50	-4.81E-03		2.05E-02
		614.28		89.80	-2.82E-02		3.06E-02
		722.94		90.80	1.47E-03		2.73E-02
	Sb-125	176.31		6.84	1.18E-01	6.27E-02	3.04E-01
		380.45		1.52	7.22E-01		1.25E+00
		427.87		29.60	-1.48E-02		6.27E-02
		463.36		10.49	1.10E-01		1.97E-01
		600.60		17.65	7.61E-03		1.25E-01
		606.71		4.98	-6.37E-02		7.37E-01
		635.95		11.22	1.16E-02		1.90E-01
		671.44		1.79	-2.59E-01		1.13E+00

Analysis Report for 26-Jul-18-10015

L1-12107K-FSGS-014SB

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61	2.65	-4.40E-01	4.15E-02	1.43E+00
		81.00	32.90	-1.26E-01		9.64E-02
		276.40	7.16	-2.73E-01		2.38E-01
		302.85	18.34	8.25E-03		9.60E-02
		356.01	62.05	-4.32E-02		4.15E-02
		383.85	8.94	2.65E-03		2.15E-01
	Cs-134	475.36	1.48	-5.04E-01	3.01E-02	1.27E+00
		563.25	8.34	1.57E-01		2.58E-01
		569.33	15.37	-1.05E-01		1.31E-01
		604.72	97.62	-2.83E-03		3.25E-02
		795.86	85.46	1.68E-02		3.01E-02
		801.95	8.69	-1.43E-01		2.60E-01
		1038.61	0.99	5.23E-01		2.67E+00
		1167.97	1.79	3.24E-01		2.05E+00
		1365.19	3.02	-8.40E-02		7.53E-01
+	Cs-137	661.66	* 85.10	8.30E-02	2.34E-02	2.34E-02
	Eu-152	121.78	28.67	-5.59E-03	6.60E-02	6.60E-02
		244.70	7.61	-1.11E-01		2.71E-01
		295.94	0.45	-5.89E-01		5.26E+00
		344.28	26.60	-1.27E-02		7.24E-02
		367.79	0.86	-3.07E-02		2.14E+00
		411.12	2.24	-1.22E-01		8.77E-01
		443.96	2.83	-3.84E-01		6.28E-01
		488.68	0.42	8.34E-01		4.68E+00
		563.99	0.49	7.57E-01		4.31E+00
		586.26	0.46	-1.27E-01		7.03E+00
		678.62	0.47	-2.19E+00		3.94E+00
		688.67	0.86	-2.52E-01		2.52E+00
		719.35	0.28	4.85E+00		8.59E+00
		778.90	12.96	-1.75E-02		1.73E-01
		810.45	0.32	2.82E+00		7.27E+00
		867.37	4.26	-2.98E-01		5.39E-01
		919.33	0.43	-5.27E+00		5.66E+00
		964.08	14.65	-1.70E-01		2.22E-01
		1085.87	10.24	-2.15E-01		2.55E-01
		1089.74	1.73	2.40E-01		1.65E+00
		1112.07	13.69	-7.74E-02		2.13E-01
		1212.95	1.43	3.71E-01		2.46E+00
		1249.94	0.19	6.90E+00		1.79E+01
		1299.14	1.63	-4.95E-02		1.56E+00
		1408.01	21.07	-9.14E-03		1.16E-01
		1457.64	0.50	-6.37E-01		2.49E+01
		1528.10	0.28	-1.47E+00		4.84E+00
	Eu-154	123.07	40.40	-7.63E-03	4.72E-02	4.72E-02
		247.93	6.89	-7.69E-03		2.60E-01
		591.76	4.95	6.02E-02		4.40E-01
		692.42	1.78	-3.04E-01		1.24E+00
		723.30	20.06	2.55E-02		1.25E-01
		756.80	4.52	-9.55E-02		4.46E-01
		873.18	12.08	4.30E-02		2.02E-01
		996.29	10.48	1.03E-01		2.56E-01

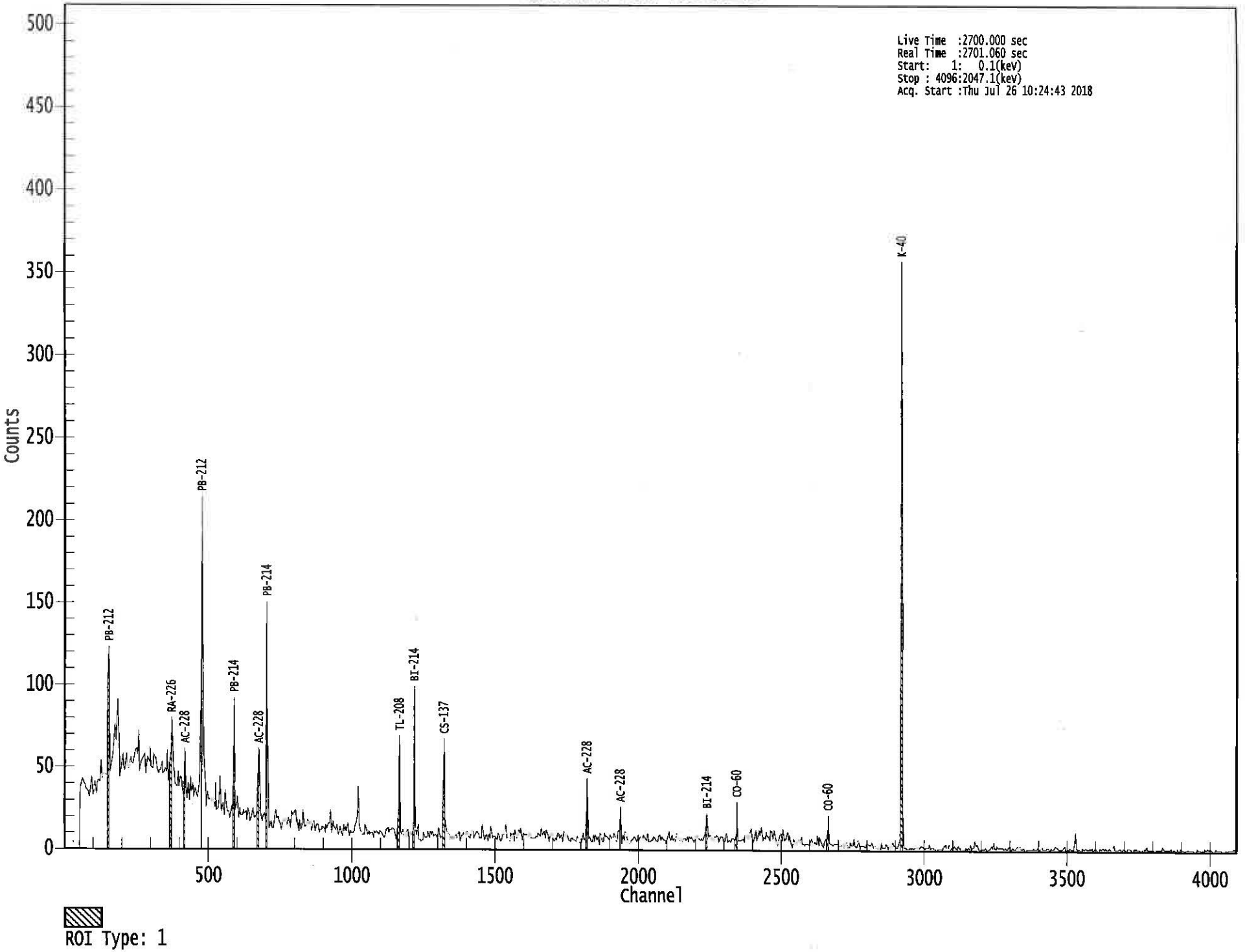
Analysis Report for 26-Jul-18-10015

L1-12107K-FSGS-014SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	1.14E-01	4.72E-02	1.52E-01
		1274.43		34.80	-4.68E-02		7.91E-02
		1596.48		1.80	-1.29E-01		9.04E-01
	Eu-155	45.30		1.31	1.79E+00	1.02E-01	6.73E+00
		60.01		1.22	-2.77E+00		7.15E+00
		86.55		30.70	4.64E-02		1.02E-01
		105.31		21.10	-2.65E-02		1.04E-01
+	Ra-226	186.21	*	3.64	4.24E-01	4.60E-01	4.60E-01
	Pa-231	27.36		10.30	7.07E-01	6.55E-01	6.55E-01
		283.69		1.70	-2.27E-01		1.04E+00
		300.07		2.47	-3.94E-01		7.15E-01
		302.65		2.20	6.88E-02		8.00E-01
		330.06		1.40	9.05E-02		1.43E+00
+	U-235	143.76		10.96	1.88E-02	2.93E-02	1.66E-01
		163.33		5.08	7.87E-03		3.99E-01
		185.71	*	57.20	2.70E-02		2.93E-02
		202.11		1.08	4.40E-01		1.85E+00
		205.31		5.01	4.01E-02		3.80E-01
	Am-241	59.54		35.90	-7.23E-02	2.50E-01	2.50E-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

0000048742.CNF



Apex-Gamma

Analysis Report for 26-Jul-18-10016

L1-12107K-FSGS-015SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10016
Sample Description	: L1-12107K-FSGS-015SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.680E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:37:00PM
Acquisition Started	: 7/26/2018 10:03:09AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.5 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	: 12/23/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48736
Fill Height	: 1680.30 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

JP. Welch 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 10:18:13AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VERIFIED 7/26/18 1200

JGraham/

Analysis Report for 26-Jul-18-10016

L1-12107K-FSGS-015SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	226.95	904 -	911	907.95	1.34E+01	8.67	3.06E+01	0.44
M	2	238.70	949 -	972	954.89	1.26E+02	12.38	4.40E+01	1.01
m	3	241.84	949 -	972	967.45	3.79E+01	8.43	5.56E+01	1.01
M	4	295.44	1172 -	1204	1181.68	7.16E+01	24.41	2.58E+01	0.86
m	5	300.13	1172 -	1204	1200.39	2.37E+01	7.57	5.09E+01	0.87
	6	351.89	1400 -	1413	1407.29	9.61E+01	13.72	3.29E+01	0.82
	7	583.10	2324 -	2338	2331.60	5.08E+01	9.76	1.52E+01	1.28
	8	609.46	2431 -	2444	2437.00	4.65E+01	9.45	1.55E+01	1.46
	9	661.65	2638 -	2653	2645.70	9.02E+01	10.93	9.84E+00	1.22
	10	910.99	3636 -	3650	3642.93	3.67E+01	7.61	7.34E+00	0.43
	11	968.73	3868 -	3880	3873.90	1.24E+01	6.77	1.26E+01	0.40
	12	1119.71	4472 -	4483	4477.93	9.54E+00	5.98	1.05E+01	0.61
	13	1460.76	5831 -	5854	5842.89	3.85E+02	20.21	5.87E+00	1.61

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.36E+00	6.37E-01
Cs-137	1.00	661.66	*	85.10	1.60E-01	2.17E-02
Tl-208	0.99	583.19	*	85.00	8.30E-02	1.67E-02
Pb-212	0.99	115.18		0.60		

Analysis Report for 26-Jul-18-10016

L1-12107K-FSGS-015SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	238.63	*	43.60	2.21E-01	2.82E-02
		300.09	*	3.30	6.25E-01	2.06E-01
Bi-214	0.99	609.32	*	45.49	1.46E-01	3.10E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	1.38E-01	8.66E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	4.04E-01	9.55E-02
		295.22	*	18.42	3.36E-01	1.18E-01
		351.93	*	35.60	2.64E-01	4.32E-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	2.67E-01	5.66E-02
		964.77		4.99		
		968.97	*	15.80	1.53E-01	8.41E-02
		1588.20		3.22		
Pa-231	1.00	27.36		10.30		
		283.69		1.70		
		300.07	*	2.47	8.35E-01	2.80E-01
		302.65		2.20		
		330.06		1.40		

* = 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 26-Jul-18-10016

L1-12107K-FSGS-015SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	9.36E+00	6.37E-01	
	Cs-137	1.000	1.60E-01	2.17E-02	
	Tl-208	0.999	8.30E-02	1.67E-02	
X	Bi-211	0.898			
	Pb-212	0.999	2.21E-01	2.81E-02	
	Bi-214	0.991	1.45E-01	2.92E-02	
	Pb-214	0.997	2.93E-01	3.73E-02	
	Ac-228	0.996	2.32E-01	4.69E-02	
	~~Pa-231~~ Pb-212	~~1.000~~	~~5.39E-01~~	~~2.78E-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

JPW 7-26-18

Pa-231 only 1 peak

Analysis Report for 26-Jul-18-10016

L1-12107K-FSGS-015SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 10:18:13AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
1	226.95	1.48864E-02	64.73	Tol.	Cs-~~138~~

1/2 Life 32 minutes & only 1 peak — JPW 7-26-18

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	5.24E-02	6.21E-02	6.21E-02
	BE-7	477.60		10.44	-2.44E-01	4.11E-01	4.11E-01
+	K-40	1460.82	*	10.66	9.36E+00	4.67E-01	4.67E-01
	Co-60	1173.23		99.85	3.78E-02	7.25E-02	9.31E-02
		1332.49		99.98	1.47E-02		7.25E-02
	Nb-94	702.65		99.81	-2.56E-02	5.15E-02	5.19E-02
		871.09		99.89	-3.17E-02		5.15E-02
	Ag-108m	79.13		6.60	8.89E-01	4.70E-02	2.03E+00
		433.94		90.50	1.03E-02		4.70E-02
		614.28		89.80	-4.36E-03		6.52E-02
		722.94		90.80	-2.51E-03		6.01E-02
	Sb-125	176.31		6.84	-2.14E-01	1.45E-01	6.06E-01
		380.45		1.52	-1.54E-01		2.98E+00
		427.87		29.60	-9.96E-02		1.45E-01
		463.36		10.49	1.42E-01		5.12E-01
		600.60		17.65	2.42E-02		2.87E-01
		606.71		4.98	1.44E+00		1.41E+00
		635.95		11.22	2.23E-01		4.16E-01

Analysis Report for 26-Jul-18-10016

L1-12107K-FSGS-015SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-1.51E+00	1.45E-01	2.64E+00
	Ba-133	79.61		2.65	5.07E-02	9.23E-02	4.84E+00
		81.00		32.90	-3.79E-01		3.40E-01
		276.40		7.16	1.54E-01		5.71E-01
		302.85		18.34	-1.27E-01		2.27E-01
		356.01		62.05	-2.55E-02		9.23E-02
		383.85		8.94	-7.08E-03		5.01E-01
	Cs-134	475.36		1.48	3.36E-01	6.10E-02	2.98E+00
		563.25		8.34	-3.22E-01		5.47E-01
		569.33		15.37	3.15E-02		2.75E-01
		604.72		97.62	-1.52E-02		6.44E-02
		795.86		85.46	-6.43E-03		6.10E-02
		801.95		8.69	-3.42E-01		6.12E-01
		1038.61		0.99	3.07E+00		5.86E+00
		1167.97		1.79	1.78E+00		4.88E+00
		1365.19		3.02	-2.24E-01		1.47E+00
+	Cs-137	661.66	*	85.10	1.60E-01	3.78E-02	3.78E-02
	Eu-152	121.78		28.67	4.28E-03	1.47E-01	1.69E-01
		244.70		7.61	-1.25E-01		6.42E-01
		295.94		0.45	-1.08E+00		1.14E+01
		344.28		26.60	-2.05E-02		1.47E-01
		367.79		0.86	-3.31E+00		4.58E+00
		411.12		2.24	6.34E-01		1.93E+00
		443.96		2.83	6.57E-01		1.73E+00
		488.68		0.42	2.34E+00		9.51E+00
		563.99		0.49	-1.85E+00		9.60E+00
		586.26		0.46	-2.99E+00		1.47E+01
		678.62		0.47	7.20E-03		1.01E+01
		688.67		0.86	3.08E+00		6.08E+00
		719.35		0.28	-1.12E+01		1.77E+01
		778.90		12.96	-6.78E-02		3.85E-01
		810.45		0.32	1.67E+00		1.55E+01
		867.37		4.26	-5.22E-01		1.12E+00
		919.33		0.43	2.26E+00		1.34E+01
		964.08		14.65	8.72E-02		5.12E-01
		1085.87		10.24	1.35E-02		5.64E-01
		1089.74		1.73	2.42E+00		3.67E+00
		1112.07		13.69	2.12E-01		5.03E-01
		1212.95		1.43	-3.11E+00		5.10E+00
		1249.94		0.19	1.36E+01		4.29E+01
		1299.14		1.63	2.24E+00		4.06E+00
		1408.01		21.07	-1.10E-01		2.16E-01
		1457.64		0.50	1.98E+02		5.07E+01
		1528.10		0.28	-5.47E+00		1.56E+01
	Eu-154	123.07		40.40	-1.95E-03	1.21E-01	1.21E-01
		247.93		6.89	1.86E-01		6.15E-01
		591.76		4.95	-9.63E-01		8.75E-01
		692.42		1.78	-1.12E+00		2.85E+00
		723.30		20.06	1.33E-01		2.81E-01
		756.80		4.52	-1.39E+00		1.05E+00
		873.18		12.08	1.43E-01		4.53E-01

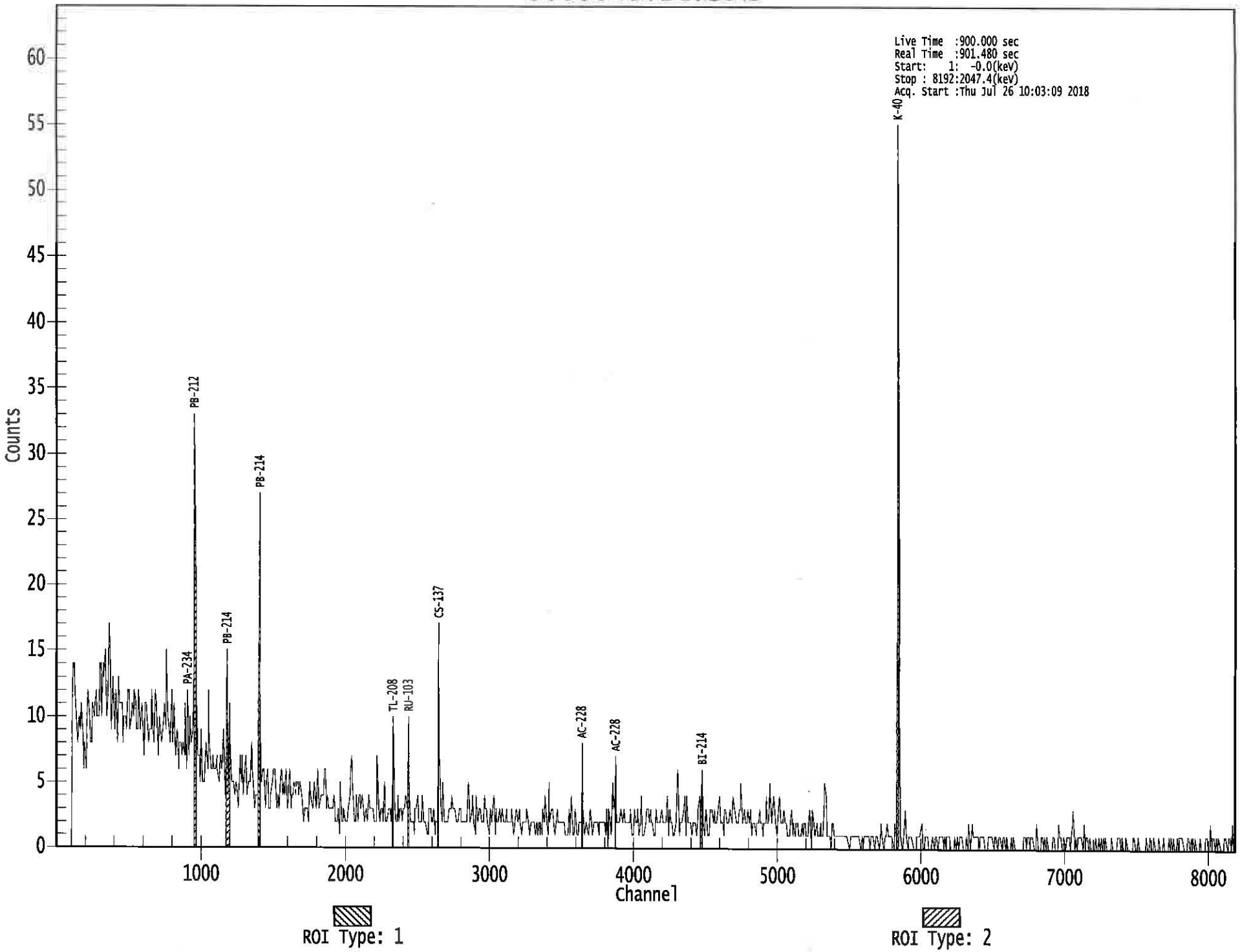
Analysis Report for 26-Jul-18-10016

L1-12107K-FSGS-015SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-4.40E-01	1.21E-01	5.80E-01
		1004.76		18.01	1.68E-01		3.66E-01
		1274.43		34.80	3.93E-03		1.87E-01
		1596.48		1.80	3.41E-01		3.01E+00
	Eu-155	45.30		1.31	-1.12E+01	2.99E-01	3.08E+01
		60.01		1.22	-2.35E+01		3.33E+01
		86.55		30.70	6.83E-02		3.15E-01
		105.31		21.10	2.35E-02		2.99E-01
	Ra-226	186.21		3.64	-5.68E-01	1.21E+00	1.21E+00
+	Pa-231	27.36		10.30	3.84E+00	1.31E+00	4.03E+00
		283.69		1.70	4.60E-01		2.61E+00
		300.07	*	2.47	8.35E-01		1.31E+00
		302.65		2.20	-1.32E+00		1.87E+00
		330.06		1.40	1.58E+00		3.30E+00
	U-235	143.76		10.96	-5.51E-02	7.82E-02	4.19E-01
		163.33		5.08	-3.79E-02		8.22E-01
		185.71		57.20	1.90E-02		7.82E-02
		202.11		1.08	3.73E-01		3.93E+00
		205.31		5.01	-2.59E-01		8.35E-01
	Am-241	59.54		35.90	-4.33E-01	1.21E+00	1.21E+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

0000048736.CNF



Apex-Gamma

Analysis Report for 26-Jul-18-10017

L1-12107K-FSGS-016SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10017
Sample Description	: L1-12107K-FSGS-016SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.623E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:08:00PM
Acquisition Started	: 7/26/2018 10:03:16AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 12/15/2017
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	:
Sample Number	: 48737
Fill Height	: 1623.40 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

J.S. Welch 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 10:18:40AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VERIFIED 7/26/18 1200

J Graham / C

Analysis Report for 26-Jul-18-10017

L1-12107K-FSGS-016SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.39	305 -	315	310.09	3.41E+01	16.32	9.19E+01	0.57
2	238.84	948 -	961	954.92	1.37E+02	18.19	6.89E+01	1.03
3	352.03	1400 -	1414	1407.14	1.01E+02	13.60	2.90E+01	1.35
4	609.40	2428 -	2442	2435.62	7.25E+01	11.72	2.25E+01	0.54
5	727.61	2904 -	2913	2908.19	1.70E+01	5.74	7.02E+00	0.96
6	910.95	3635 -	3647	3641.25	2.87E+01	7.67	1.13E+01	0.78
7	1460.28	5827 -	5850	5839.05	4.23E+02	21.14	6.00E+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	0.95	1460.82	*	10.66	9.33E+00	6.18E-01
Bi-211	0.86	351.07	*	13.02	6.87E-01	1.08E-01
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	3.73E-01	1.28E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.15E-01	3.35E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		

Analysis Report for 26-Jul-18-10017

L1-12107K-FSGS-016SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	77.11	*	17.10	2.37E-01	1.16E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	2.07E-01	3.57E-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	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.51E-01	3.94E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	4.18E-01	2.06E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.90E-01	5.14E-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 26-Jul-18-10017

L1-12107K-FSGS-016SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.954	9.33E+00	6.18E-01	
?	Bi-211	0.862	6.87E-01	1.08E-01	
	Bi-212	0.992	3.73E-01	1.28E-01	
	Pb-212	0.994	2.15E-01	3.35E-02	
?	Pb212-XR	0.993	2.37E-01	1.16E-01	
	Bi-214	1.000	2.07E-01	3.57E-02	
?	Pb-214	0.512	2.51E-01	3.94E-02	
?	Pb214-XR	0.993	4.18E-01	2.06E-01	
	Ac-228	0.997	1.90E-01	5.14E-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 26-Jul-18-10017

L1-12107K-FSGS-016SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 10:18:40AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	2.37E-02	4.66E-02	4.66E-02
	BE-7	477.60		10.44	1.58E-01	3.73E-01	3.73E-01
+	K-40	1460.82	*	10.66	9.33E+00	4.30E-01	4.30E-01
	Co-60	1173.23		99.85	-1.77E-02	5.68E-02	6.94E-02
		1332.49		99.98	5.05E-02		5.68E-02
	Nb-94	702.65		99.81	1.12E-02	4.88E-02	4.88E-02
		871.09		99.89	1.15E-02		5.04E-02
	Ag-108m	79.13		6.60	-2.99E-01	3.16E-02	1.12E+00
		433.94		90.50	-4.76E-02		3.16E-02
		614.28		89.80	-1.42E-02		6.78E-02
		722.94		90.80	-6.79E-02		5.40E-02
	Sb-125	176.31		6.84	5.67E-02	1.16E-01	4.82E-01
		380.45		1.52	2.28E-01		2.08E+00
		427.87		29.60	-4.01E-03		1.16E-01
		463.36		10.49	2.24E-01		3.85E-01
		600.60		17.65	-4.76E-02		2.10E-01
		606.71		4.98	2.40E+00		1.43E+00
		635.95		11.22	-1.19E-02		3.37E-01
		671.44		1.79	-2.78E+00		2.30E+00

Analysis Report for 26-Jul-18-10017

L1-12107K-FSGS-016SB

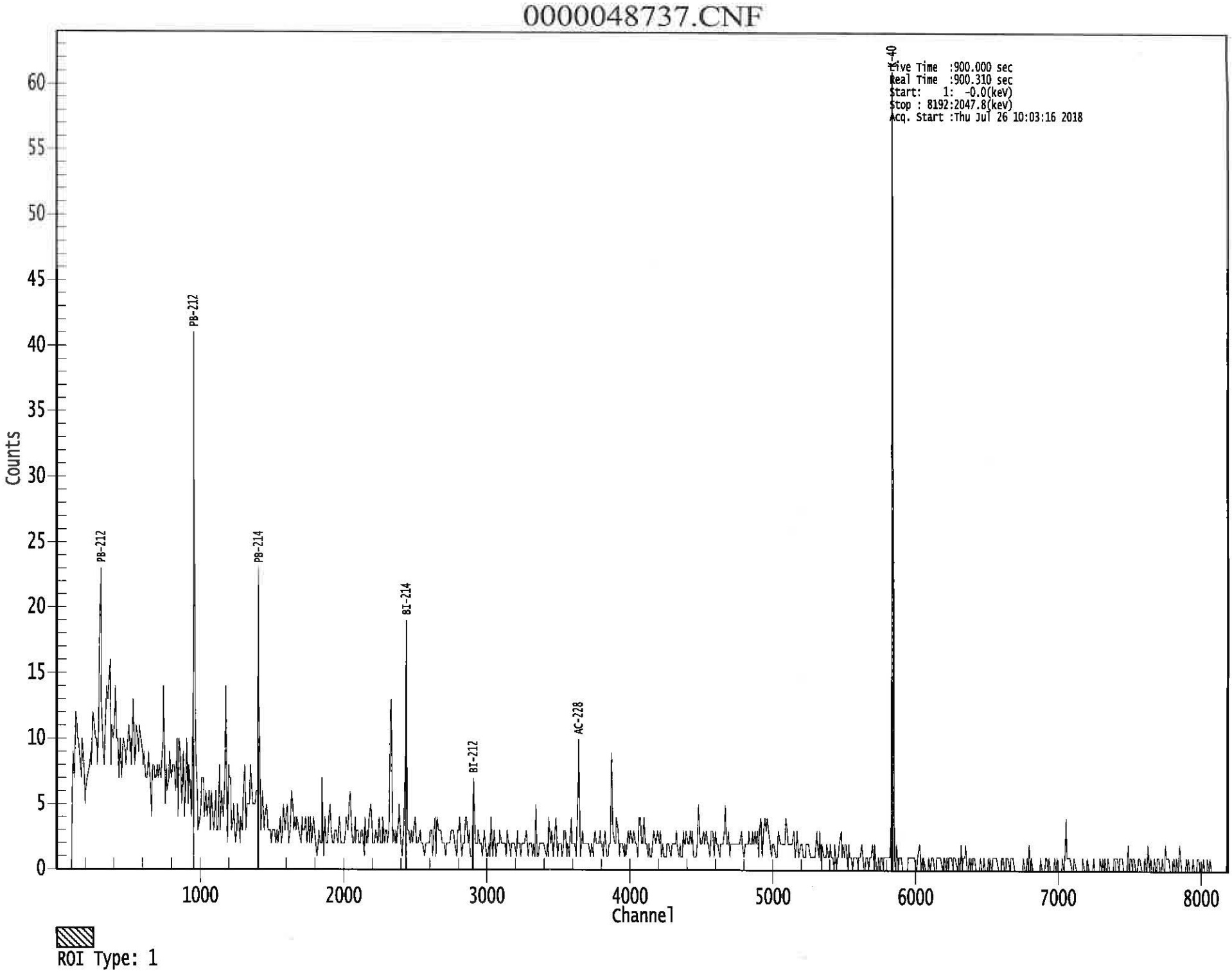
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-8.51E-01	7.11E-02	2.75E+00
	81.00	32.90	-7.76E-02		1.81E-01
	276.40	7.16	1.63E-01		4.29E-01
	302.85	18.34	1.55E-01		2.09E-01
	356.01	62.05	-4.32E-03		7.11E-02
	383.85	8.94	-1.49E-02		3.43E-01
Cs-134	475.36	1.48	7.38E-01	4.72E-02	2.60E+00
	563.25	8.34	-2.00E-01		5.08E-01
	569.33	15.37	-8.40E-02		2.59E-01
	604.72	97.62	-3.09E-02		5.78E-02
	795.86	85.46	-2.20E-03		4.72E-02
	801.95	8.69	1.02E-01		4.48E-01
	1038.61	0.99	4.29E+00		5.81E+00
	1167.97	1.79	-8.56E-01		3.98E+00
	1365.19	3.02	8.46E-01		1.68E+00
Cs-137	661.66	85.10	3.08E-02	5.55E-02	5.55E-02
Eu-152	121.78	28.67	-2.54E-02	1.25E-01	1.25E-01
	244.70	7.61	3.13E-01		4.97E-01
	295.94	0.45	8.10E+00		1.01E+01
	344.28	26.60	4.03E-02		1.38E-01
	367.79	0.86	1.15E+00		4.01E+00
	411.12	2.24	-3.02E-01		1.64E+00
	443.96	2.83	-1.62E-01		1.20E+00
	488.68	0.42	7.51E+00		8.52E+00
	563.99	0.49	-4.69E+00		8.53E+00
	586.26	0.46	1.10E+01		1.32E+01
	678.62	0.47	2.07E+00		8.25E+00
	688.67	0.86	2.36E-01		4.87E+00
	719.35	0.28	1.30E-01		1.57E+01
	778.90	12.96	5.92E-04		3.45E-01
	810.45	0.32	-1.47E+01		1.11E+01
	867.37	4.26	-5.25E-01		1.19E+00
	919.33	0.43	-3.50E+00		1.30E+01
	964.08	14.65	1.59E-02		4.77E-01
	1085.87	10.24	1.55E-01		5.21E-01
	1089.74	1.73	-1.60E+00		3.14E+00
	1112.07	13.69	4.39E-02		4.83E-01
	1212.95	1.43	2.48E+00		4.91E+00
	1249.94	0.19	-4.51E+00		3.61E+01
	1299.14	1.63	-1.76E+00		3.57E+00
	1408.01	21.07	-5.16E-02		1.79E-01
	1457.64	0.50	1.95E+02		4.81E+01
	1528.10	0.28	6.05E+00		1.34E+01
Eu-154	123.07	40.40	-4.31E-03	8.95E-02	8.95E-02
	247.93	6.89	-5.92E-02		4.50E-01
	591.76	4.95	-7.88E-01		7.95E-01
	692.42	1.78	-5.28E-03		2.46E+00
	723.30	20.06	-2.99E-01		2.53E-01
	756.80	4.52	4.97E-01		8.95E-01
	873.18	12.08	2.22E-01		4.45E-01
	996.29	10.48	-1.13E-01		5.20E-01

Analysis Report for 26-Jul-18-10017

L1-12107K-FSGS-016SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-9.19E-02	8.95E-02	3.25E-01
	1274.43	34.80	1.32E-01		2.06E-01
	1596.48	1.80	-7.60E-02		2.05E+00
Eu-155	45.30	1.31	3.24E+00	1.86E-01	1.19E+01
	60.01	1.22	1.22E+01		1.40E+01
	86.55	30.70	-2.96E-02		1.86E-01
	105.31	21.10	1.01E-01		2.06E-01
Ra-226	186.21	3.64	9.87E-01	1.01E+00	1.01E+00
Pa-231	27.36	10.30	1.03E+00	1.29E+00	1.29E+00
	283.69	1.70	1.37E+00		1.94E+00
	300.07	2.47	-3.37E+00		1.53E+00
	302.65	2.20	1.51E+00		1.75E+00
	330.06	1.40	-6.50E-02		2.78E+00
U-235	143.76	10.96	3.77E-01	6.42E-02	3.31E-01
	163.33	5.08	-4.54E-01		5.94E-01
	185.71	57.20	3.64E-02		6.42E-02
	202.11	1.08	-1.58E+00		2.97E+00
	205.31	5.01	2.04E-01		6.40E-01
Am-241	59.54	35.90	4.92E-01	5.02E-01	5.02E-01

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


0000048737.CNF
K-40
Live Time :900.000 sec
Real Time :900.310 sec
Start: 1: -0.0(keV)
Stop : 8192:2047.8(keV)
Acq. Start :Thu Jul 26 10:03:16 2018
PB-212
PB-212
PB-214
BI-214
BI-212
AC-228
Counts
Channel
ROI Type: 1

Apex-Gamma

Analysis Report for 26-Jul-18-10018

L1-12107K-FSGS-017SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 26-Jul-18-10018
Sample Description	: L1-12107K-FSGS-017SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.602E+03 grams
Facility	: Default
Sample Taken On	: 7/25/2018 2:12:00PM
Acquisition Started	: 7/26/2018 10:03:24AM
Procedure	: 130G_SOIL_1
Operator	: jwelch
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	: 3/12/2018
Efficiency Calibration Used Done On	: 7/26/2018
Efficiency Calibration Description	: install
Sample Number	: 48738
Fill Height	: 1602.22 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

J. Welch 7-26-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 7/26/2018 10:18:32AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VERIFIED 7/26/18 1200

J Graham

Analysis Report for 26-Jul-18-10018

L1-12107K-FSGS-017SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.15	304 -	316	309.90	3.98E+01	16.27	8.32E+01	0.79
2	238.65	948 -	961	955.09	1.24E+02	18.46	7.87E+01	1.00
3	295.21	1175 -	1189	1181.06	6.85E+01	10.49	1.45E+01	0.56
4	338.60	1348 -	1359	1354.43	2.94E+01	8.13	1.46E+01	1.06
5	351.84	1401 -	1414	1407.36	8.39E+01	13.02	3.11E+01	1.36
6	583.15	2325 -	2341	2331.91	7.39E+01	10.85	1.41E+01	1.09
7	609.04	2429 -	2443	2435.44	6.53E+01	11.18	2.07E+01	0.81
8	1460.88	5830 -	5855	5843.88	4.67E+02	21.94	3.37E+00	1.89

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	9.65E+00	6.17E-01
Tl-208	1.00	583.19	*	85.00	1.05E-01	1.66E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.93E-01	3.27E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	3.69E-01	1.56E-01
		87.35		3.97		
		89.78		1.46		

Analysis Report for 26-Jul-18-10018

L1-12107K-FSGS-017SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	609.32	*	45.49	1.78E-01	3.22E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.83E-01	4.88E-02
		351.93	*	35.60	2.02E-01	3.53E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	6.51E-01	2.76E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.18E-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		
		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 26-Jul-18-10018

L1-12107K-FSGS-017SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	9.65E+00	6.17E-01	
	Tl-208	1.000	1.05E-01	1.66E-02	
X	Bi-211	0.909			
	Pb-212	1.000	1.93E-01	3.27E-02	
?	Pb212-XR	1.000	3.69E-01	1.56E-01	
	Bi-214	0.995	1.78E-01	3.22E-02	
	Pb-214	0.999	2.30E-01	2.86E-02	
?	Pb214-XR	1.000	6.51E-01	2.76E-01	
	Ac-228	0.998	2.18E-01	6.28E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 26-Jul-18-10018

L1-12107K-FSGS-017SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 7/26/2018 10:18:32AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.90E-02	5.28E-02	5.28E-02
	BE-7	477.60		10.44	-1.86E-01	3.96E-01	3.96E-01
+	K-40	1460.82	*	10.66	9.65E+00	3.29E-01	3.29E-01
	Co-60	1173.23		99.85	-1.47E-02	6.60E-02	7.66E-02
		1332.49		99.98	6.05E-02		6.60E-02
	Nb-94	702.65		99.81	-5.72E-03	4.49E-02	4.58E-02
		871.09		99.89	1.64E-02		4.49E-02
	Ag-108m	79.13		6.60	-4.72E-02	3.87E-02	1.50E+00
		433.94		90.50	2.75E-03		3.87E-02
		614.28		89.80	-4.58E-02		7.15E-02
		722.94		90.80	1.26E-02		5.18E-02
	Sb-125	176.31		6.84	-1.93E-01	1.25E-01	5.39E-01
		380.45		1.52	-1.54E+00		2.28E+00
		427.87		29.60	4.81E-02		1.25E-01
		463.36		10.49	-1.55E-01		3.56E-01
		600.60		17.65	1.46E-02		2.28E-01
		606.71		4.98	2.13E+00		1.35E+00
		635.95		11.22	-2.89E-01		3.60E-01
		671.44		1.79	-1.74E+00		2.42E+00

Analysis Report for 26-Jul-18-10018

L1-12107K-FSGS-017SB

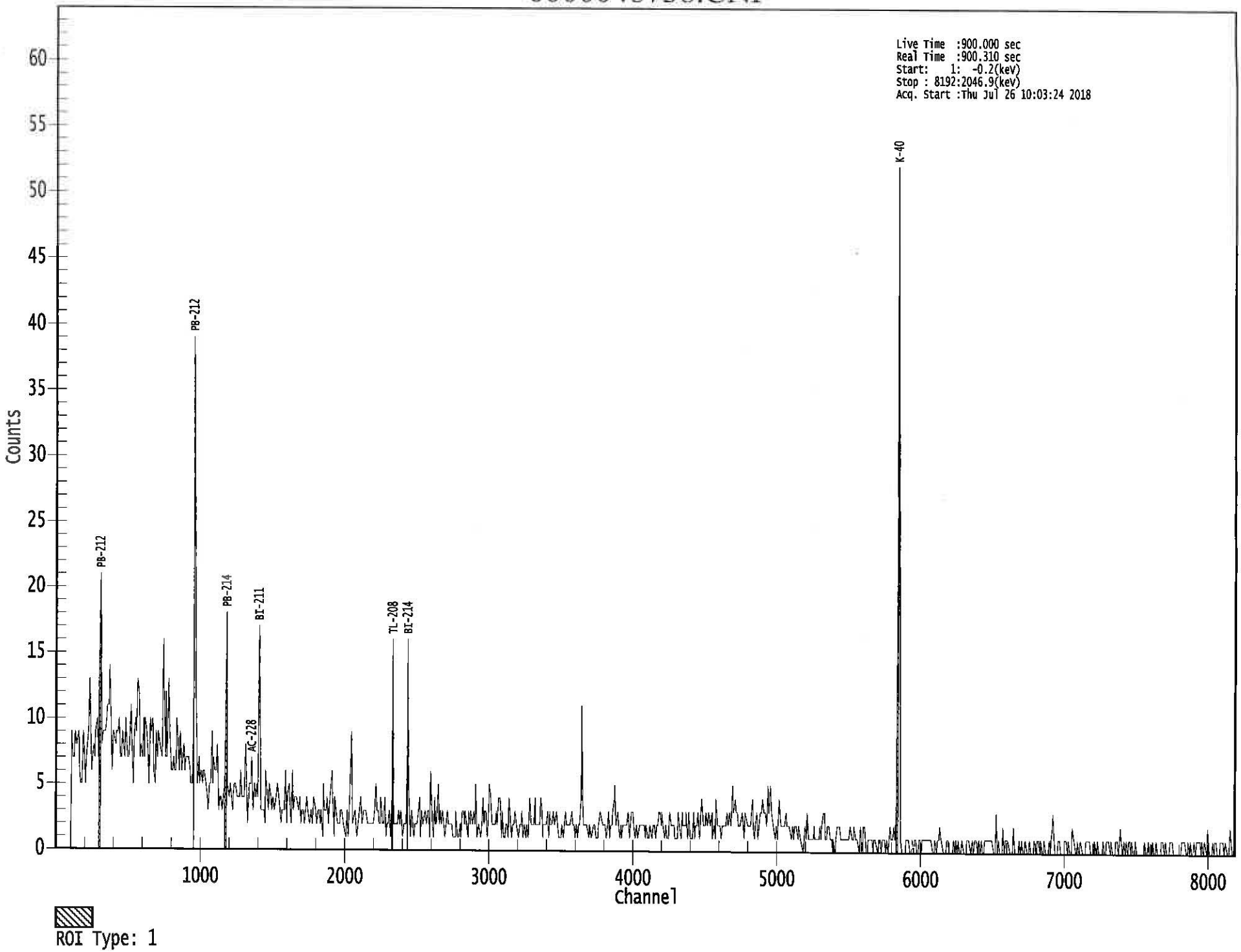
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	2.13E-01	7.55E-02	3.61E+00
	81.00	32.90	3.64E-02		2.41E-01
	276.40	7.16	1.41E-01		5.13E-01
	302.85	18.34	2.36E-01		2.01E-01
	356.01	62.05	-4.55E-02		7.55E-02
	383.85	8.94	1.55E-01		3.99E-01
Cs-134	475.36	1.48	2.67E+00	5.18E-02	2.81E+00
	563.25	8.34	1.11E-01		4.85E-01
	569.33	15.37	4.54E-02		2.50E-01
	604.72	97.62	-3.13E-02		6.27E-02
	795.86	85.46	3.62E-02		5.18E-02
	801.95	8.69	-2.81E-01		5.26E-01
	1038.61	0.99	-2.53E+00		5.09E+00
	1167.97	1.79	1.42E+00		4.30E+00
	1365.19	3.02	3.60E-01		1.65E+00
Cs-137	661.66	85.10	4.49E-02	6.06E-02	6.06E-02
Eu-152	121.78	28.67	3.60E-02	1.32E-01	1.45E-01
	244.70	7.61	2.62E-01		5.67E-01
	295.94	0.45	4.62E+00		9.60E+00
	344.28	26.60	-5.95E-02		1.32E-01
	367.79	0.86	-2.86E+00		4.08E+00
	411.12	2.24	-1.59E+00		1.71E+00
	443.96	2.83	-2.01E-01		1.24E+00
	488.68	0.42	-8.71E+00		8.75E+00
	563.99	0.49	-8.91E+00		7.96E+00
	586.26	0.46	2.05E+01		1.38E+01
	678.62	0.47	2.50E+00		9.77E+00
	688.67	0.86	-2.83E+00		4.69E+00
	719.35	0.28	1.07E+01		1.61E+01
	778.90	12.96	-6.64E-02		3.55E-01
	810.45	0.32	9.81E+00		1.51E+01
	867.37	4.26	-7.58E-01		1.05E+00
	919.33	0.43	-1.39E+01		1.23E+01
	964.08	14.65	3.08E-01		4.50E-01
	1085.87	10.24	-4.33E-01		5.86E-01
	1089.74	1.73	-1.29E+00		3.55E+00
	1112.07	13.69	-1.86E-01		4.45E-01
	1212.95	1.43	7.94E-01		4.46E+00
	1249.94	0.19	-1.09E+01		2.76E+01
	1299.14	1.63	-2.27E-01		3.10E+00
	1408.01	21.07	-1.88E-01		1.84E-01
	1457.64	0.50	2.07E+02		4.71E+01
	1528.10	0.28	2.25E-01		1.40E+01
Eu-154	123.07	40.40	-2.20E-02	1.03E-01	1.03E-01
	247.93	6.89	-5.51E-01		4.93E-01
	591.76	4.95	1.11E-01		7.67E-01
	692.42	1.78	-1.85E+00		2.07E+00
	723.30	20.06	2.46E-02		2.37E-01
	756.80	4.52	-8.76E-01		9.99E-01
	873.18	12.08	1.98E-02		3.48E-01
	996.29	10.48	-3.69E-02		5.10E-01

Analysis Report for 26-Jul-18-10018

L1-12107K-FSGS-017SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-2.29E-01	1.03E-01	2.65E-01
	1274.43	34.80	1.86E-01		1.89E-01
	1596.48	1.80	9.36E-02		2.04E+00
Eu-155	45.30	1.31	3.51E+00	2.27E-01	1.93E+01
	60.01	1.22	-4.30E+00		2.23E+01
	86.55	30.70	-5.81E-03		2.31E-01
	105.31	21.10	3.31E-02		2.27E-01
Ra-226	186.21	3.64	-5.32E-01	1.10E+00	1.10E+00
Pa-231	27.36	10.30	3.06E+00	1.56E+00	2.52E+00
	283.69	1.70	-1.76E+00		1.96E+00
	300.07	2.47	8.85E-01		1.56E+00
	302.65	2.20	2.62E+00		1.68E+00
	330.06	1.40	1.20E-01		2.64E+00
U-235	143.76	10.96	9.04E-02	7.01E-02	3.81E-01
	163.33	5.08	-6.90E-02		6.99E-01
	185.71	57.20	-4.21E-03		7.01E-02
	202.11	1.08	6.68E-01		3.28E+00
	205.31	5.01	-8.58E-02		7.17E-01
Am-241	59.54	35.90	-3.19E-01	7.86E-01	7.86E-01

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


0000048738.CNF
Live Time :900.000 sec
Real Time :900.310 sec
Start: 1: -0.2(keV)
Stop : 8192:2046.9(keV)
Acq. Start :Thu Jul 26 10:03:24 2018
PB-212
PB-212
PB-214
AC-228
BI-211
TL-208
BI-214
K-40
Counts
Channel
ROI Type: 1

ATTACHMENT 8
EBERLINE ANALYTICAL REPORTS

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

EBS-OR-44222

August 27, 2018

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

CASE NARRATIVE
Work Order # 18-08029-OR

SAMPLE RECEIPT

This work order contains thirteen soil samples received 08/07/2018. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-12107K-FSGS-001-SB-B	18-08029-04	L1-12107K-FSGS-010-SB-B	18-08029-11
L1-12107K-FSGS-002-SB-B	18-08029-05	L1-12107K-FSGS-013-SB-B	18-08029-12
L1-12107K-FQGS-002-SB-B	18-08029-06	L1-12107K-FSGS-014-SB-B	18-08029-13
L1-12107K-FSGS-004-SB-B	18-08029-07	L1-12107K-FSGS-015-SB-B	18-08029-14
L1-12107K-FSGS-005-SB-B	18-08029-08	L1-12107K-FSGS-016-SB-B	18-08029-15
L1-12107K-FSGS-006-SB-B	18-08029-09	L1-12107K-FSGS-017-SB-B	18-08029-16
L1-12107K-FSGS-008-SB-B	18-08029-10		

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 digesting with acids as appropriate. Strontium recovery carriers were added to the samples. Chemical separations were conducted using selective extractions. Strontium precipitate was mounted on tared filter media. Chemical recovery was determined by Strontium carrier mass determinations. Samples were counted by gas flow proportional counting and corrected for Yttrium-90 ingrowth.

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

TRITIUM

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

Samples were prepared by digesting with acids as appropriate. An aliquot was placed into appropriately sized beakers. Stable elemental Nickel carrier was added to each sample prior to digestion. 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 a High Purity Germanium (HPGe) gamma ray detector.

ANALYTICAL RESULTS CONTINUED

GAMMA SPECTROSCOPY CONTINUED

Samples demonstrated acceptable results for all gamma-emitting radionuclides as reported. Some samples demonstrated results that are greater than the method detection limit. These results are reported from the Canberra Gamma Apex "Nuclide MDA Report" and are not positive. These results are qualified as non-detect (U). The method blank demonstrated acceptable results for all radionuclides as reported. Results for the Bismuth-214 and Potassium-40 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Europium-155 replicate demonstrated a high relative percent difference; however, normalized difference is within acceptable limits for the analytical technique. 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: 8/27/2018

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
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:
SDG: 18-08029
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
18-08029-01	LCS	KNOWN	08/07/18 00:00	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	2.23E+02	8.01E+00				pCi/g
18-08029-01	LCS	SPIKE	08/07/18 00:00	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	1.94E+02	5.40E+00	1.21E+01	4.05E+00		pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	0.00E+00	2.35E+00	2.35E+00	4.04E+00	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	7.38E-01	2.30E+00	2.30E+00	3.91E+00	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	-1.08E+00	2.20E+00	2.20E+00	3.83E+00	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	7.39E-01	2.30E+00	2.30E+00	3.92E+00	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	-1.48E+00	2.25E+00	2.25E+00	3.94E+00	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	1.83E+00	2.26E+01	2.26E+01	3.88E+01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	0.00E+00	2.28E+00	2.28E+00	3.92E+00	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	1.81E-01	2.24E+00	2.24E+00	3.84E+00	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	-2.02E+00	2.21E+00	2.22E+00	3.89E+00	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	-7.45E-01	2.28E+00	2.28E+00	3.95E+00	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	3.68E-01	2.28E+00	2.28E+00	3.91E+00	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/11/2018	18-08029	Tritium	LANL ER-210 Modified	-1.96E+00	2.15E+00	2.15E+00	3.78E+00	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/12/2018	18-08029	Tritium	LANL ER-210 Modified	-1.91E+00	2.09E+00	2.09E+00	3.67E+00	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/12/2018	18-08029	Tritium	LANL ER-210 Modified	0.00E+00	2.22E+00	2.22E+00	3.81E+00	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/12/2018	18-08029	Tritium	LANL ER-210 Modified	-2.03E+00	2.22E+00	2.23E+00	3.91E+00	U	pCi/g
18-08029-01	LCS	KNOWN	08/07/18 00:00	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	1.54E+03	4.62E+01				pCi/g
18-08029-01	LCS	SPIKE	08/07/18 00:00	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	1.62E+03	9.75E+00	9.60E+01	2.32E+00		pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	0.00E+00	1.39E+00	1.39E+00	2.38E+00	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	4.39E+00	1.42E+00	1.44E+00	2.27E+00		pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	2.89E+00	1.38E+00	1.39E+00	2.26E+00		pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	-4.43E-01	1.33E+00	1.33E+00	2.29E+00	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	1.95E-01	1.48E+00	1.48E+00	2.53E+00	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	-7.26E-01	1.36E+00	1.36E+00	2.35E+00	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	-4.98E-01	1.50E+00	1.50E+00	2.58E+00	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	1.04E+00	1.46E+00	1.46E+00	2.45E+00	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	-7.10E-01	1.33E+00	1.33E+00	2.30E+00	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	3.88E+00	1.48E+00	1.50E+00	2.39E+00		pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	-2.60E-01	1.30E+00	1.30E+00	2.24E+00	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	4.16E-01	1.27E+00	1.27E+00	2.15E+00	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	-8.64E-01	1.29E+00	1.29E+00	2.24E+00	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	1.83E-01	1.39E+00	1.39E+00	2.37E+00	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/11/2018	18-08029	Nickel-63	ASTM 3500-Ni Modified	0.00E+00	1.27E+00	1.27E+00	2.16E+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
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:
SDG: 18-08029
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
18-08029-01	LCS	KNOWN	08/07/18 00:00	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	4.92E+01	2.75E-01				pCi/g
18-08029-01	LCS	SPIKE	08/07/18 00:00	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	4.81E+01	1.88E+00	1.68E+01	8.90E-01		pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	0.00E+00	5.02E-01	5.02E-01	8.99E-01	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	-1.79E-01	4.49E-01	4.53E-01	8.30E-01	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	3.33E-01	4.07E-01	4.23E-01	6.87E-01	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	6.89E-01	4.36E-01	4.98E-01	6.95E-01	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	5.96E-01	4.28E-01	4.75E-01	6.89E-01	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	8.40E-02	4.13E-01	4.14E-01	7.32E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	2.73E-01	4.47E-01	4.57E-01	7.67E-01	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	4.63E-01	4.40E-01	4.69E-01	7.30E-01	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	1.76E-01	4.83E-01	4.87E-01	8.43E-01	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	6.07E-01	3.87E-01	4.41E-01	6.12E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	3.40E-01	4.43E-01	4.59E-01	7.51E-01	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	4.16E-01	5.05E-01	5.25E-01	8.52E-01	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	3.68E-01	4.13E-01	4.32E-01	6.92E-01	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	1.16E+00	5.78E-01	7.05E-01	8.88E-01		pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/10/2018	18-08029	Strontium-90	ElChroM SRW01 Modified	5.44E-01	5.36E-01	5.69E-01	8.91E-01	U	pCi/g
18-08029-01	LCS	KNOWN	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
18-08029-01	LCS	KNOWN	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
18-08029-01	LCS	SPIKE	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	1.35E+02	8.74E+00	1.12E+01	1.48E+00		pCi/g
18-08029-01	LCS	SPIKE	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	8.93E+01	9.79E+00	1.08E+01	1.72E+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
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:

SDG: **18-08029**
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
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	4.62E-02	8.51E-02	8.51E-02	1.62E-01	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	6.33E-03	2.13E-02	2.13E-02	3.26E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	-4.01E-02	3.25E-02	3.26E-02	4.09E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	-2.38E-02	3.58E-02	3.59E-02	3.82E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	3.57E-02	4.95E-02	4.95E-02	8.39E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	1.22E-03	2.51E-02	2.51E-02	4.28E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-7.01E-04	2.79E-02	2.79E-02	4.01E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	-6.35E-03	2.94E-02	2.94E-02	4.61E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	6.23E-03	8.24E-02	8.24E-02	6.42E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	-6.53E-03	8.33E-02	8.33E-02	3.32E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	2.49E-03	1.90E-02	1.90E-02	4.25E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-1.17E-02	4.01E-02	4.01E-02	3.03E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	5.33E-02	1.12E-01	1.12E-01	1.66E-01	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	5.24E-01	3.14E-01	3.15E-01	3.02E-01		pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	8.24E-03	2.13E-02	2.13E-02	3.98E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	-1.42E-02	2.11E-02	2.11E-02	3.25E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	3.03E-01	2.85E-01	2.86E-01	4.72E-01	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	1.30E-02	3.63E-02	3.63E-02	5.51E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	4.42E-02	4.75E-02	4.75E-02	7.84E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-7.08E-03	5.82E-02	5.82E-02	8.53E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	3.57E-02	4.95E-02	4.95E-02	8.39E-02	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	2.59E-02	7.28E-02	7.28E-02	1.10E-01	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	2.94E-01	2.69E-01	2.69E-01	4.29E-01	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	9.06E-02	7.58E-02	7.59E-02	1.36E-01	U	pCi/g
18-08029-02	MBL	BLANK	08/07/18 00:00	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	1.29E-02	2.86E-01	2.86E-01	1.44E-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
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:
SDG: 18-08029
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
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	2.35E-01	1.38E-01	1.38E-01	2.63E-01	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	2.69E-03	3.92E-02	3.92E-02	4.30E-02	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	-1.55E-02	5.26E-02	5.26E-02	1.03E-01	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	-1.41E-03	2.03E-02	2.03E-02	5.29E-02	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	3.02E-01	8.73E-02	8.87E-02	1.46E-01		pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	2.74E-03	5.16E-02	5.16E-02	6.70E-02	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-7.00E-04	1.74E-02	1.74E-02	4.34E-02	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	3.76E-02	3.91E-02	3.91E-02	6.43E-02	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	5.93E-02	1.55E-01	1.55E-01	1.49E-01	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	3.69E-02	1.15E-01	1.15E-01	7.34E-02	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	1.12E-01	6.38E-02	6.41E-02	1.69E-01	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-7.83E-03	4.81E-02	4.81E-02	5.79E-02	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	5.24E+00	2.16E+01	2.16E+01	1.71E+00	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.23E+01	1.70E+00	1.81E+00	7.78E-01		pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	-7.53E-03	3.68E-02	3.68E-02	5.57E-02	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	-1.09E-03	3.10E-02	3.10E-02	4.84E-02	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	9.67E-01	9.48E-01	9.49E-01	1.58E+00	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	2.28E-01	6.93E-02	7.02E-02	1.58E-01		pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	3.28E-01	9.35E-02	9.50E-02	1.51E-01		pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-1.08E-01	3.21E-01	3.21E-01	4.58E-01	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	3.02E-01	8.73E-02	8.87E-02	1.46E-01		pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	-7.90E-02	7.67E-02	7.68E-02	1.13E-01	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	9.93E-01	7.64E-01	7.66E-01	1.09E+00	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	2.54E-01	9.86E-02	9.95E-02	1.91E-01	U	pCi/g
18-08029-03	DUP	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	-8.73E-02	5.60E-01	5.60E-01	3.03E-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
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:
SDG: 18-08029
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
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	3.70E-01	1.22E-01	1.23E-01	2.43E-01		pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	-1.92E-02	2.64E-02	2.64E-02	3.81E-02	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	3.76E-02	8.23E-02	8.23E-02	1.12E-01	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	7.65E-03	5.03E-02	5.03E-02	6.68E-02	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	3.00E-01	8.38E-02	8.52E-02	1.30E-01		pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	7.43E-02	4.16E-02	4.18E-02	8.04E-02	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-4.94E-03	1.67E-02	1.67E-02	4.07E-02	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	1.42E-02	4.07E-02	4.07E-02	6.49E-02	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	1.30E-02	1.35E-01	1.35E-01	1.33E-01	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	-9.60E-02	1.18E-01	1.18E-01	6.88E-02	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	5.41E-02	7.81E-02	7.81E-02	1.04E-01	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-6.17E-03	5.51E-02	5.51E-02	5.46E-02	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	5.77E+00	2.37E+01	2.37E+01	1.73E+00	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.17E+01	1.69E+00	1.79E+00	1.02E+00		pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	-3.09E-03	3.63E-02	3.63E-02	5.50E-02	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	6.32E-03	3.18E-02	3.18E-02	5.17E-02	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	1.00E+00	9.77E-01	9.78E-01	1.61E+00	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	4.45E-01	1.09E-01	1.11E-01	1.43E-01		pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	3.12E-01	8.91E-02	9.05E-02	1.71E-01		pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-3.83E-03	3.04E-01	3.04E-01	4.72E-01	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	3.00E-01	8.38E-02	8.52E-02	1.30E-01		pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	-1.30E-02	7.03E-02	7.03E-02	1.17E-01	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	6.81E-01	7.50E-01	7.51E-01	1.05E+00	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	2.07E-01	1.01E-01	1.02E-01	1.83E-01	U	pCi/g
18-08029-04	DO	L1-12107K-FSGS-001-SB-B	07/25/18 14:47	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	2.12E-01	4.59E-01	4.59E-01	2.90E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Patricia Giza
Zion Solutions
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:
SDG: 18-08029
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
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	3.71E-01	1.87E-01	1.87E-01	3.32E-01		pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	-1.40E-02	5.31E-02	5.31E-02	6.77E-02	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	5.87E-02	7.58E-02	7.58E-02	1.13E-01	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	-1.60E-03	3.43E-02	3.43E-02	1.22E-01	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	3.93E-01	1.23E-01	1.25E-01	2.42E-01		pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	7.04E-03	7.08E-02	7.08E-02	1.01E-01	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-1.41E-01	9.20E-02	9.23E-02	9.18E-02	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	2.75E-02	6.17E-02	6.17E-02	9.34E-02	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	1.26E-01	1.34E-01	1.35E-01	1.77E-01	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	-9.30E-02	1.71E-01	1.71E-01	9.02E-02	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	3.15E-02	9.11E-02	9.11E-02	1.35E-01	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-1.03E-01	1.10E-01	1.10E-01	6.17E-02	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	-2.83E-02	5.74E-02	5.74E-02	8.15E-02	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.08E+01	1.67E+00	1.76E+00	7.09E-01		pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	-1.65E-02	5.40E-02	5.40E-02	8.43E-02	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	3.60E-02	4.71E-02	4.71E-02	8.56E-02	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	4.12E-01	6.02E-01	6.03E-01	9.22E-01	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	3.87E-01	1.08E-01	1.10E-01	1.58E-01		pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	3.18E-01	9.66E-02	9.80E-02	1.65E-01		pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-9.95E-03	6.87E-02	6.87E-02	1.00E-01	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	3.93E-01	1.23E-01	1.25E-01	2.42E-01		pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	-1.04E-01	1.55E-01	1.55E-01	1.94E-01	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	7.35E-01	7.01E-01	7.02E-01	1.08E+00	U	pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	3.07E-01	1.11E-01	1.12E-01	5.43E-02		pCi/g
18-08029-05	TRG	L1-12107K-FSGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	-1.95E-01	5.69E-01	5.69E-01	3.50E-01	U	pCi/g

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

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Final Report of Analysis

Report To:

Patricia Giza
Zion Solutions
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:

SDG: **18-08029**
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
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	3.68E-01	1.30E-01	1.32E-01	2.08E-01		pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	-2.63E-02	3.38E-02	3.38E-02	3.38E-02	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	-1.18E-01	7.49E-02	7.51E-02	1.06E-01	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	1.04E-02	1.62E-02	1.62E-02	7.36E-02	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	2.26E-01	9.61E-02	9.68E-02	1.65E-01		pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	3.82E-03	3.60E-02	3.60E-02	4.76E-02	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	1.50E-03	1.43E-02	1.43E-02	4.50E-02	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	3.52E-02	2.65E-02	2.66E-02	4.16E-02	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	-6.03E-03	1.01E-01	1.01E-01	1.18E-01	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	-8.89E-02	9.95E-02	9.96E-02	6.19E-02	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	6.46E-02	7.04E-02	7.05E-02	1.17E-01	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-6.65E-02	5.62E-02	5.63E-02	4.74E-02	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	1.82E-02	1.18E-01	1.18E-01	1.56E-01	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	9.82E+00	1.27E+00	1.36E+00	7.26E-01		pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	1.41E-03	3.14E-02	3.14E-02	4.87E-02	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	-1.77E-02	3.20E-02	3.20E-02	4.01E-02	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	6.90E-01	6.30E-01	6.31E-01	1.07E+00	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	4.19E-01	8.60E-02	8.86E-02	1.12E-01		pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	3.18E-01	8.16E-02	8.33E-02	1.30E-01		pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-3.55E-02	1.10E-01	1.10E-01	1.40E-01	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	2.26E-01	9.61E-02	9.68E-02	1.65E-01		pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	-5.20E-02	8.24E-02	8.24E-02	1.13E-01	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	7.78E-01	6.33E-01	6.35E-01	1.06E+00	U	pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	3.31E-01	7.43E-02	7.62E-02	2.18E-02		pCi/g
18-08029-06	TRG	L1-12107K-FQGS-002-SB-B	07/25/18 14:20	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	-1.75E-01	3.99E-01	3.99E-01	2.66E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Patricia Giza
Zion Solutions
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:
SDG: 18-08029
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
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	4.86E-01	2.19E-01	2.20E-01	4.32E-01	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	-1.80E-02	5.26E-02	5.26E-02	6.49E-02	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	-9.67E-02	7.22E-02	7.23E-02	9.34E-02	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	6.53E-02	8.89E-02	8.89E-02	1.08E-01	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	2.22E-01	1.29E-01	1.29E-01	2.01E-01		pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	4.55E-02	6.69E-02	6.70E-02	1.27E-01	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-9.93E-03	2.90E-02	2.90E-02	9.03E-02	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	5.15E-02	5.14E-02	5.15E-02	9.20E-02	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	-2.76E-02	1.23E-01	1.23E-01	1.59E-01	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	2.92E-02	2.05E-01	2.05E-01	7.90E-02	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	5.50E-02	6.61E-02	6.61E-02	1.12E-01	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-3.28E-02	9.08E-02	9.09E-02	6.66E-02	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	8.24E-02	1.77E-01	1.77E-01	2.62E-01	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.92E+01	3.57E+00	3.71E+00	6.72E-01		pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	-4.22E-02	6.53E-02	6.53E-02	9.48E-02	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	-2.38E-02	4.65E-02	4.65E-02	6.78E-02	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	4.07E-01	6.56E-01	6.56E-01	9.99E-01	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	3.12E-01	8.35E-02	8.50E-02	1.80E-01		pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	4.33E-01	1.20E-01	1.22E-01	2.07E-01		pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-2.22E-02	1.13E-01	1.13E-01	1.63E-01	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	2.22E-01	1.29E-01	1.29E-01	2.01E-01		pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	1.58E-01	1.22E-01	1.22E-01	2.02E-01	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	7.44E-01	6.10E-01	6.11E-01	9.40E-01	U	pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	2.81E-01	1.61E-01	1.62E-01	2.48E-01		pCi/g
18-08029-07	TRG	L1-12107K-FSGS-004-SB-B	07/25/18 14:41	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	7.21E-02	4.50E-01	4.50E-01	3.31E-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
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:
SDG: 18-08029
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
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	3.63E-01	2.42E-01	2.42E-01	4.70E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	1.79E-03	3.63E-02	3.68E-02	8.08E-02	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	-8.52E-02	9.56E-02	9.57E-02	1.30E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	1.55E-02	4.60E-02	4.60E-02	1.43E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	3.48E-01	1.39E-01	1.40E-01	1.89E-01		pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	4.20E-02	9.32E-02	9.32E-02	1.47E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-2.05E-02	3.94E-02	3.94E-02	8.95E-02	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	2.10E-01	8.04E-02	8.11E-02	2.42E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	-1.84E-02	1.84E-01	1.84E-01	2.01E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	1.80E-02	1.80E-01	1.80E-01	1.04E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	-9.96E-03	7.72E-02	7.72E-02	1.48E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-1.15E-01	1.40E-01	1.40E-01	7.39E-02	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	-2.42E-02	4.38E-02	4.38E-02	9.61E-02	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.35E+01	2.20E+00	2.31E+00	1.56E+00		pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	-3.43E-02	7.08E-02	7.08E-02	1.08E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	1.71E-03	5.95E-02	5.95E-02	9.64E-02	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	7.39E-01	7.17E-01	7.18E-01	1.12E+00	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	3.54E-01	1.23E-01	1.25E-01	1.86E-01		pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	3.18E-01	1.29E-01	1.30E-01	2.27E-01		pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	1.52E-02	6.24E-02	6.24E-02	1.22E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	3.48E-01	1.39E-01	1.40E-01	1.89E-01		pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	3.12E-02	1.76E-01	1.76E-01	2.51E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	1.02E+00	8.17E-01	8.19E-01	1.28E+00	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	2.43E-01	2.17E-01	2.17E-01	3.49E-01	U	pCi/g
18-08029-08	TRG	L1-12107K-FSGS-005-SB-B	07/25/18 14:45	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	4.11E-01	7.43E-01	7.43E-01	4.22E-01	U	pCi/g

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

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Final Report of Analysis

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Work Order Details:

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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
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	3.50E-01	1.44E-01	1.45E-01	2.80E-01	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	-1.52E-03	2.09E-02	2.09E-02	4.53E-02	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	-6.35E-03	3.53E-02	3.53E-02	1.12E-01	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	-2.85E-02	4.29E-02	4.29E-02	8.17E-02	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	3.60E-01	9.06E-02	9.24E-02	1.34E-01		pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	-2.90E-02	5.13E-02	5.14E-02	5.55E-02	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	1.90E-02	2.16E-02	2.16E-02	5.61E-02	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	9.56E-02	4.23E-02	4.26E-02	1.01E-01	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	1.57E-02	9.16E-02	9.16E-02	1.45E-01	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	7.58E-02	1.01E-01	1.01E-01	7.33E-02	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	-3.19E-02	8.09E-02	8.09E-02	1.27E-01	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-2.11E-02	5.47E-02	5.47E-02	5.55E-02	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	1.51E-02	6.67E-02	6.67E-02	1.80E-01	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.22E+01	1.59E+00	1.71E+00	1.06E+00		pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	8.85E-03	3.11E-02	3.11E-02	5.00E-02	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	9.60E-03	2.89E-02	2.89E-02	4.33E-02	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	9.60E-01	6.96E-01	6.98E-01	1.19E+00	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	2.77E-01	7.07E-02	7.21E-02	1.57E-01		pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	4.05E-01	7.96E-02	8.23E-02	1.35E-01		pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-2.54E-02	7.69E-02	7.70E-02	1.50E-01	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	3.60E-01	9.06E-02	9.24E-02	1.34E-01		pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	2.23E-02	8.90E-02	8.90E-02	1.34E-01	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	9.91E-01	1.04E+00	1.04E+00	1.74E+00	U	pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	3.02E-01	1.41E-01	1.42E-01	2.24E-01		pCi/g
18-08029-09	TRG	L1-12107K-FSGS-006-SB-B	07/25/18 13:57	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	-1.95E-01	4.37E-01	4.37E-01	2.95E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Patricia Giza
Zion Solutions
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:
SDG: 18-08029
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
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	4.25E-01	1.40E-01	1.42E-01	3.60E-01		pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	-1.73E-02	3.40E-02	3.40E-02	3.50E-02	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	2.18E-02	3.91E-02	3.92E-02	1.05E-01	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	-9.70E-03	2.27E-02	2.27E-02	6.22E-02	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	2.76E-01	9.42E-02	9.52E-02	1.40E-01		pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	1.03E-02	4.45E-02	4.45E-02	6.60E-02	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-9.13E-03	1.64E-02	1.64E-02	3.94E-02	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	5.67E-02	4.14E-02	4.15E-02	6.55E-02	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	-2.20E-02	1.35E-01	1.35E-01	1.36E-01	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	3.27E-02	1.18E-01	1.18E-01	6.62E-02	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	1.02E-01	7.39E-02	7.41E-02	1.01E-01	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-3.04E-02	5.88E-02	5.88E-02	5.40E-02	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	3.70E+00	1.53E+01	1.53E+01	1.57E+00	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.12E+01	1.55E+00	1.65E+00	7.60E-01		pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	8.47E-04	4.00E-02	4.00E-02	6.19E-02	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	2.66E-02	3.04E-02	3.04E-02	4.49E-02	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	1.41E+00	9.62E-01	9.64E-01	1.60E+00	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	3.38E-01	1.01E-01	1.03E-01	1.44E-01		pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	3.08E-01	9.54E-02	9.67E-02	1.75E-01		pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-1.87E-01	3.18E-01	3.18E-01	4.35E-01	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	2.76E-01	9.42E-02	9.52E-02	1.40E-01		pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	3.55E-03	7.34E-02	7.34E-02	1.24E-01	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	1.04E+00	9.68E-01	9.70E-01	1.60E+00	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	2.01E-01	9.32E-02	9.38E-02	1.85E-01	U	pCi/g
18-08029-10	TRG	L1-12107K-FSGS-008-SB-B	07/25/18 14:23	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	1.20E-01	5.41E-01	5.41E-01	2.85E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Patricia Giza
Zion Solutions
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:
SDG: 18-08029
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
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	3.28E-01	1.86E-01	1.87E-01	3.49E-01	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	-1.36E-03	4.98E-02	4.98E-02	6.12E-02	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	-6.66E-02	6.55E-02	6.56E-02	8.93E-02	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	3.66E-03	2.73E-02	2.73E-02	9.08E-02	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	3.55E-01	1.38E-01	1.40E-01	2.19E-01		pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	3.28E-01	7.10E-02	7.30E-02	6.94E-02		pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-4.53E-03	2.39E-02	2.39E-02	7.75E-02	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	2.40E-01	8.77E-02	8.85E-02	1.29E-01		pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	8.20E-03	1.45E-01	1.45E-01	1.41E-01	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	-6.31E-02	1.77E-01	1.77E-01	7.32E-02	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	6.22E-02	6.02E-02	6.03E-02	1.01E-01	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-3.61E-02	4.09E-02	4.10E-02	5.57E-02	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	5.37E-03	1.60E-01	1.60E-01	2.35E-01	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.48E+01	2.87E+00	2.97E+00	1.07E+00		pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	-3.16E-02	4.95E-02	4.95E-02	7.33E-02	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	1.39E-02	4.76E-02	4.76E-02	7.59E-02	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	5.93E-01	5.95E-01	5.96E-01	9.19E-01	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	3.97E-01	1.04E-01	1.06E-01	1.45E-01		pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	2.53E-01	1.19E-01	1.20E-01	1.85E-01		pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-3.01E-02	9.86E-02	9.86E-02	1.43E-01	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	3.55E-01	1.38E-01	1.40E-01	2.19E-01		pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	2.01E-02	5.98E-02	5.98E-02	2.04E-01	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	7.74E-01	5.65E-01	5.67E-01	8.75E-01	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	2.41E-01	1.68E-01	1.68E-01	2.69E-01	U	pCi/g
18-08029-11	TRG	L1-12107K-FSGS-010-SB-B	07/25/18 14:40	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	-1.79E-01	5.78E-01	5.78E-01	3.16E-01	U	pCi/g

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

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Final Report of Analysis

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101 Shiloh Blvd
Zion, IL 60099

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SDG: 18-08029
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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
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	3.24E-01	2.09E-01	2.10E-01	4.05E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	1.03E-02	6.04E-02	6.04E-02	6.13E-02	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	-3.78E-02	7.80E-02	7.80E-02	1.10E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	5.71E-02	8.44E-02	8.44E-02	1.19E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	3.98E-01	1.33E-01	1.35E-01	2.09E-01		pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	2.77E-02	5.80E-02	5.80E-02	1.03E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-1.44E-03	3.35E-02	3.35E-02	9.27E-02	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	1.52E-01	9.61E-02	9.64E-02	1.52E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	-1.73E-01	1.89E-01	1.89E-01	1.82E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	-1.39E-01	1.93E-01	1.93E-01	9.29E-02	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	1.40E-02	3.49E-02	3.49E-02	1.25E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	1.28E-02	5.14E-02	5.14E-02	6.53E-02	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	-3.57E-02	5.68E-02	5.68E-02	7.99E-02	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.13E+01	1.80E+00	1.89E+00	1.17E+00		pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	4.94E-02	4.56E-02	4.57E-02	8.67E-02	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	-1.69E-02	4.59E-02	4.59E-02	7.19E-02	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	5.79E-01	6.16E-01	6.17E-01	9.51E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	4.26E-01	1.29E-01	1.31E-01	1.94E-01		pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	2.06E-01	1.14E-01	1.15E-01	2.26E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-2.92E-02	6.75E-02	6.75E-02	9.53E-02	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	3.98E-01	1.33E-01	1.35E-01	2.09E-01		pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	-7.12E-02	1.53E-01	1.53E-01	1.98E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	1.11E+00	9.77E-01	9.78E-01	1.62E+00	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	7.27E-02	2.01E-01	2.01E-01	2.93E-01	U	pCi/g
18-08029-12	TRG	L1-12107K-FSGS-013-SB-B	07/25/18 14:26	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	-8.69E-02	5.93E-01	5.93E-01	3.63E-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
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:

SDG: 18-08029
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
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	2.87E-01	1.37E-01	1.38E-01	2.40E-01		pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	-6.03E-03	3.52E-02	3.52E-02	3.91E-02	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	1.20E-02	7.94E-02	7.94E-02	1.04E-01	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	-1.49E-03	2.04E-02	2.04E-02	6.03E-02	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	3.15E-01	7.86E-02	8.02E-02	1.67E-01		pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	1.21E-01	4.48E-02	4.52E-02	8.32E-02		pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-3.78E-03	1.26E-02	1.26E-02	4.21E-02	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	1.23E-01	3.82E-02	3.87E-02	8.89E-02		pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	4.69E-02	1.29E-01	1.29E-01	1.34E-01	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	1.96E-02	1.13E-01	1.13E-01	7.06E-02	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	8.76E-02	7.87E-02	7.89E-02	1.06E-01	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	4.37E-03	5.07E-02	5.07E-02	5.74E-02	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	2.37E+00	9.96E+00	9.97E+00	1.68E+00	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.24E+01	1.68E+00	1.79E+00	6.85E-01		pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	-3.32E-03	3.29E-02	3.29E-02	5.01E-02	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	1.54E-02	2.81E-02	2.81E-02	4.83E-02	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	1.39E+00	8.86E-01	8.89E-01	1.52E+00	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	2.71E-01	7.25E-02	7.39E-02	1.56E-01		pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	3.73E-01	9.38E-02	9.57E-02	1.47E-01		pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	6.36E-02	3.15E-01	3.15E-01	4.88E-01	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	3.15E-01	7.86E-02	8.02E-02	1.67E-01		pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	3.88E-02	7.58E-02	7.59E-02	1.34E-01	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	5.23E-01	7.40E-01	7.40E-01	1.01E+00	U	pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	2.24E-01	1.19E-01	1.20E-01	1.90E-01		pCi/g
18-08029-13	TRG	L1-12107K-FSGS-014-SB-B	07/25/18 14:34	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	7.77E-02	5.67E-01	5.67E-01	3.12E-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
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:

SDG: **18-08029**
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
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	3.31E-01	1.93E-01	1.94E-01	3.86E-01	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	-2.54E-02	4.78E-02	4.78E-02	5.27E-02	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	-1.47E-01	6.12E-02	6.17E-02	7.49E-02	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	1.06E-02	7.59E-02	7.59E-02	8.83E-02	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	2.98E-01	1.21E-01	1.22E-01	1.94E-01		pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	5.11E-02	6.64E-02	6.64E-02	1.10E-01	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	6.87E-04	1.44E-02	1.44E-02	7.25E-02	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	1.81E-01	5.67E-02	5.74E-02	1.29E-01		pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	8.50E-02	1.44E-01	1.44E-01	1.24E-01	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	-6.74E-02	1.65E-01	1.65E-01	6.17E-02	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	9.26E-02	6.04E-02	6.06E-02	9.31E-02	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-9.09E-02	7.89E-02	7.90E-02	5.11E-02	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	3.88E-02	6.05E-02	6.05E-02	2.24E-01	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.69E+01	3.14E+00	3.26E+00	9.78E-01		pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	-9.33E-03	3.65E-02	3.65E-02	5.77E-02	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	-1.10E-02	3.91E-02	3.91E-02	6.03E-02	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	5.21E-01	6.35E-01	6.35E-01	1.06E+00	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	3.25E-01	1.10E-01	1.12E-01	1.67E-01		pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	3.25E-01	1.06E-01	1.07E-01	1.93E-01		pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-1.95E-02	9.51E-02	9.51E-02	1.37E-01	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	2.98E-01	1.21E-01	1.22E-01	1.94E-01		pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	-1.79E-01	1.37E-01	1.37E-01	1.56E-01	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	7.46E-01	4.93E-01	4.94E-01	7.71E-01	U	pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	3.72E-01	1.42E-01	1.43E-01	1.74E-01		pCi/g
18-08029-14	TRG	L1-12107K-FSGS-015-SB-B	07/25/18 14:37	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	-3.96E-01	5.46E-01	5.46E-01	2.83E-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
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:
SDG: 18-08029
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
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	3.87E-01	1.38E-01	1.40E-01	2.34E-01		pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	-3.37E-02	4.32E-02	4.32E-02	3.57E-02	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	-1.25E-01	7.69E-02	7.72E-02	1.06E-01	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	-2.93E-02	7.67E-02	7.67E-02	7.75E-02	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	4.31E-01	1.00E-01	1.03E-01	1.66E-01		pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	1.33E-02	3.42E-02	3.43E-02	5.68E-02	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-2.06E-01	7.43E-02	7.50E-02	4.89E-02	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	1.97E-02	3.26E-02	3.26E-02	5.37E-02	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	1.63E-02	8.99E-02	8.99E-02	1.28E-01	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	3.15E-02	1.05E-01	1.05E-01	6.50E-02	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	2.36E-02	6.03E-02	6.03E-02	1.14E-01	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-2.01E-03	5.12E-02	5.12E-02	4.79E-02	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	-8.99E-02	1.25E-01	1.25E-01	1.47E-01	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.18E+01	1.46E+00	1.58E+00	1.07E+00		pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	9.73E-03	3.04E-02	3.04E-02	4.93E-02	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	-2.56E-02	3.32E-02	3.33E-02	3.70E-02	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	6.79E-01	6.17E-01	6.18E-01	1.04E+00	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	2.73E-01	6.50E-02	6.64E-02	1.79E-01		pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	3.93E-01	7.92E-02	8.17E-02	1.25E-01		pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-5.52E-03	1.03E-01	1.03E-01	1.33E-01	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	4.31E-01	1.00E-01	1.03E-01	1.66E-01		pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	1.93E-02	8.06E-02	8.06E-02	1.25E-01	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	1.10E+00	6.53E-01	6.56E-01	1.11E+00	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	2.90E-01	1.11E-01	1.12E-01	2.01E-01	U	pCi/g
18-08029-15	TRG	L1-12107K-FSGS-016-SB-B	07/25/18 14:08	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	4.53E-02	3.28E-01	3.28E-01	2.85E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:
Patricia Giza
Zion Solutions
101 Shiloh Blvd
Zion, IL 60099

Work Order Details:
SDG: 18-08029
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
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Actinium-228	EPA 901.1 Modified	3.16E-01	1.36E-01	1.37E-01	4.16E-01	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Silver-108m	EPA 901.1 Modified	1.02E-02	1.92E-02	1.92E-02	3.90E-02	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Americium-241	EPA 901.1 Modified	2.09E-02	9.03E-02	9.03E-02	1.18E-01	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Barium-133	EPA 901.1 Modified	7.67E-03	2.12E-02	2.12E-02	6.30E-02	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Bismuth-214	EPA 901.1 Modified	3.72E-01	9.26E-02	9.46E-02	2.72E-01		pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Cobalt-60	EPA 901.1 Modified	5.34E-02	5.81E-02	5.82E-02	8.99E-02	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Cesium-134	EPA 901.1 Modified	-9.52E-02	4.36E-02	4.39E-02	4.23E-02	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Cesium-137	EPA 901.1 Modified	3.31E-02	4.05E-02	4.06E-02	6.88E-02	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Europium-152	EPA 901.1 Modified	-1.31E-01	1.55E-01	1.55E-01	1.44E-01	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Europium-154	EPA 901.1 Modified	1.18E-01	1.05E-01	1.05E-01	7.65E-02	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Europium-155	EPA 901.1 Modified	1.05E-01	8.42E-02	8.43E-02	1.15E-01	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Holmium-166m	EPA 901.1 Modified	-2.76E-03	6.61E-02	6.61E-02	5.97E-02	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Iodine-129	EPA 901.1 Modified	5.70E+00	2.35E+01	2.35E+01	1.81E+00	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Potassium-40	EPA 901.1 Modified	1.41E+01	1.88E+00	2.02E+00	7.10E-01		pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Manganese-54	EPA 901.1 Modified	-1.82E-02	4.27E-02	4.27E-02	5.99E-02	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Niobium-94	EPA 901.1 Modified	3.32E-02	3.32E-02	3.32E-02	5.32E-02	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Lead-210	EPA 901.1 Modified	1.94E+00	1.08E+00	1.08E+00	1.81E+00	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Lead-212	EPA 901.1 Modified	5.47E-01	1.21E-01	1.24E-01	1.51E-01		pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Lead-214	EPA 901.1 Modified	4.05E-01	1.04E-01	1.06E-01	1.60E-01		pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Promethium-145	EPA 901.1 Modified	-2.74E-01	3.78E-01	3.79E-01	4.82E-01	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Radium-226	EPA 901.1 Modified	3.72E-01	9.26E-02	9.46E-02	2.72E-01		pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Antimony-125	EPA 901.1 Modified	-7.97E-02	8.23E-02	8.24E-02	1.21E-01	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Thorium-234	EPA 901.1 Modified	9.02E-01	8.07E-01	8.08E-01	1.13E+00	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Thallium-208	EPA 901.1 Modified	2.60E-01	1.10E-01	1.11E-01	2.08E-01	U	pCi/g
18-08029-16	TRG	L1-12107K-FSGS-017-SB-B	07/25/18 14:12	8/7/2018	8/8/2018	18-08029	Uranium-235	EPA 901.1 Modified	3.28E-01	5.72E-01	5.72E-01	3.36E-01	U	pCi/g

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

ZION SOLUTIONS LLC
An EnergySolutions Company

18 08028

REC'D AUG 07 2018

ZS-WM-131
Revision 0
Information Use

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
4 L1-12107K-FSGS-001-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1447	HTD	NA	882.48g
5 L1-12107K-FSGS-002-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1420	HTD	NA	866.99g
6 L1-12107K-FSGS-002-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1420	HTD	NA	1023.34g
7 L1-12107K-FSGS-004-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1441	HTD	NA	821.94g
8 L1-12107K-FSGS-005-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1445	HTD	NA	812.42g
9 L1-12107K-FSGS-006-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1357	HTD	NA	857.74g
10 L1-12107K-FSGS-008-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1423	HTD	NA	890.87g
11 L1-12107K-FSGS-010-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1440	HTD	NA	883.26g
12 L1-12107K-FSGS-013-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1426	HTD	NA	979.91g
13 L1-12107K-FSGS-014-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1434	HTD	NA	918.00g
14 L1-12107K-FSGS-015-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1437	HTD	NA	943.87g
15 L1-12107K-FSGS-016-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1408	HTD	NA	940.53g
16 L1-12107K-FSGS-017-SB-B	NA	NA	SOIL	500	ml	Marinelli	1	07.25.2018	1412	HTD	NA	826.59g

ZS-WM-131
Revision 0
Information Use

ZION SOLUTIONS LLC
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TB 08029 REC'D AUG 07 2018

Laboratory:	Date Submitted To Lab:	Ship Container No.:	Cooler Temperature:	Airbill Number:
Eberline Labs		**N/A**	**N/A**	Fed Ex Express Saver 8115 9539 7390

Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	Time:
JACK MUCIA	8/2/18	0730	Richard E. Rickert	08/02/2018	0730
Richard E. Rickert	08/02/2018	1600	Fed Ex Express Saver	08/02/2018	1600
Fed Ex	8/7/18	0915	Bobby Bannister	08/07/2018	0915
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	Time:

Comments

PO# 677118 5 ROC ~~FSS~~ **HTD 7 day turnaround**
QA 8/2/18

EBERLINE ANALYTICAL

EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD
OAK RIDGE, TENNESSEE 37830
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EBS-OR-46756

February 13, 2020

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

CASE NARRATIVE
Work Order # 20-02012-OR

SAMPLE RECEIPT

This work order contains five soil samples received 02/04/2020. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L112107KFSGS018SB-A	20-02012-04	L112107KFSGS021SB-A	20-02012-07
L112107KFSGS019SB-A	20-02012-05	L112107KFSGS022SB-A	20-02012-08
L112107KFSGS020SB-A	20-02012-06		

ANALYTICAL METHODS

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

Laboratory qualifiers are as follows:

U - Result is less than the MDA.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

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

TOTAL STRONTIUM

Samples were prepared by aliquoting as appropriate and adding Strontium recovery carriers to the samples Chemical separations were conducted using selective extractions. Strontium precipitates were mounted on tared filter media. Chemical recovery was determined by Strontium carrier mass determinations. Samples were counted by gas flow proportional counting and corrected for Yttrium-90 ingrowth.

ANALYTICAL RESULTS CONTINUED

TOTAL STRONTIUM CONTINUED

Samples demonstrated acceptable results for all Total Strontium analyses. Strontium-90 results are reported from Total Strontium. Chemical recovery was acceptable for all samples. The Total Strontium method blank demonstrated an acceptable result. Results for the Total Strontium duplicate demonstrated 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 round-bottomed distillation flasks and attached to single stage stills. A portion of each middle distillation fraction was transferred to a liquid scintillation vial and cocktail was added. Samples were counted by beta liquid scintillation.

Samples demonstrated acceptable results for all Tritium analyses. The Tritium method blank demonstrated an acceptable result. Results for the Tritium duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Tritium laboratory control sample demonstrated an acceptable percent recovery.

NICKEL-63

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

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

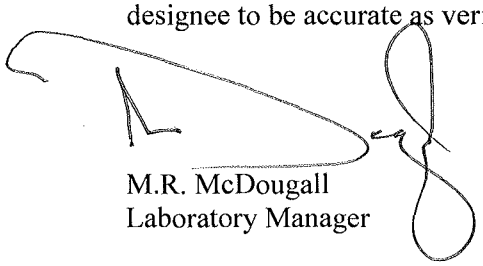
GAMMA SPECTROSCOPY

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

Samples demonstrated acceptable results for all gamma-emitting radionuclides as reported. The method blank demonstrated acceptable results for all radionuclides as reported. Results for the Bismuth-214, Potassium-40 and Lead-210 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Cobalt-60 and Cesium-137 laboratory control sample demonstrated an acceptable percent recovery.

CERTIFICATION OF ACCURACY

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



M.R. McDougall
Laboratory Manager

Date: 2/13/2020

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

Eberline Analytical
Final Report of Analysis

Report To:

Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	**20-02012**
Purchase Order:	677118
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-02012-01	LCS	KNOWN	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Tritium	LANL ER-210 Modified	2.01E+02	7.25E+00				pCi/g
20-02012-01	LCS	SPIKE	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Tritium	LANL ER-210 Modified	2.08E+02	7.92E+00	1.41E+01	6.10E+00		pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Tritium	LANL ER-210 Modified	-1.12E+00	3.44E+00	3.44E+00	6.02E+00	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Tritium	LANL ER-210 Modified	2.99E+01	4.31E+00	4.62E+00	5.89E+00		pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Tritium	LANL ER-210 Modified	2.72E+01	4.25E+00	4.51E+00	5.91E+00		pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Tritium	LANL ER-210 Modified	1.87E-01	3.49E+00	3.49E+00	6.03E+00	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Tritium	LANL ER-210 Modified	-1.97E+00	3.27E+00	3.27E+00	5.78E+00	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Tritium	LANL ER-210 Modified	3.53E-01	3.31E+00	3.31E+00	5.71E+00	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Tritium	LANL ER-210 Modified	-1.64E+00	3.35E+00	3.35E+00	5.90E+00	U	pCi/g
20-02012-01	LCS	KNOWN	02/04/20 00:00	2/4/2020	2/7/2020	20-02012	Nickel-63	ASTM 3500-Ni Modified	1.51E+03	4.54E+01				pCi/g
20-02012-01	LCS	SPIKE	02/04/20 00:00	2/4/2020	2/7/2020	20-02012	Nickel-63	ASTM 3500-Ni Modified	1.47E+03	1.29E+01	8.73E+01	3.19E+00		pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/7/2020	20-02012	Nickel-63	ASTM 3500-Ni Modified	2.63E+00	1.89E+00	1.90E+00	3.12E+00	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/7/2020	20-02012	Nickel-63	ASTM 3500-Ni Modified	0.00E+00	1.87E+00	1.87E+00	3.23E+00	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/7/2020	20-02012	Nickel-63	ASTM 3500-Ni Modified	1.55E+00	1.88E+00	1.89E+00	3.17E+00	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/7/2020	20-02012	Nickel-63	ASTM 3500-Ni Modified	1.77E-01	1.89E+00	1.89E+00	3.25E+00	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/7/2020	20-02012	Nickel-63	ASTM 3500-Ni Modified	3.19E+00	1.93E+00	1.94E+00	3.17E+00		pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/7/2020	20-02012	Nickel-63	ASTM 3500-Ni Modified	5.56E-01	1.71E+00	1.71E+00	2.93E+00	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/7/2020	20-02012	Nickel-63	ASTM 3500-Ni Modified	6.81E-01	1.84E+00	1.84E+00	3.13E+00	U	pCi/g
20-02012-01	LCS	KNOWN	02/04/20 00:00	2/4/2020	2/6/2020	20-02012	Strontium-90	ElChroM SRW01 Modified	5.17E+01	2.89E-01				pCi/g
20-02012-01	LCS	SPIKE	02/04/20 00:00	2/4/2020	2/6/2020	20-02012	Strontium-90	ElChroM SRW01 Modified	4.22E+01	1.23E+00	1.47E+01	6.86E-01		pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/6/2020	20-02012	Strontium-90	ElChroM SRW01 Modified	1.51E-02	2.66E-02	2.71E-02	5.51E-02	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/6/2020	20-02012	Strontium-90	ElChroM SRW01 Modified	1.62E-02	2.71E-02	2.77E-02	5.62E-02	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/6/2020	20-02012	Strontium-90	ElChroM SRW01 Modified	1.80E-02	3.81E-02	3.86E-02	7.94E-02	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/6/2020	20-02012	Strontium-90	ElChroM SRW01 Modified	1.60E-02	2.65E-02	2.71E-02	5.50E-02	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/6/2020	20-02012	Strontium-90	ElChroM SRW01 Modified	1.60E-02	2.62E-02	2.68E-02	5.44E-02	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/6/2020	20-02012	Strontium-90	ElChroM SRW01 Modified	1.65E-02	3.38E-02	3.43E-02	7.04E-02	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/6/2020	20-02012	Strontium-90	ElChroM SRW01 Modified	1.48E-02	2.82E-02	2.86E-02	5.86E-02	U	pCi/g
20-02012-01	LCS	KNOWN	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
20-02012-01	LCS	KNOWN	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
20-02012-01	LCS	SPIKE	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Cobalt-60	EPA 901.1 Modified	1.30E+02	7.94E+00	1.04E+01	1.63E+00		pCi/g
20-02012-01	LCS	SPIKE	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Cesium-137	EPA 901.1 Modified	8.53E+01	7.66E+00	8.82E+00	1.92E+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

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Jeffrey Graham	SDG:	20-02012
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Actinium-228	EPA 901.1 Modified	4.92E-02	7.03E-02	7.03E-02	1.30E-01	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Silver-108m	EPA 901.1 Modified	7.86E-03	1.79E-02	1.79E-02	2.00E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Americium-241	EPA 901.1 Modified	-6.63E-02	5.66E-02	5.67E-02	5.30E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Barium-133	EPA 901.1 Modified	-1.01E-02	2.54E-02	2.54E-02	3.20E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Bismuth-214	EPA 901.1 Modified	1.23E-02	4.66E-02	4.66E-02	7.40E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Cobalt-60	EPA 901.1 Modified	3.21E-04	1.99E-02	1.99E-02	3.21E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Cesium-134	EPA 901.1 Modified	-2.18E-02	2.39E-02	2.40E-02	3.14E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Cesium-137	EPA 901.1 Modified	5.02E-03	2.02E-02	2.02E-02	3.45E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Europium-152	EPA 901.1 Modified	2.83E-02	7.06E-02	7.06E-02	8.27E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Europium-154	EPA 901.1 Modified	3.88E-03	5.06E-02	5.06E-02	4.11E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Europium-155	EPA 901.1 Modified	-2.33E-03	4.37E-02	4.37E-02	5.75E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Holmium-166m	EPA 901.1 Modified	3.51E-03	3.15E-02	3.15E-02	3.21E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Iodine-129	EPA 901.1 Modified	1.43E-01	7.96E-02	8.00E-02	1.30E-01	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Potassium-40	EPA 901.1 Modified	-2.91E-02	2.26E-01	2.26E-01	3.63E-01	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Manganese-54	EPA 901.1 Modified	7.53E-03	1.78E-02	1.78E-02	3.20E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Molybdenum-93	EPA 901.1 Modified	-1.16E-02	1.95E-02	1.95E-02	2.68E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Niobium-94	EPA 901.1 Modified	7.56E-03	1.14E-02	1.14E-02	2.40E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Lead-210	EPA 901.1 Modified	1.49E-01	4.84E-01	4.85E-01	6.71E-01	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Lead-212	EPA 901.1 Modified	2.16E-02	3.90E-02	3.90E-02	5.41E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Lead-214	EPA 901.1 Modified	2.52E-02	4.13E-02	4.13E-02	6.44E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Promethium-145	EPA 901.1 Modified	3.96E-02	6.26E-02	6.27E-02	9.21E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Radium-226	EPA 901.1 Modified	1.23E-02	4.66E-02	4.66E-02	7.40E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Antimony-125	EPA 901.1 Modified	-1.94E-02	4.65E-02	4.65E-02	7.41E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Thorium-234	EPA 901.1 Modified	3.47E-01	3.91E-01	3.91E-01	5.76E-01	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Thallium-208	EPA 901.1 Modified	9.52E-02	6.42E-02	6.44E-02	9.64E-02	U	pCi/g
20-02012-02	MBL	BLANK	02/04/20 00:00	2/4/2020	2/5/2020	20-02012	Uranium-235	EPA 901.1 Modified	6.83E-02	1.33E-01	1.33E-01	1.90E-01	U	pCi/g

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Eberline Analytical
Final Report of Analysis

Report To:

Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	**20-02012**
Purchase Order:	677118
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Actinium-228	EPA 901.1 Modified	7.39E-01	2.26E-01	2.29E-01	4.29E-01		pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Silver-108m	EPA 901.1 Modified	-1.11E-01	7.75E-02	7.77E-02	7.85E-02	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Americium-241	EPA 901.1 Modified	1.79E-02	5.83E-02	5.83E-02	1.77E-01	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Barium-133	EPA 901.1 Modified	1.06E-02	1.58E-01	1.58E-01	1.48E-01	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Bismuth-214	EPA 901.1 Modified	9.34E-01	1.89E-01	1.95E-01	7.96E-02		pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Cobalt-60	EPA 901.1 Modified	-5.07E-02	7.80E-02	7.81E-02	9.71E-02	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Cesium-134	EPA 901.1 Modified	-4.61E-01	1.43E-01	1.45E-01	8.69E-02	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Cesium-137	EPA 901.1 Modified	8.40E-03	6.22E-02	6.22E-02	9.67E-02	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Europium-152	EPA 901.1 Modified	-3.53E-02	1.53E-01	1.53E-01	2.63E-01	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Europium-154	EPA 901.1 Modified	1.13E-01	1.79E-01	1.79E-01	1.37E-01	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Europium-155	EPA 901.1 Modified	2.34E-01	1.38E-01	1.39E-01	2.73E-01	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Holmium-166m	EPA 901.1 Modified	5.74E-02	9.32E-02	9.32E-02	1.00E-01	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Iodine-129	EPA 901.1 Modified	-2.42E-01	2.67E-01	2.67E-01	3.95E-01	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Potassium-40	EPA 901.1 Modified	2.15E+01	2.63E+00	2.86E+00	9.78E-01		pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Manganese-54	EPA 901.1 Modified	7.21E-03	5.95E-02	5.95E-02	9.24E-02	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Molybdenum-93	EPA 901.1 Modified	1.17E-02	5.25E-02	5.25E-02	8.16E-02	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Niobium-94	EPA 901.1 Modified	-2.60E-03	4.18E-02	4.18E-02	8.14E-02	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Lead-210	EPA 901.1 Modified	1.54E+00	1.19E+00	1.19E+00	1.98E+00	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Lead-212	EPA 901.1 Modified	8.43E-01	1.75E-01	1.80E-01	2.57E-01		pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Lead-214	EPA 901.1 Modified	1.05E+00	2.16E-01	2.23E-01	2.96E-01		pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Promethium-145	EPA 901.1 Modified	-5.38E-02	1.82E-01	1.82E-01	2.88E-01	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Radium-226	EPA 901.1 Modified	9.34E-01	1.89E-01	1.95E-01	7.96E-02		pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Antimony-125	EPA 901.1 Modified	-2.09E-01	1.72E-01	1.72E-01	2.19E-01	U	pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Thorium-234	EPA 901.1 Modified	2.69E+00	1.63E+00	1.63E+00	2.67E+00		pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Thallium-208	EPA 901.1 Modified	6.62E-01	1.90E-01	1.93E-01	2.87E-01		pCi/g
20-02012-03	DUP	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Uranium-235	EPA 901.1 Modified	6.22E-02	3.65E-01	3.65E-01	5.38E-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

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Zion Solutions
2701 Deborah Ave
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Analysis Category:	ENVIRONMENTAL
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Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Actinium-228	EPA 901.1 Modified	8.13E-01	2.60E-01	2.63E-01	5.32E-01		pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Silver-108m	EPA 901.1 Modified	-2.51E-02	6.54E-02	6.54E-02	7.65E-02	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Americium-241	EPA 901.1 Modified	-1.33E-01	1.20E-01	1.21E-01	1.77E-01	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Barium-133	EPA 901.1 Modified	3.06E-02	2.97E-02	2.97E-02	1.60E-01	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Bismuth-214	EPA 901.1 Modified	1.04E+00	1.83E-01	1.91E-01	2.32E-01		pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Cobalt-60	EPA 901.1 Modified	-3.71E-02	8.55E-02	8.55E-02	8.71E-02	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Cesium-134	EPA 901.1 Modified	-1.48E-02	1.91E-02	1.91E-02	8.41E-02	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Cesium-137	EPA 901.1 Modified	2.41E-02	5.87E-02	5.87E-02	9.41E-02	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Europium-152	EPA 901.1 Modified	8.76E-03	1.20E-01	1.20E-01	2.74E-01	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Europium-154	EPA 901.1 Modified	-2.35E-01	2.10E-01	2.11E-01	1.39E-01	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Europium-155	EPA 901.1 Modified	1.18E-01	1.13E-01	1.13E-01	2.18E-01	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Holmium-166m	EPA 901.1 Modified	-2.02E-02	9.67E-02	9.67E-02	9.63E-02	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Iodine-129	EPA 901.1 Modified	1.30E-01	2.61E-01	2.61E-01	4.23E-01	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Potassium-40	EPA 901.1 Modified	2.28E+01	2.82E+00	3.05E+00	1.40E+00		pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Manganese-54	EPA 901.1 Modified	-4.60E-02	6.07E-02	6.07E-02	8.24E-02	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Molybdenum-93	EPA 901.1 Modified	-3.74E-02	5.70E-02	5.70E-02	7.99E-02	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Niobium-94	EPA 901.1 Modified	9.81E-03	5.42E-02	5.42E-02	8.40E-02	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Lead-210	EPA 901.1 Modified	1.25E+00	1.48E+00	1.48E+00	2.47E+00	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Lead-212	EPA 901.1 Modified	9.02E-01	1.78E-01	1.83E-01	2.64E-01		pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Lead-214	EPA 901.1 Modified	1.18E+00	2.19E-01	2.28E-01	2.61E-01		pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Promethium-145	EPA 901.1 Modified	1.22E-01	1.78E-01	1.78E-01	2.95E-01	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Radium-226	EPA 901.1 Modified	1.04E+00	1.83E-01	1.91E-01	2.32E-01		pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Antimony-125	EPA 901.1 Modified	-4.62E-04	1.53E-01	1.53E-01	2.27E-01	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Thorium-234	EPA 901.1 Modified	1.15E+00	1.05E+00	1.05E+00	1.73E+00	U	pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Thallium-208	EPA 901.1 Modified	7.97E-01	1.98E-01	2.02E-01	3.03E-01		pCi/g
20-02012-04	DO	L112107KFSGS018SB-A	01/29/20 13:17	2/4/2020	2/5/2020	20-02012	Uranium-235	EPA 901.1 Modified	3.76E-01	3.59E-01	3.60E-01	5.51E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-02012
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Actinium-228	EPA 901.1 Modified	9.54E-01	2.19E-01	2.24E-01	3.97E-01		pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Silver-108m	EPA 901.1 Modified	-4.75E-04	3.06E-02	3.06E-02	6.52E-02	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Americium-241	EPA 901.1 Modified	7.49E-02	8.28E-02	8.29E-02	5.70E-01	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Barium-133	EPA 901.1 Modified	1.85E-02	2.53E-02	2.53E-02	1.29E-01	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Bismuth-214	EPA 901.1 Modified	1.18E+00	1.82E-01	1.92E-01	5.57E-02		pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Cobalt-60	EPA 901.1 Modified	4.89E-02	6.45E-02	6.46E-02	7.38E-02	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Cesium-134	EPA 901.1 Modified	1.88E-03	9.24E-02	9.24E-02	1.02E-01	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Cesium-137	EPA 901.1 Modified	3.23E-04	6.08E-02	6.08E-02	8.43E-02	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Europium-152	EPA 901.1 Modified	2.67E-02	1.15E-01	1.15E-01	2.55E-01	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Europium-154	EPA 901.1 Modified	6.09E-02	1.62E-01	1.62E-01	1.28E-01	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Europium-155	EPA 901.1 Modified	3.44E-01	2.23E-01	2.24E-01	2.56E-01		pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Holmium-166m	EPA 901.1 Modified	7.27E-04	9.99E-02	9.99E-02	9.74E-02	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Iodine-129	EPA 901.1 Modified	3.79E-02	2.00E-01	2.00E-01	2.92E-01	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Potassium-40	EPA 901.1 Modified	2.42E+01	2.89E+00	3.14E+00	1.38E+00		pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Manganese-54	EPA 901.1 Modified	-2.12E-02	6.17E-02	6.17E-02	8.00E-02	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Molybdenum-93	EPA 901.1 Modified	-2.68E-02	5.55E-02	5.55E-02	6.12E-02	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Niobium-94	EPA 901.1 Modified	-7.48E-03	5.53E-02	5.53E-02	7.38E-02	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Lead-210	EPA 901.1 Modified	1.39E+00	1.24E+00	1.24E+00	1.88E+00	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Lead-212	EPA 901.1 Modified	9.42E-01	1.77E-01	1.83E-01	2.30E-01		pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Lead-214	EPA 901.1 Modified	1.06E+00	2.05E-01	2.12E-01	2.64E-01		pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Promethium-145	EPA 901.1 Modified	2.55E-03	1.69E-01	1.69E-01	2.48E-01	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Radium-226	EPA 901.1 Modified	1.18E+00	1.82E-01	1.92E-01	5.57E-02		pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Antimony-125	EPA 901.1 Modified	-5.23E-02	1.36E-01	1.36E-01	1.97E-01	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Thorium-234	EPA 901.1 Modified	2.17E+00	1.32E+00	1.32E+00	2.00E+00	U	pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Thallium-208	EPA 901.1 Modified	8.60E-01	1.95E-01	2.00E-01	3.31E-01		pCi/g
20-02012-05	TRG	L112107KFSGS019SB-A	01/29/20 14:30	2/4/2020	2/5/2020	20-02012	Uranium-235	EPA 901.1 Modified	-9.91E-02	3.67E-01	3.67E-01	5.28E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Jeffrey Graham	SDG:	20-02012
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Actinium-228	EPA 901.1 Modified	7.76E-01	1.91E-01	1.95E-01	2.20E-01		pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Silver-108m	EPA 901.1 Modified	-4.49E-03	1.81E-02	1.81E-02	5.04E-02	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Americium-241	EPA 901.1 Modified	-1.29E-01	1.32E-01	1.32E-01	1.55E-01	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Barium-133	EPA 901.1 Modified	-1.49E-02	2.79E-02	2.79E-02	7.49E-02	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Bismuth-214	EPA 901.1 Modified	9.22E-01	1.46E-01	1.54E-01	2.04E-01		pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Cobalt-60	EPA 901.1 Modified	1.64E-02	5.17E-02	5.17E-02	7.61E-02	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Cesium-134	EPA 901.1 Modified	2.40E-03	2.42E-02	2.42E-02	7.34E-02	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Cesium-137	EPA 901.1 Modified	5.73E-02	4.87E-02	4.88E-02	8.32E-02	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Europium-152	EPA 901.1 Modified	3.08E-02	1.52E-01	1.52E-01	2.11E-01	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Europium-154	EPA 901.1 Modified	6.96E-02	1.38E-01	1.38E-01	1.07E-01	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Europium-155	EPA 901.1 Modified	1.89E-01	8.57E-02	8.62E-02	2.16E-01	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Holmium-166m	EPA 901.1 Modified	1.50E-02	6.93E-02	6.93E-02	8.20E-02	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Iodine-129	EPA 901.1 Modified	1.83E-01	1.38E-01	1.38E-01	2.04E-01	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Potassium-40	EPA 901.1 Modified	2.03E+01	2.38E+00	2.59E+00	9.36E-01		pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Manganese-54	EPA 901.1 Modified	-7.76E-03	3.60E-02	3.60E-02	7.43E-02	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Molybdenum-93	EPA 901.1 Modified	-2.71E-02	4.18E-02	4.18E-02	5.63E-02	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Niobium-94	EPA 901.1 Modified	6.41E-03	4.17E-02	4.17E-02	6.52E-02	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Lead-210	EPA 901.1 Modified	-7.75E-01	1.20E+00	1.20E+00	1.46E+00	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Lead-212	EPA 901.1 Modified	1.04E+00	2.00E-01	2.07E-01	2.17E-01		pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Lead-214	EPA 901.1 Modified	9.53E-01	1.74E-01	1.81E-01	2.27E-01		pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Promethium-145	EPA 901.1 Modified	1.81E-02	1.55E-01	1.55E-01	2.03E-01	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Radium-226	EPA 901.1 Modified	9.22E-01	1.46E-01	1.54E-01	2.04E-01		pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Antimony-125	EPA 901.1 Modified	8.62E-02	9.33E-02	9.34E-02	1.68E-01	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Thorium-234	EPA 901.1 Modified	2.37E+00	1.52E+00	1.53E+00	2.51E+00	U	pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Thallium-208	EPA 901.1 Modified	6.33E-01	1.38E-01	1.42E-01	2.41E-01		pCi/g
20-02012-06	TRG	L112107KFSGS020SB-A	01/29/20 14:00	2/4/2020	2/5/2020	20-02012	Uranium-235	EPA 901.1 Modified	9.44E-02	3.20E-01	3.20E-01	4.27E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:

Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG: **20-02012**
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Actinium-228	EPA 901.1 Modified	9.70E-01	2.66E-01	2.70E-01	4.99E-01		pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Silver-108m	EPA 901.1 Modified	-1.02E-02	2.03E-02	2.03E-02	6.84E-02	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Americium-241	EPA 901.1 Modified	-2.56E-01	1.61E-01	1.61E-01	2.12E-01	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Barium-133	EPA 901.1 Modified	-1.72E-02	4.09E-02	4.09E-02	1.39E-01	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Bismuth-214	EPA 901.1 Modified	1.21E+00	1.92E-01	2.02E-01	2.47E-01		pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Cobalt-60	EPA 901.1 Modified	-2.97E-02	7.14E-02	7.14E-02	8.61E-02	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Cesium-134	EPA 901.1 Modified	1.31E-02	2.42E-02	2.42E-02	1.03E-01	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Cesium-137	EPA 901.1 Modified	4.52E-02	6.21E-02	6.21E-02	9.36E-02	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Europium-152	EPA 901.1 Modified	1.10E-02	1.14E-01	1.14E-01	2.65E-01	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Europium-154	EPA 901.1 Modified	4.38E-02	1.42E-01	1.42E-01	1.35E-01	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Europium-155	EPA 901.1 Modified	3.51E-01	1.49E-01	1.50E-01	2.67E-01		pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Holmium-166m	EPA 901.1 Modified	1.26E-03	1.08E-01	1.08E-01	1.01E-01	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Iodine-129	EPA 901.1 Modified	-3.14E-02	1.09E-01	1.09E-01	3.05E-01	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Potassium-40	EPA 901.1 Modified	2.66E+01	3.20E+00	3.48E+00	1.67E+00		pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Manganese-54	EPA 901.1 Modified	1.87E-02	6.16E-02	6.16E-02	8.93E-02	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Molybdenum-93	EPA 901.1 Modified	-1.28E-02	5.78E-02	5.78E-02	6.93E-02	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Niobium-94	EPA 901.1 Modified	-2.78E-02	4.53E-02	4.53E-02	7.62E-02	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Lead-210	EPA 901.1 Modified	1.17E+00	1.33E+00	1.33E+00	2.22E+00	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Lead-212	EPA 901.1 Modified	9.24E-01	1.69E-01	1.76E-01	2.37E-01		pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Lead-214	EPA 901.1 Modified	1.29E+00	2.10E-01	2.20E-01	2.64E-01		pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Promethium-145	EPA 901.1 Modified	-1.52E-02	1.42E-01	1.42E-01	2.65E-01	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Radium-226	EPA 901.1 Modified	1.21E+00	1.92E-01	2.02E-01	2.47E-01		pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Antimony-125	EPA 901.1 Modified	-1.01E-02	1.46E-01	1.46E-01	2.16E-01	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Thorium-234	EPA 901.1 Modified	2.48E+00	1.80E+00	1.81E+00	2.89E+00	U	pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Thallium-208	EPA 901.1 Modified	9.03E-01	1.96E-01	2.01E-01	2.29E-01		pCi/g
20-02012-07	TRG	L112107KFSGS021SB-A	01/29/20 15:00	2/4/2020	2/5/2020	20-02012	Uranium-235	EPA 901.1 Modified	-9.64E-02	3.94E-01	3.94E-01	5.71E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-02012
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Actinium-228	EPA 901.1 Modified	8.29E-01	2.20E-01	2.24E-01	3.14E-01		pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Silver-108m	EPA 901.1 Modified	1.15E-02	2.88E-02	2.88E-02	5.81E-02	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Americium-241	EPA 901.1 Modified	4.55E-02	8.33E-02	8.34E-02	1.67E-01	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Barium-133	EPA 901.1 Modified	-6.93E-02	6.39E-02	6.40E-02	7.50E-02	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Bismuth-214	EPA 901.1 Modified	9.52E-01	1.39E-01	1.48E-01	2.26E-01		pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Cobalt-60	EPA 901.1 Modified	3.05E-02	6.08E-02	6.08E-02	6.52E-02	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Cesium-134	EPA 901.1 Modified	-3.51E-03	2.66E-02	2.66E-02	7.77E-02	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Cesium-137	EPA 901.1 Modified	-8.03E-03	1.86E-02	1.86E-02	7.32E-02	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Europium-152	EPA 901.1 Modified	4.11E-02	2.06E-01	2.06E-01	2.28E-01	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Europium-154	EPA 901.1 Modified	6.85E-02	1.51E-01	1.51E-01	1.17E-01	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Europium-155	EPA 901.1 Modified	-1.08E-01	1.61E-01	1.61E-01	1.94E-01	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Holmium-166m	EPA 901.1 Modified	2.69E-02	7.86E-02	7.86E-02	8.51E-02	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Iodine-129	EPA 901.1 Modified	3.14E-01	1.53E-01	1.53E-01	2.31E-01	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Potassium-40	EPA 901.1 Modified	2.40E+01	2.76E+00	3.02E+00	9.66E-01		pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Manganese-54	EPA 901.1 Modified	7.82E-03	4.91E-02	4.91E-02	7.58E-02	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Molybdenum-93	EPA 901.1 Modified	1.98E-04	4.44E-02	4.44E-02	5.88E-02	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Niobium-94	EPA 901.1 Modified	2.51E-02	4.21E-02	4.21E-02	7.02E-02	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Lead-210	EPA 901.1 Modified	8.17E-01	1.27E+00	1.27E+00	1.68E+00	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Lead-212	EPA 901.1 Modified	1.12E+00	2.30E-01	2.37E-01	2.54E-01		pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Lead-214	EPA 901.1 Modified	1.05E+00	1.82E-01	1.90E-01	2.19E-01		pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Promethium-145	EPA 901.1 Modified	-9.71E-02	1.75E-01	1.75E-01	2.15E-01	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Radium-226	EPA 901.1 Modified	9.52E-01	1.39E-01	1.48E-01	2.26E-01		pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Antimony-125	EPA 901.1 Modified	-4.75E-02	5.13E-02	5.13E-02	1.56E-01	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Thorium-234	EPA 901.1 Modified	1.20E+00	1.29E+00	1.29E+00	2.16E+00	U	pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Thallium-208	EPA 901.1 Modified	7.59E-01	1.63E-01	1.68E-01	1.47E-01		pCi/g
20-02012-08	TRG	L112107KFSGS022SB-A	01/29/20 15:25	2/4/2020	2/5/2020	20-02012	Uranium-235	EPA 901.1 Modified	-2.48E-01	3.95E-01	3.95E-01	4.87E-01	U	pCi/g

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

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ZS-WM-131
Revision 0
Information Use

REC'D FEB 04 2020

20-02012

Attachment 1 – Chain-of-Custody Form

	Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
4	L112107KFSGS018SB-A	NA	NA	Soil	500	ml	Marinelli	1	01-29-2020	1317	5 ROC	NA	784.06g
5	L112107KFSGS019SB-A	NA	NA	Soil	500	ml	Marinelli	1	01-29-2020	1430	5 ROC	NA	743.06g
6	L112107KFSGS020SB-A	NA	NA	Soil	500	ml	Marinelli	1	01-29-2020	1400	5 ROC	NA	851.83g
7	L112107KFSGS021SB-A	NA	NA	Soil	500	ml	Marinelli	1	01-29-2020	1500	5 ROC	NA	784.10g
8	L112107KFSGS022SB-A	NA	NA	Soil	500	ml	Marinelli	1	01-29-2020	1525	5 ROC	NA	843.36g

Laboratory:	Date Submitted To Lab:	Ship Container No.:	Cooler Temperature:	Airbill Number:
1.1. **Eberline Labs**		**NA**	**NA**	FedEx Standard Overnight 8132 0229 4890

Relinquished by: Vicky Baldwin 02-03-2020	Date: ~~03/03/2020~~ 02/03/2020	Time: 08:15	Received by: Richard F. Rickert	Date: 02-03-2020	Time: 0815
Relinquished by: Richard F. Rickert	Date: 02/03/2020	Time: 1600	Received by: FedEx Standard Overnight	Date: 02-03-2020	Time: 1600
Relinquished by: FedEx	Date:	Time:	Received by: Randolph Spencer	Date: 02-04-2020	Time: 0900
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

Comments

PO# 67116 **5 ROC** **7 day turn around**

PO for 5ROC = 677118 Exp 2/4/20

EBERLINE ANALYTICAL

EBERLINE ANALYTICAL CORPORATION
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OAK RIDGE, TENNESSEE 37830
PHONE (865) 481-0683
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EBS-OR-46784

February 17, 2020

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

CASE NARRATIVE
Work Order # 20-02027-OR

SAMPLE RECEIPT

This work order contains one soil sample relogged 02/05/2020 per client request. Sample was analyzed for Total Strontium.

CLIENT ID	LAB ID
L112107KFSGS016SB-C	20-02027-04

ANALYTICAL METHODS

Total Strontium was analyzed using EIChroM Method SRW01 Modified.

Laboratory qualifiers are as follows:

U - Result is less than the MDA.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

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

TOTAL STRONTIUM

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

ANALYTICAL RESULTS CONTINUED

TOTAL STRONTIUM CONTINUED

Sample demonstrated acceptable results for all Total Strontium analyses. Strontium-90 results are reported from Total Strontium assuming secular equilibrium. All results demonstrated slightly high method detection limits. 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.

CERTIFICATION OF ACCURACY

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

M.R. McDougall
Laboratory Manager

Date: 2/17/2020

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Jeffrey Graham	*SDG:*	**20-02027**
Zion Solutions	*Purchase Order:*	677118
2701 Deborah Ave	*Analysis Category:*	ENVIRONMENTAL
Zion, IL 60099	*Sample Matrix:*	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-02027-01	LCS	KNOWN	02/05/20 00:00	2/5/2020	2/12/2020	20-02027	Strontium-90	ElChroM SRW01 Modified	5.32E+01	2.98E-01				pCi/g
20-02027-01	LCS	SPIKE	02/05/20 00:00	2/5/2020	2/12/2020	20-02027	Strontium-90	ElChroM SRW01 Modified	4.53E+01	1.40E+00	1.58E+01	7.47E-01		pCi/g
20-02027-02	MBL	BLANK	02/05/20 00:00	2/5/2020	2/12/2020	20-02027	Strontium-90	ElChroM SRW01 Modified	3.35E-01	3.41E-01	3.61E-01	6.91E-01	U	pCi/g
20-02027-03	DUP	L112107KFSGS016SB-C	07/25/18 14:08	2/5/2020	2/12/2020	20-02027	Strontium-90	ElChroM SRW01 Modified	6.59E-02	4.22E-02	4.80E-02	8.31E-02	U	pCi/g
20-02027-04	DO	L112107KFSGS016SB-C	07/25/18 14:08	2/5/2020	2/12/2020	20-02027	Strontium-90	ElChroM SRW01 Modified	5.60E-02	3.29E-02	3.82E-02	6.40E-02	U	pCi/g

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

EBERLINE ANALYTICAL

EBERLINE ANALYTICAL CORPORATION
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ZION SOLUTIONS LLC
An EnergySolutions Company

Relogged eyr 2/5/20 REC'D FEB 05 2020 Okay eyr 2/5/20

ZS-WM-131
Revision 0
Information Use

20-02027

REC'D JAN 30 2020 ~~20-01130~~

Attachment 1 – Chain-of-Custody Form

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
L112107KFSGS016SB-C	NA	NA	Soil	250	ml	Marinelli	1	7/25/2018	1408	5 ROC	NA	340.54g
L210213AVJGS004SS-A	NA	NA	Soil	500	ml	Marinelli	1	10/25/2019	1033	5 ROC	NA	461.77g
L210213AVJGS005SS-A	NA	NA	Soil	500	ml	Marinelli	1	10/25/2019	1040	5 ROC	NA	516.27g
L210213AVJGS006SS-A	NA	NA	Soil	500	ml	Marinelli	1	10/25/2019	1045	5 ROC	NA	495.91g

Laboratory:	Date Submitted To Lab:	Ship Container No.:	Cooler Temperature:	Airbill Number:
1.1. **Eberline Labs**		**NA**	**NA**	FedEx Standard Overnight 8132 0229 4904

Relinquished by: Vicky Baldwin	Date: 01/29/2020	Time: 09:00	Received by: Richard F. Rickert	Date: 01/29/2020	Time: 09:00
Relinquished by: Richard F. Rickert	Date: 01/29/2020	Time: 1600	Received by: FedEx Standard Overnight	Date: 01/29/2020	Time: 1600
Relinquished by: Fedex	Date:	Time:	Received by: Randolph Spencer	Date: 01/30/2020	Time: 0903
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

Comments

PO# 67116 **5 ROC** **7 day turn around**

5ROC PO is 67118 eyr 1/30/20

EBERLINE ANALYTICAL

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EBS-OR-46932

March 16, 2020

Gerald Wood
Zion Solutions, LLC
2701 Deborah Avenue
Zion, IL 60099

CASE NARRATIVE
Work Order # 20-03011-OR

SAMPLE RECEIPT

This work order contains sixteen soil samples received 03/04/2020. Samples were analyzed for Total Strontium.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L112106KFSGS020SB-C	20-03011-04	L112106KFIGS009SB-C	20-03011-12
L112106KFIGS012SB-C	20-03011-05	L112106KFIGS010SB-C	20-03011-13
L112106KFIGS014SB-C	20-03011-06	L112107KFSGS006SB-C	20-03011-14
L112107KFSGS001SB-C	20-03011-07	L112105KFSGS022SB-C	20-03011-15
L112106KFSGS037SB-C	20-03011-08	L112107KFQGS002SB-C	20-03011-16
L112106KFSGS038SB-C	20-03011-09	L112105KFSGS035SB-C	20-03011-17
L112106KFIGS011SB-C	20-03011-10	L112105KFSGS023SB-C	20-03011-18
L112107KFSGS013SB-C	20-03011-11	L112106KFIGS013SB-C	20-03011-19

ANALYTICAL METHODS

Total Strontium was analyzed using EIChroM Method SRW01 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 leaching aliquots as appropriate and adding Strontium recovery carriers to each sample. Chemical separations were conducted using selective extractions. Strontium precipitates were mounted on tared filter media. Chemical recovery was determined by Strontium carrier mass determinations. Samples were counted by gas flow proportional counting and corrected for Yttrium-90 ingrowth.

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

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: 3/16/2020

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Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-03011
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	Report Units
20-03011-01	LCS	KNOWN	03/04/20 00:00	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	4.98E+01	2.79E-01			pCi/g
20-03011-01	LCS	SPIKE	03/04/20 00:00	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	4.81E+01	1.34E+00	1.68E+01	8.30E-01	pCi/g
20-03011-02	MBL	BLANK	03/04/20 00:00	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	2.38E-02	3.41E-02	3.50E-02	8.42E-02	pCi/g
20-03011-03	DUP	L112106KFSGS020SB-C	07/14/18 09:37	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	1.83E-02	4.23E-02	4.28E-02	1.06E-01	pCi/g
20-03011-04	DO	L112106KFSGS020SB-C	07/14/18 09:37	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	2.86E-02	3.69E-02	3.83E-02	9.10E-02	pCi/g
20-03011-05	TRG	L112106KFIGS012SB-C	07/20/18 08:52	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	4.58E-02	3.33E-02	3.70E-02	7.96E-02	pCi/g
20-03011-06	TRG	L112106KFIGS014SB-C	07/23/18 08:56	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	4.50E-02	3.62E-02	3.95E-02	8.71E-02	pCi/g
20-03011-07	TRG	L112107KFSGS001SB-C	07/25/18 14:47	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	4.11E-02	3.67E-02	3.94E-02	8.88E-02	pCi/g
20-03011-08	TRG	L112106KFSGS037SB-C	07/14/18 09:51	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	4.42E-02	3.32E-02	3.66E-02	7.93E-02	pCi/g
20-03011-09	TRG	L112106KFSGS038SB-C	07/14/18 09:57	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	4.87E-02	3.13E-02	3.56E-02	7.32E-02	pCi/g
20-03011-10	TRG	L112106KFIGS011SB-C	07/20/18 08:51	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	5.83E-02	3.40E-02	3.96E-02	7.91E-02	pCi/g
20-03011-11	TRG	L112107KFSGS013SB-C	07/25/18 14:26	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	2.12E-02	3.05E-02	3.14E-02	7.54E-02	pCi/g
20-03011-12	TRG	L112106KFIGS009SB-C	07/20/18 08:48	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	1.80E-02	2.97E-02	3.04E-02	7.39E-02	pCi/g
20-03011-13	TRG	L112106KFIGS010SB-C	07/20/18 08:50	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	4.31E-02	3.11E-02	3.45E-02	7.36E-02	pCi/g
20-03011-14	TRG	L112107KFSGS006SB-C	07/25/18 13:57	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	6.38E-02	3.83E-02	4.43E-02	8.96E-02	pCi/g
20-03011-15	TRG	L112105KFSGS022SB-C	07/12/18 10:18	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	5.39E-02	3.64E-02	4.10E-02	8.57E-02	pCi/g
20-03011-16	TRG	L112107KFQGS002SB-C	07/25/18 14:20	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	3.65E-02	3.82E-02	4.02E-02	9.31E-02	pCi/g
20-03011-17	TRG	L112105KFSGS035SB-C	07/12/18 13:50	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	3.25E-02	3.80E-02	3.97E-02	9.31E-02	pCi/g
20-03011-18	TRG	L112105KFSGS023SB-C	07/12/18 10:22	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	7.31E-02	3.30E-02	4.17E-02	7.45E-02	pCi/g
20-03011-19	TRG	L112106KFIGS013SB-C	07/20/18 08:47	3/4/2020	3/6/2020	20-03011	Strontium-90	ElChroM SRW01 Modified	1.75E-02	3.87E-02	3.92E-02	9.70E-02	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

ZION SOLUTIONS LLC
An EnergySolutions Company

REC'D MAR 04 2020

20503011

0Attachment 1 – Chain-of-Custody Form

Sample container 002 Page 1 of 2

	Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks (weight in grams)
4	L112106KFSGS020SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:37	HTD	N/A	307.54 g
5	L112106KFIGS012SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-20-18	08:52	HTD	N/A	265.09 g
6	L112106KFIGS014SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-23-18	08:56	HTD	N/A	272.34 g
7	L112107KFSGS001SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:47	HTD	N/A	265.58 g
8	L112106KFSGS037SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:51	HTD	N/A	303.99 g
9	L112106KFSGS038SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:57	HTD	N/A	317.18 g
10	L112106KFIGS011SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-20-18	08:51	HTD	N/A	305.86 g
11	L112107KFSGS013SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:26	HTD	N/A	242.24 g
12	L112106KFIGS009SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-20-18	08:48	HTD	N/A	284.07 g
13	L112106KFIGS010SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-20-18	08:50	HTD	N/A	297.67 g

Laboratory:	Date Submitted To Lab:	Ship Container No.:	Cooler Temperature:	Airbill Number:
Eberline Analytical		002	N/A	Fed Ex Standard Overnight 8132 0229 0151

Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	Time:
Karen Nicholson	03/03/2020	0900	Richard E. Rickert	03/03/2020	0900
Richard E. Rickert	03/03/2020	1630	Fed Ex Standard Overnight	03/03/2020	1630
Fedex			Randolph Spencer	03/04/2020	0935

Comments

ZION SOLUTIONS LLC
An EnergySolutions Company

REC'D MAR 04 2020

20-03011

Attachment 1 – Chain-of-Custody Form

Continuation sheet for Sample container 002 Page 2 of 2

	Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
4	L112107KFSGS006SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	13:57	HTD	N/A	282.07 g
5	L112105KFSGS022SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	10:18	HTD	N/A	314.38 g
6	L112107KFQGS002SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:20	HTD	N/A	290.60 g
7	L112105KFSGS035SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:50	HTD	N/A	252.66 g
8	L112105KFSGS023SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	10:22	HTD	N/A	281.22 g
9	L112106KFIGS013SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-20-18	08:47	HTD	N/A	316.68 g
	L112105KFSGS039SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:59	HTD	N/A	260.90 g
	L112107KFSGS017SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:12	HTD	N/A	269.78 g
	L112106KFSGS031SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:47	HTD	N/A	269.36 g
	L112105KFSGS025SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:24	HTD	N/A	246.99 g
	L112105KFSGS034SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:48	HTD	N/A	253.63 g
	L112106KFSGS019SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:43	HTD	N/A	302.35 g
	L112107KFSGS004SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:41	HTD	N/A	282.30 g
	L112106KFSGS024SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	10:05	HTD	N/A	339.09 g

Rec 3-4-20 @ 0935 YB

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

EBS-OR-46933

March 16, 2020

Gerald Wood
Zion Solutions, LLC
2701 Deborah Avenue
Zion, IL 60099

CASE NARRATIVE
Work Order # 20-03012-OR

SAMPLE RECEIPT

This work order contains sixteen soil samples received 03/04/2020. Samples were analyzed for Total Strontium.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L112105KFSGS039SB-C	20-03012-04	L112101AFSGS002SB-C	20-03012-12
L112107KFSGS017SB-C	20-03012-05	L112106KFIGS005SB-C	20-03012-13
L112106KFSGS031SB-C	20-03012-06	L112106KFIGS006SB-C	20-03012-14
L112105KFSGS025SB-C	20-03012-07	L112106KFIGS007SB-C	20-03012-15
L112105KFSGS034SB-C	20-03012-08	L112106KFIGS008SB-C	20-03012-16
L112106KFSGS019SB-C	20-03012-09	L112106KFIGS016SB-C	20-03012-17
L112107KFSGS004SB-C	20-03012-10	L112106KFIGS017SB-C	20-03012-18
L112106KFSGS024SB-C	20-03012-11	L112105KFSGS038SB-C	20-03012-19

ANALYTICAL METHODS

Total Strontium was analyzed using EIChroM Method SRW01 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 leaching aliquots as appropriate and adding Strontium recovery carriers to each sample. Chemical separations were conducted using selective extractions. Strontium precipitates were mounted on tared filter media. Chemical recovery was determined by Strontium carrier mass determinations. Samples were counted by gas flow proportional counting and corrected for Yttrium-90 ingrowth.

Samples demonstrated acceptable results for all Total Strontium analyses. Strontium-90 results are reported from Total Strontium activity assuming secular equilibrium. All results demonstrated slightly high method detection limits. 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.

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: 3/16/2020

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Gerald Wood	SDG:	20-03012
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	Report Units
20-03012-01	LCS	KNOWN	03/04/20 00:00	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	5.05E+01	2.83E-01			pCi/g
20-03012-01	LCS	SPIKE	03/04/20 00:00	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	5.25E+01	1.40E+00	1.83E+01	8.98E-01	pCi/g
20-03012-02	MBL	BLANK	03/04/20 00:00	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	1.92E-02	3.49E-02	3.55E-02	8.70E-02	pCi/g
20-03012-03	DUP	L112105KFSGS039SB-C	07/12/18 13:59	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	1.01E-02	3.86E-02	3.88E-02	9.77E-02	pCi/g
20-03012-04	DO	L112105KFSGS039SB-C	07/12/18 13:59	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	8.95E-03	3.60E-02	3.62E-02	9.10E-02	pCi/g
20-03012-05	TRG	L112107KFSGS017SB-C	07/25/18 14:12	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	7.36E-02	3.44E-02	4.29E-02	7.84E-02	pCi/g
20-03012-06	TRG	L112106KFSGS031SB-C	07/14/18 09:47	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	7.61E-02	3.84E-02	4.67E-02	8.86E-02	pCi/g
20-03012-07	TRG	L112105KFSGS025SB-C	07/12/18 13:24	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	5.40E-02	3.25E-02	3.76E-02	7.61E-02	pCi/g
20-03012-08	TRG	L112105KFSGS034SB-C	07/12/18 13:48	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	3.14E-02	3.35E-02	3.52E-02	8.18E-02	pCi/g
20-03012-09	TRG	L112106KFSGS019SB-C	07/14/18 09:43	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	5.34E-02	2.92E-02	3.46E-02	6.68E-02	pCi/g
20-03012-10	TRG	L112107KFSGS004SB-C	07/25/18 14:41	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	6.69E-02	3.62E-02	4.31E-02	8.42E-02	pCi/g
20-03012-11	TRG	L112106KFSGS024SB-C	07/14/18 10:05	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	2.48E-02	3.16E-02	3.27E-02	7.77E-02	pCi/g
20-03012-12	TRG	L112101AFSGS002SB-C	03/06/19 09:20	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	2.51E-02	3.43E-02	3.54E-02	8.46E-02	pCi/g
20-03012-13	TRG	L112106KFIGS005SB-C	07/14/18 14:16	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	5.26E-02	3.46E-02	3.91E-02	8.18E-02	pCi/g
20-03012-14	TRG	L112106KFIGS006SB-C	07/14/18 14:18	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	5.93E-02	3.27E-02	3.86E-02	7.51E-02	pCi/g
20-03012-15	TRG	L112106KFIGS007SB-C	07/17/18 08:04	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	4.68E-02	3.38E-02	3.75E-02	7.98E-02	pCi/g
20-03012-16	TRG	L112106KFIGS008SB-C	07/17/18 09:03	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	7.53E-02	3.78E-02	4.60E-02	8.65E-02	pCi/g
20-03012-17	TRG	L112106KFIGS016SB-C	07/23/18 08:59	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	1.16E-02	3.69E-02	3.71E-02	9.35E-02	pCi/g
20-03012-18	TRG	L112106KFIGS017SB-C	07/23/18 09:01	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	6.44E-02	3.26E-02	3.96E-02	7.44E-02	pCi/g
20-03012-19	TRG	L112105KFSGS038SB-C	07/12/18 13:57	3/4/2020	3/10/2020	20-03012	Strontium-90	ElChroM SRW01 Modified	1.94E-02	3.97E-02	4.03E-02	9.92E-02	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

EBERLINE ANALYTICAL

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

ZION SOLUTIONS LLC
An Energy Solutions Company

REC'D MAR 04 2020

20-03012

Attachment 1 – Chain-of-Custody Form

Continuation sheet for Sample container 003 Page 2 of 2

Sample ID	Sample Log	Matrix	Sample Type	Sample Container				Sample Date	Sample Time	Analysis Type	Preservative	Remarks
				Vol	Unit	Type	Qty					
L112107KFSGS006SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	13:57	HTD	N/A	282.07 g
L112105KFSGS022SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	10:18	HTD	N/A	314.38 g
L112107KFQGS002SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:20	HTD	N/A	290.60 g
L112105KFSGS035SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:50	HTD	N/A	252.66 g
L112105KFSGS023SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	10:22	HTD	N/A	281.22 g
L112106KFIGS013SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-20-18	08:47	HTD	N/A	316.68 g
L112105KFSGS039SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:59	HTD	N/A	260.90 g
L112107KFSGS017SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:12	HTD	N/A	269.78 g
L112106KFSGS031SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:47	HTD	N/A	269.36 g
L112105KFSGS025SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:24	HTD	N/A	246.99 g
L112105KFSGS034SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:48	HTD	N/A	253.63 g
L112106KFSGS019SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:43	HTD	N/A	302.35 g
L112107KFSGS004SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:41	HTD	N/A	282.30 g
L112106KFSGS024SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	10:05	HTD	N/A	339.09 g

Rec 3-4-20 @ 0935 YSB

ZION SOLUTIONS LLC
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REC'D MAR 04 2020

20-03012

Attachment 1 – Chain-of-Custody Form

Sample container 001 Page 1 of 2

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks (weight in grams)
L112101AFSGS002SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	3-6-19	09:20	HTD	N/A	269.26 g
L112106KFIGS005SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	14:16	HTD	N/A	296.56 g
L112106KFIGS006SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	14:18	HTD	N/A	295.92 g
L112106KFIGS007SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-17-18	08:04	HTD	N/A	313.14 g
L112106KFIGS008SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-17-18	09:03	HTD	N/A	256.11 g
L112106KFIGS016SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-23-18	08:59	HTD	N/A	281.48 g
L112107KFIGS017SB-C *	N/A	N/A	Soil	500	mL	Marinelli	1	7-23-18	09:01	HTD	N/A	312.39 g
L112105KFSGS038SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:57	HTD	N/A	282.32 g
L112105KFSGS037SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:53	HTD	N/A	276.94 g
L112106KFQGS020SE-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:38	HTD	N/A	277.49 g

Laboratory: Eberline Analytical	Date Submitted To Lab:	Ship Container No.: 001	Cooler Temperature: N/A	Airbill Number: Fed Ex Standard Overnight 8132 0229 0162

Relinquished by: Karen Nicholson	Date (mm/dd/yyyy): 03/03/2020	Time: 0900	Received by: Richard F. Rickert	Date: (mm/dd/yyyy): 03/03/2020	Time: 0900
Relinquished by: Richard F. Rickert	Date (mm/dd/yyyy): 03/03/2020	Time: 1630	Received by: Fed Ex Standard Overnight	Date: (mm/dd/yyyy): 03/03/2020	Time: 1630
Relinquished by: Fedex	Date (mm/dd/yyyy):	Time:	Received by: Randolph Spencer	Date: (mm/dd/yyyy): 03/04/2020	Time: 0935
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	Time:

Comments

* per email 3/12/20 - ID should be L112106KFIGS017SBC
3/12/20

EBERLINE ANALYTICAL

EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD
OAK RIDGE, TENNESSEE 37830
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EBS-OR-46934

March 16, 2020

Gerald Wood
Zion Solutions, LLC
2701 Deborah Avenue
Zion, IL 60099

CASE NARRATIVE
Work Order # 20-03013-OR

SAMPLE RECEIPT

This work order contains fifteen soil samples received 03/04/2020. Samples were analyzed for Total Strontium.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L112105KFSGS037SB-C	20-03013-04	L112107KFSGS002SB-C	20-03013-12
L112106KFQGS020SB-C	20-03013-05	L112107KFSGS005SB-C	20-03013-13
L112106KFSGS021SB-C	20-03013-06	L112107KFSGS008SB-C	20-03013-14
L112106KFSGS022SB-C	20-03013-07	L112107KFSGS010SB-C	20-03013-15
L112106KFSGS023SB-C	20-03013-08	L112107KFSGS014SB-C	20-03013-16
L112106KFSGS028SB-C	20-03013-09	L112107KFSGS015SB-C	20-03013-17
L112106KFSGS029SB-C	20-03013-10	L112107KFSGS016SB-E	20-03013-18
L112106KFSGS032SB-C	20-03013-11		

ANALYTICAL METHODS

Total Strontium was analyzed using EIChroM Method SRW01 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 leaching aliquots as appropriate and adding Strontium recovery carriers to each sample. Chemical separations were conducted using selective extractions. Strontium precipitates were mounted on tared filter media. Chemical recovery was determined by Strontium carrier mass determinations. Samples were counted by gas flow proportional counting and corrected for Yttrium-90 ingrowth.

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

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: 3/16/2020

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

Eberline Analytical
Final Report of Analysis

Report To:

Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	**20-03013**
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	Report Units
20-03013-01	LCS	KNOWN	03/04/20 00:00	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	5.10E+01	2.86E-01			pCi/g
20-03013-01	LCS	SPIKE	03/04/20 00:00	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	5.08E+01	2.71E+00	1.79E+01	1.13E+00	pCi/g
20-03013-02	MBL	BLANK	03/04/20 00:00	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	-1.53E-02	3.41E-02	3.45E-02	9.28E-02	pCi/g
20-03013-03	DUP	L112105KFSGS037SB-C	07/12/18 13:53	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	7.49E-02	3.69E-02	4.52E-02	8.84E-02	pCi/g
20-03013-04	DO	L112105KFSGS037SB-C	07/12/18 13:53	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	7.68E-03	3.65E-02	3.66E-02	9.64E-02	pCi/g
20-03013-05	TRG	L112106KFQGS020SB-C	07/14/18 09:38	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	6.39E-02	3.93E-02	4.51E-02	9.68E-02	pCi/g
20-03013-06	TRG	L112106KFSGS021SB-C	07/14/18 09:35	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	7.78E-02	3.41E-02	4.36E-02	8.05E-02	pCi/g
20-03013-07	TRG	L112106KFSGS022SB-C	07/14/18 09:06	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	5.96E-02	3.61E-02	4.16E-02	8.82E-02	pCi/g
20-03013-08	TRG	L112106KFSGS023SB-C	07/14/18 10:01	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	5.34E-02	3.17E-02	3.67E-02	7.70E-02	pCi/g
20-03013-09	TRG	L112106KFSGS028SB-C	07/14/18 09:21	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	2.99E-02	3.28E-02	3.44E-02	8.36E-02	pCi/g
20-03013-10	TRG	L112106KFSGS029SB-C	07/14/18 09:55	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	4.64E-02	2.85E-02	3.28E-02	6.89E-02	pCi/g
20-03013-11	TRG	L112106KFSGS032SB-C	07/14/18 09:50	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	4.65E-02	3.46E-02	3.82E-02	8.62E-02	pCi/g
20-03013-12	TRG	L112107KFSGS002SB-C	07/25/18 14:20	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	2.46E-02	3.14E-02	3.25E-02	8.05E-02	pCi/g
20-03013-13	TRG	L112107KFSGS005SB-C	07/25/18 14:45	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	8.98E-03	3.23E-02	3.25E-02	8.52E-02	pCi/g
20-03013-14	TRG	L112107KFSGS008SB-C	07/25/18 14:23	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	4.89E-02	3.37E-02	3.78E-02	8.34E-02	pCi/g
20-03013-15	TRG	L112107KFSGS010SB-C	07/25/18 14:40	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	6.89E-02	3.40E-02	4.16E-02	8.02E-02	pCi/g
20-03013-16	TRG	L112107KFSGS014SB-C	07/25/18 14:34	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	6.13E-02	3.54E-02	4.14E-02	8.52E-02	pCi/g
20-03013-17	TRG	L112107KFSGS015SB-C	07/25/18 14:37	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	4.22E-02	3.62E-02	3.91E-02	9.07E-02	pCi/g
20-03013-18	TRG	L112107KFSGS016SB-E	07/25/18 14:08	3/4/2020	3/10/2020	20-03013	Strontium-90	ElChroM SRW01 Modified	6.30E-02	4.00E-02	4.56E-02	9.77E-02	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

ZION SOLUTIONS LLC
An EnergySolutions Company

REC'D MAR 04 2020

ZS-WM-131
Revision 0
Information Use

20-03013

Attachment 1 – Chain-of-Custody Form

Sample container 001 Page 1 of 2

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks (weight in grams)
L112101AFSGS002SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	3-6-19	09:20	HTD	N/A	269.26 g
L112106KFIGS005SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	14:16	HTD	N/A	296.56 g
L112106KFIGS006SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	14:18	HTD	N/A	295.92 g
L112106KFIGS007SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-17-18	08:04	HTD	N/A	313.14 g
L112106KFIGS008SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-17-18	09:03	HTD	N/A	256.11 g
L112106KFIGS016SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-23-18	08:59	HTD	N/A	281.48 g
L112107KFIGS017SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-23-18	09:01	HTD	N/A	312.39 g
L112105KFSGS038SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:57	HTD	N/A	282.32 g
L112105KFSGS037SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-12-18	13:53	HTD	N/A	276.94 g
L112106KFQGS020SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:38	HTD	N/A	277.49 g

Laboratory:	Date Submitted To Lab:	Ship Container No.:	Cooler Temperature:	Airbill Number:
Eberline Analytical		001	N/A	Fed Ex Standard Overnight 8132 0229 0162

Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	Time:
Karen Nicholson	03/03/2020	0900	Richard F. Rickert	03/03/2020	0900
Richard F. Rickert	03/03/2020	1630	Fed Ex Standard Overnight	03/03/2020	1630
Fedex			Jonathan Spencer	03/04/2020	0935

Comments

ZION SOLUTIONS LLC
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REC'D MAR 04 2020

Attachment 1 – Chain-of-Custody Form

2503013

Continuation sheet for Sample container 001 Page 2 of 2

Sample ID	Sample Log	Matrix	Sample Type	Sample Container				Sample Date	Sample Time	Analysis Type	Preservative	Remarks
				Vol	Unit	Type	Qty					
L112106KFSGS021SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:35	HTD	N/A	269.22 g
L112106KFSGS022SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:06	HTD	N/A	285.77 g
L112106KFSGS023SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	10:01	HTD	N/A	282.02 g
L112106KFSGS028SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:21	HTD	N/A	312.20 g
L112106KFSGS029SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:55	HTD	N/A	288.33 g
L112106KFSGS032SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-14-18	09:50	HTD	N/A	304.80 g
L112107KFSGS002SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:20	HTD	N/A	262.65 g
L112107KFSGS005SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:45	HTD	N/A	272.75 g
L112107KFSGS008SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:23	HTD	N/A	256.42 g
L112107KFSGS010SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:40	HTD	N/A	261.75 g
L112107KFSGS014SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:34	HTD	N/A	272.38 g
L112107KFSGS015SB-C	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:37	HTD	N/A	271.52 g
L112107KFSGS016SB-E	N/A	N/A	Soil	500	mL	Marinelli	1	7-25-18	14:08	HTD	N/A	180.02 g

Rec KAS 3-4-20 00935