ZION SOLUTIONS LLC
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ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

WWTF SLUDGE DRYING BED AREA

SURVEY UNIT 12101

REVISION 1

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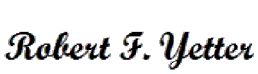
REVIEWED BY / DATE: Robert Yetter  Robert F. Yetter Apr 29 2020 2:03 PM cosign

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LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
AMCG	Average Member of the Critical Group
BcDCGL	Base Case Soil DCGLs
BcSOF	Base Case Sum of Fractions
C/LT	Characterization/License Termination
cpm	Counts per minute
DQA	Data Quality Assessment
DQO	Data Quality Objective
DCGL	Derived Concentration Guideline Level
EMC	Elevated Measurement Comparison
FSS	Final Status Survey
GPS	Global Positioning System
HTD	Hard-to-Detect
HSA	Historical Site Assessment
IC	Insignificant Contributor
LBGR	Lower Bound of the Gray Region
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimum Detectable Count Rate
NAD	North American Datum
NaI	Sodium Iodide
OpDCGL	Operational Derived Concentration Guideline Level
OpSOF	Operational Sum of Fractions
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Radiological Assessment
RE	Radiological Engineer

ROC	Radionuclides of Concern
SOF	Sum of Fractions
TEDE	Total Effective Dose Equivalent
TSD	Technical Support Document
UBGR	Upper Bound of the Gray Region
UCL	Upper Confidence Level
VSP	Visual Sample Plan
WWTF	Waste Water Treatment Facility
ZNPS	Zion Nuclear Power Station
ZSRP	Zion Station Restoration Project

1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for Survey Unit 12101, "Waste Water Treatment Facility (WWTF) Sludge Drying Bed Area," has been generated for the Zion Station Restoration Project (ZSRP) in accordance with Zion*Solutions* procedure ZS-LT-300-001-005, *"Final Status Survey Data Reporting"* (Reference 1) and satisfies the requirements of Section 5.11 of the *"Zion Station Restoration Project License Termination Plan"* (LTP) (Reference 2).

An FSS package (L1-12101A-F) was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001,*"Final Status Survey Package Development"* (Reference 3), the ZSRP LTP, and guidance from NUREG-1575, "*Multi-Agency Radiation Survey and Site Investigation Manual"* (MARSSIM) (Reference 4).

This open land survey unit has a MARSSIM classification of one. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I (α) and Type II (β) decision error rates were set at 0.05. Seventeen (17) systematic surface soil samples were acquired from the survey unit. In addition, surface scanning was performed on 100% of the total surface area in the survey unit. No areas of elevated activity were detected during the scans. The analytical results for all soil samples taken in survey unit 12101 indicate that the Sum of Fractions (SOF) for each sample, when compared to the Operational Derived Concentration Guideline Levels (OpDCGL), was less than 1.0, with a maximum Operational SOF (OpSOF) of 0.200. The mean OpSOF for the systematic samples was 0.055. The mean Base Case SOF (BcSOF), when the analytical results were compared to the Base Case DCGLs (BcDCGL), was 0.014, which results in a dose assigned to the survey unit of 0.355 mrem/year. Therefore, the null hypothesis is rejected and survey unit 12101 is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 12101, "WWTF Sludge Drying Bed Area," is a Class 1 open land survey unit that is 2,036 m^2 in size. It is bounded on the west by survey unit 12201E, the south by survey unit 12102, the east by survey unit 10223, and the north by survey units 10201D and 10202D.

The topography of the survey unit is mainly flat with some small dips and depressions. The soil is mostly loam. There is a fence running along the east side of the survey unit.

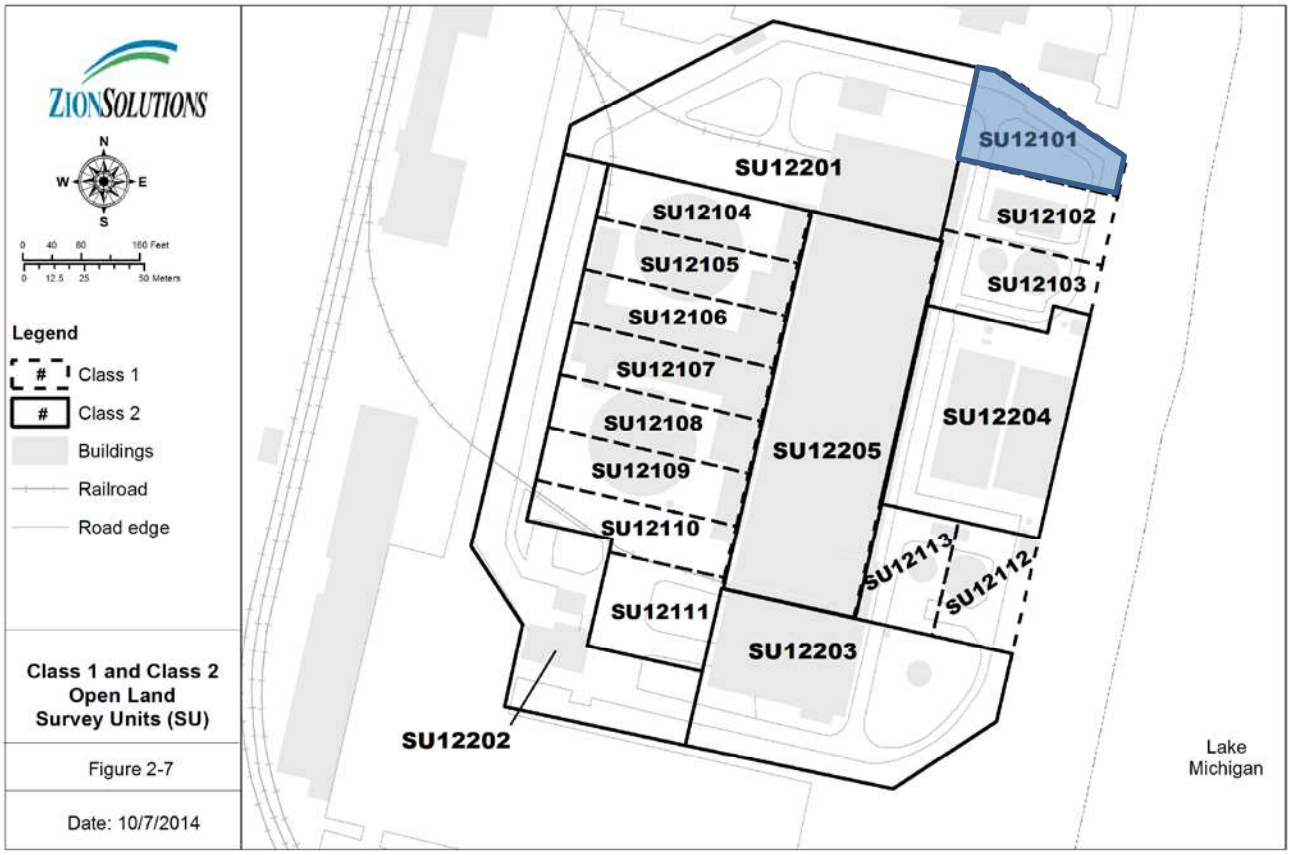
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 12101 was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 5).

The area encompassing this survey unit was described in the *"Zion Station Historical Site Assessment"* (HSA) (Reference 6) as the "WWTF Area" and was located within survey unit 10101 as identified in Figure 3 of the HSA. Subsequently, in the LTP, the area of survey units 10112 and 10101 that was inside the Security Area fence line was split into three survey units, 12101, 12102, and 12103. Survey unit 12101 was described as the "WWTF Sludge Drying Bed Area" in Table 2-4 of the LTP. The location of these survey units is represented in Figure 2-7 of the LTP, which is replicated below as Figure 1.

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



A Characterization Survey was performed in September 2012 for survey unit 12101. This characterization survey consisted of gamma walkover scans using a Ludlum Model 2350-1 and a Model 44-10 (2" x 2") sodium iodide (NaI) detector. These scans identified areas with activity above the Minimum Detectable Count Rate (MDCR) of the instrument. Investigations were performed and thirteen (13) of these locations were selected for surface and subsurface sampling.

Characterization samples were taken in June 2013 at the thirteen (13) locations identified from the previous survey. The results were:

- Thirteen (13) surface soil samples were taken, two (2) of which had positive activity for Cs-137. The activities for the two samples were 0.16 and 0.21 pCi/g. Co-60 was less than the Minimum Detectable Concentration (MDC) for all samples.
- Thirteen (13) locations had subsurface samples taken to a depth of three (3) meters, composited in 1-meter intervals. One (1) of the samples had positive Cs-137 activity at 0.08 pCi/g. All of the subsurface samples were < MDC for Co-60.

In August of 2014, a surveillance survey was performed in the three WWTF Drying Beds. Gamma walkover scans were performed, which identified seven (7) points with activity above the MDCR of the instrument. Nine (9) investigation samples were taken, three (3) in each of the beds. Cs-137 was detected in all nine (9) samples, ranging from 0.21 to 4.72 pCi/g. Co-60 was identified in six (6) samples, ranging from 0.18 to 1.83 pCi/g. The soil in the three WWTF Drying Beds was subsequently removed.

In August of 2015, the security fence was removed at the north Section of survey unit 12101, enabling access to the area between the double fence. A gamma walkover survey was performed of this area of the survey unit. No areas of activity above the MDCR of the instrument were identified.

In April and May of 2017, excavations were performed to remove buried pipe in survey units 12101, 12102, and 12103. Surveys and sampling were performed during this pipe removal on a Radiological Assessment (RA) survey. Gamma scans on the pipe Sections and excavated soil showed no activity above the MDC_{scan} of the instrument, and soil samples showed no activity above MDC for the Radionuclides of Concern (ROC).

In February of 2019, scans and surface/subsurface sampling was performed in the drying bed area to ensure the activity identified in 2014 had been removed. The gamma walkover scans did not identify any areas of activity above MDCR. Four (4) sample locations were marked, at the approximate locations of the 2014 samples. One (1) surface sample had Cs-137 activity above MDC, at 0.06 pCi/g. Two (2) subsurface samples had Cs-137 activity above MDC, at 0.17 pCi/g and 0.18 pCi/g.

A Radiological Engineer (RE) and a Characterization/License Termination (C/LT) Supervisor performed a visual inspection and walk-down of the survey unit on February 21, 2019, prior to performing FSS. The purpose of the walk-down was to assess the physical condition of the survey unit, evaluate access points and travel paths and identify potentially hazardous conditions. A final classification assessment was performed in accordance with procedure ZS-LT-300-001-002, "*Survey Unit Classification*" as part of the survey design for FSS. The assessment confirmed that survey unit 12101 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 12101 does not exceed the release criteria specified in the LTP and that the potential dose from residual radioactivity is As Low As Reasonably Achievable (ALARA).

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

Zion*Solutions* TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* (Reference 8), was written to refine the initial selection of ROC for decommissioning at the ZSRP. The list of ROC was evaluated using Containment Building(s) and Auxiliary Building concrete core analysis data to evaluate the dose significance of each radionuclide in the end state model. Section 4.4 of TSD 14-019 evaluated the results of the characterization data of surveys taken of soils. The following conclusion was reached: *"The results of* surface *and subsurface soil characterization in the impacted area surrounding Zion indicate that there is minimal residual radioactivity in soil. Essentially all of the soil results were reported as non-detectable. Other than Cs-137 at very low levels, and Co-60 at a concentration of 0.24 pCi/g in one sample, the results for all radionuclides were less than MDC. Therefore, the direct determination of radionuclide mixture fractions for initial suite radionuclides in soil is not technically feasible due to the MDC biasing issues discussed above. Based on a generalized assumption that the contaminated water that caused concrete contamination would be similar to the source of soil contamination, the ROC and radionuclide mixture derived for the Auxiliary Building concrete was considered to be reasonably representative of soils for FSS planning and implementation.*"

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

Table 1 - Dose Significant Radionuclides and Mixture

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

(1) Based on maximum percent of total activity from Table 20 of TSD 14-019, normalized to one for the dose significant radionuclides

(2) Does not include dose significant radionuclides for activated concrete (H-3, Eu-152, Eu-154).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

As part of the DQOs applied to laboratory processes, analysis results were reported as actual calculated results. The actual recorded value was used as the recorded FSS result for measurement and/or sample values that are less than MDC. Negative values were recorded as "zero." For radionuclides less than MDC, the value representing the highest abundance was

selected. Results were not reported as "less than MDC." Sample report summaries included unique sample identification, analytical method, radionuclide, result, uncertainty, laboratory data qualifiers, units, and the observed MDC.

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

5. SURVEY DESIGN

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

The DQO process determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 would be the ROC in survey unit 12101. During FSS, concentrations for Hard-to-Detect (HTD) ROC Ni-63 and Sr-90 are inferred using a surrogate approach. Cs-137 is the principle surrogate radionuclide for Sr-90 and Co-60 is the principle surrogate radionuclide for Ni-63. The mean, maximum and 95% Upper Confidence Level (UCL) of the surrogate ratios for concrete core samples taken in the Auxiliary Building basement were calculated in Zion*Solutions* TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* and are presented in Table 6. The maximum ratios will be used in the surrogate calculations during FSS unless area specific ratios are determined by continuing characterization.

Table 6 - Surrogate Ratios

Ratios	Auxiliary Building		
	Mean	Max	95%UCL
Ni-63/Co-60	44.143	180.450	154.632
Sr-90/Cs-137	0.001	0.002	0.002

For the FSS of survey unit 12101, the surrogate OpDCGLs for Co-60 and Cs-137 were computed based on the maximum ratios from Table 6.

The equation for calculating a surrogate DCGL is as follows:

Equation 1

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

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

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

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

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

Equation 2

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

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

Equation 3

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

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

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

Equation 4

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

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

Equation 5

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

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

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

Table 7 - Investigation Levels

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

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

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

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

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

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

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

The computer program Visual Sample Plan (VSP) was used to generate the sample map, in accordance with ZS-LT-300-001-001. The map used was provided by the Survey Mapping/Computer Assisted Design Specialist, with coordinates based on the Illinois State Plane NAD 1983 standard topographical grid coordinate system. The number of samples generated by VSP for a systematic triangular grid was 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: $A = \frac{A_{SU}}{N} = \frac{2036}{17} = 119.8\ m^2$
- From the LTP, Table 5-16, the Area Factors for the next larger area (300 m^2) area were used:
  - Cs-137 - 1.46
  - Cs-134 - 1.30
  - Co-60 - 1.16
- The $DCGL_{EMC}$ is the Surrogate Base Case DCGL times the Area Factor:
  - The $DCGL_{EMC}$ for Cs-137 – $1.46 * 14.15 = 20.66\ pCi/g$
  - The $DCGL_{EMC}$ for Cs-134 – $1.30 * 6.77 = 8.80\ pCi/g$
  - The $DCGL_{EMC}$ for Co-60 – $1.16 * 3.51 = 4.07\ pCi/g$

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

The implementation of quality control 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 (L1-12101A-FQGS-009-SS) was selected randomly for split sample analysis for the FSS of this survey unit.

In accordance with Section 5.7.1.6.2 of the LTP, a subsurface soil sample was taken at 10% of the systematic surface soil sample locations in the survey unit with the location(s) selected at random. Locations L1-12101A-FSGS-002-SB and L1-12101A-FSGS-008-SB were selected for this survey unit.

The locations of the seventeen (17) systematic samples are listed in Table 8. Also included

are the locations of the two (2) subsurface samples. A map of the systematic sample locations is included in Attachment 1.

Table 8 - Systematic Sample Measurement Locations

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L1-12101A-FSGS-001-SS	641860.54	343782.54
L1-12101A-FSGS-002-SS	641860.54	343794.30
L1-12101A-FSGS-003-SS	641860.54	343806.05
L1-12101A-FSGS-004-SS	641860.54	343817.81
L1-12101A-FSGS-005-SS	641870.73	343764.90
L1-12101A-FSGS-006-SS	641870.73	343776.66
L1-12101A-FSGS-007-SS	641870.73	343788.42
L1-12101A-FSGS-008-SS	641870.73	343800.18
L1-12101A-FSGS-009-SS	641870.73	343811.93
L1-12101A-FSGS-010-SS	641880.91	343759.02
L1-12101A-FSGS-011-SS	641880.91	343770.78
L1-12101A-FSGS-012-SS	641880.91	343782.54
L1-12101A-FSGS-013-SS	641880.91	343794.30
L1-12101A-FSGS-014-SS	641891.10	343764.90
L1-12101A-FSGS-015-SS	641891.10	343776.66
L1-12101A-FSGS-016-SS	641891.10	343788.42
L1-12101A-FSGS-017-SS	641901.28	343770.78
L1-12101A-FSGS-002-SB	641860.54	343794.30
L1-12101A-FSGS-008-SB	641870.73	343800.18

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. Four (4) samples, L1-12101A-FSGS-011-SS, L1-12101A-FSGS-012-SS, L1-12101A-

FSGS-014-SS and L1-12101A-FSGS-002-SB, exceeded an OpSOF of 0.1 during the FSS of survey unit 12101. These soil samples satisfy the requirement that 10% of the samples collected for the FSS of survey unit 12101 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.

Table 9 provides a synopsis of the survey design for survey unit 12101.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	2,036 m^2	GPS measurements of area
Number of Surface Soil Samples	17 (Systematic)	• $\sigma = 0.30$ • UBGR = SOF of 1 • LBGR = SOF of 0.5 • Type I error = 0.05 • Type II error = 0.05 • $\Delta/\sigma = 1.67$ (MARSSIM Table 5.5)
Grid Spacing	11.8 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)
Quality Control (QC)	One (1) surface soil sample selected randomly for split sample analysis	(LTP, Section 5.9)
Number of Subsurface Soil Samples	Two (2) systematic surface soil sample locations selected, at locations 2 and 8	(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 L1-12101A-F, which was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, "*Final Status Survey Package Development*." The FSS unit was inspected and controlled in accordance with Zion*Solutions* procedure ZS-LT-300-001-003, "*Isolation and Control for Final Status Survey*" (Reference 13).

For survey unit 12101, compliance with the unrestricted release criteria was demonstrated through a combination of surface scanning with a Ludlum Model 44-10 gamma detector and the sampling of surface soil for isotopic analysis. In accordance with the LTP Chapter 5, two (2) subsurface samples were obtained and analyzed. Also, if during the performance of FSS, the analysis of a surface soil sample, or the results of a surface gamma scan indicated the potential presence of residual radioactivity at a concentration of 75% of the subsurface OpDCGL, then a biased subsurface soil sample(s) would have been taken to the appropriate depth within the area of concern as part of the investigation. This threshold was not encountered during the FSS of survey unit 12101.

FSS field activities were conducted under FSS sample plan L1-12101A-F. A "Field Log" (ZS-LT-300-001-001, Attachment 14) was used to document field activities and other information pertaining to the performance of the FSS.

FSS field activities were projected to take four (4) working days to complete. Daily briefings were conducted to discuss the expectations for job performance and to review safety aspects of the job. The survey required field activities were performed during normal working hours starting on February 25, 2019, and concluding on March 6, 2019.

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

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

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

Table 10 - Instruments and Detectors

Instrument/Detector Type	Serial #	Calibration Due Date
Ludlum 2350-1/Ludlum 44-10	216173/PRES0118	12/6/2019
Ludlum 2350-1/Ludlum 44-10	304712/PR372143	12/18/2019
Ludlum 2350-1/Ludlum 44-10	95361/PR372150	12/5/2019
Ludlum 2350-1/Ludlum 44-10	304718/PR363311	12/13/2019
Ludlum 2350-1/Ludlum 44-10	304713/PR311786	12/11/2019
Ludlum 2350-1/Ludlum 44-10	304730/PR375272	1/6/2020
Ludlum 2350-1/Ludlum 44-10	293136/PR316938	1/9/2020
Ludlum 2350-1/Ludlum 44-10	266669/PR311756	12/12/2019
Ludlum 2350-1/Ludlum 44-10	266668/PR363489	12/19/2019

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

Four (4) samples (L1-12101A-FSGS-011SS, L1-12101A-FSGS-012-SS, L1-12101A-FSGS-014-SS, and L1-12101A-FSGS-002-SB) were selected for HTD radionuclide analysis.

7. SURVEY RESULTS

One hundred percent (100%) of the surface of the survey unit was scanned for elevated radiation levels. Sixty-nine (69) 1-meter wide scan rows, as shown on the map in Attachment 1, were marked in the field and scanned with the 2350-1/44-10 using latching mode. Readings were recorded at approximately 10-meter intervals during the scans. No elevated measurement locations were identified by surface scan. Table 11 provides an overview of the scan results. Complete scan results are provided in Attachment 2.

Table 11 - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[(1)] (cpm)	# of Scan Alarms	Investigation Samples
Row 1	1850	2189	None	None
Row 2	1885	2189	None	None
Row 3	1804	2189	None	None
Row 4	1976	2240	None	None
Row 5	1841	2189	None	None
Row 6	1893	2189	None	None
Row 7	2075	2189	None	None
Row 8	2056	2189	None	None
Row 9	2055	2189	None	None
Row 10	2014	2189	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 11	2363	2518	None	None
Row 12	2273	2518	None	None
Row 13	2363	2518	None	None
Row 14	2369	2518	None	None
Row 15	2315	2518	None	None
Row 16	2254	2518	None	None
Row 17	2270	2518	None	None
Row 18	2220	2518	None	None
Row 19	2155	2518	None	None
Row 20	2109	2518	None	None
Row 21	2157	2276	None	None
Row 22	2110	2276	None	None
Row 23	2195	2276	None	None
Row 24	2153	2276	None	None
Row 25	2173	2276	None	None
Row 26	2219	2276	None	None
Row 27	2212	2276	None	None
Row 28	2166	2276	None	None
Row 29	2160	2276	None	None
Row 30	2217	2276	None	None
Row 31	2321	2534	None	None
Row 32	2146	2534	None	None
Row 33	2149	2534	None	None
Row 34	2301	2534	None	None
Row 35	2199	2534	None	None
Row 36	2345	2534	None	None
Row 37	2368	2534	None	None
Row 38	2211	2534	None	None
Row 39	2280	2534	None	None
Row 40	2204	2534	None	None
Row 41	2067	2348	None	None
Row 42	2222	2348	None	None
Row 43	2178	2348	None	None
Row 44	2126	2348	None	None
Row 45	2170	2468	None	None
Row 46	2391	2468	None	None
Row 47	2180	2468	None	None
Row 48	2221	2468	None	None
Row 49	2216	2332	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 50	2185	2370	None	None
Row 51	2209	2426	None	None
Row 52	2250	2332	None	None
Row 53	2224	2370	None	None
Row 54	2186	2426	None	None
Row 55	2108	2372	None	None
Row 56	2135	2372	None	None
Row 57	2033	2372	None	None
Row 58	2246	2372	None	None
Row 59	2077	2372	None	None
Row 60	2068	2242	None	None
Row 61	2053	2242	None	None
Row 62	2057	2242	None	None
Row 63	2114	2242	None	None
Row 64	2070	2242	None	None
Row 65	2063	2360	None	None
Row 66	2313	2360	None	None
Row 67	2144	2360	None	None
Row 68	2191	2360	None	None
Row 69	2191	2360	None	None

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

The seventeen (17) soil samples taken for non-parametric statistical testing and the two (2) subsurface soil samples were analyzed using the on-site gamma spectroscopy system. Summaries of the sample analysis results are provided in Tables 12 and 13, respectively. The basic statistics for the systematic sample population are summarized in Table 19. The gamma spectroscopy results revealed sixteen (16) samples with activity level above MDC for Cs-137, three (3) 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 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)
L1-12101A-FSGS-001-SS	0.00E+00	1.15E-02	**6.50E-02**	0.00E+00	1.30E-04
L1-12101A-FSGS-002-SS	0.00E+00	5.31E-03	**2.40E-02**	0.00E+00	4.80E-05
L1-12101A-FSGS-003-SS	0.00E+00	4.78E-03	**2.95E-02**	0.00E+00	5.90E-05
L1-12101A-FSGS-004-SS	1.82E-02	3.16E-03	3.43E-02	3.28E+00	6.86E-05
L1-12101A-FSGS-005-SS	3.49E-02	2.17E-03	**8.68E-02**	6.30E+00	1.74E-04
L1-12101A-FSGS-006-SS	1.43E-02	2.74E-02	**2.59E-02**	2.58E+00	5.18E-05
L1-12101A-FSGS-007-SS	0.00E+00	1.26E-02	**3.65E-02**	0.00E+00	7.30E-05
L1-12101A-FSGS-008-SS	1.03E-02	0.00E+00	**3.65E-02**	1.86E+00	7.30E-05
L1-12101A-FSGS-009-SS	1.63E-02	2.48E-02	**3.32E-02**	2.94E+00	6.64E-05
L1-12101A-FSGS-010-SS	5.00E-03	1.60E-02	2.41E-02	9.02E-01	4.82E-05
L1-12101A-FSGS-011-SS	**4.29E-02**	2.31E-02	**1.51E-01**	7.74E+00	3.02E-04
L1-12101A-FSGS-012-SS	**4.13E-02**	4.11E-02	**1.49E-01**	7.45E+00	2.98E-04
L1-12101A-FSGS-013-SS	2.57E-02	7.01E-03	**4.35E-02**	4.64E+00	8.70E-05
L1-12101A-FSGS-014-SS	**1.07E-01**	5.45E-03	**2.83E-01**	1.93E+01	5.66E-04
L1-12101A-FSGS-015-SS	3.58E-02	1.23E-03	**1.55E-01**	6.46E+00	3.10E-04
L1-12101A-FSGS-016-SS	4.27E-02	3.00E-02	**8.45E-02**	7.71E+00	1.69E-04
L1-12101A-FSGS-017-SS	2.18E-02	0.00E+00	**2.47E-02**	3.93E+00	4.94E-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)
L1-12101A-FSGS-002-SB	2.57E-02	1.02E-02	**1.41E-01**	4.64E+00	2.82E-04
L1-12101A-FSGS-008-SB	0.00E+00	1.40E-02	4.21E-02	0.00E+00	8.42E-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 four (4) samples selected for HTD ROC analysis (L1-12101A-FSGS-011-SS-A, L1-12101A-FSGS-012-SS-A, L1-12101A-FSGS-014-SS-A and L1-12101A-FSGS-002-SB-A). Only HTD radionuclides included as ROC (Ni-63 and Sr-90 for soils) were included in the analysis. All analyses met the required MDC. Only Cs-137 and Co-60 were positively detected in the samples at a concentration greater than MDC. Consequently, comparison of existing ratios versus the maximum ratios from Table 6 was not required. The off-site analysis results are provided in Table 14.

Table 14 - Off-Site Analysis Results

Sample # L1-12101A-FSGS-011-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	1.84E-01	6.17E-02	1.07E-01	Yes
Cs-134	8.39E-04	2.76E-02	9.80E-02	No
Cs-137	1.54E-01	8.17E-02	1.26E-01	Yes
Ni-63	-1.49E+00	1.87E+00	3.31E+00	No
Sr-90	3.09E-01	2.63E-01	5.27E-01	No

Sample # L1-12101A-FSGS-012-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	1.68E-01	6.73E-02	1.01E-01	Yes
Cs-134	0.00E+00	5.20E-02	1.30E-01	No
Cs-137	2.23E-01	1.24E-01	1.93E-01	Yes
Ni-63	-6.60E-01	2.05E+00	3.56E+00	No
Sr-90	-1.05E-01	2.97E-01	6.45E-01	No

Sample # L1-12101A-FSGS-014-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	2.31E-01	7.18E-02	1.57E-01	Yes
Cs-134	-4.36E-03	1.78E-02	8.76E-02	No
Cs-137	3.22E-01	7.71E-02	8.71E-02	Yes
Ni-63	-6.60E-01	2.04E+00	3.55E+00	No
Sr-90	1.59E-02	2.97E-01	6.33E-01	No

Sample # L1-12101A-FSGS-002-SB-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	8.83E-03	9.52E-02	1.50E-01	No
Cs-134	5.69E-03	1.88E-02	1.16E-01	No
Cs-137	2.72E-01	8.33E-02	1.04E-01	Yes
Ni-63	1.75E+00	2.06E+00	3.47E+00	No
Sr-90(1)	2.51E-02	3.43E-02	8.46E-02	No

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

The implementation of survey specific QC measures included the collection of one (1) sample (L1-12101A-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 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)
L1-12101A-FQGS-009-SS	0.00E+00	1.98E-02	3.18E-02	0.00E+00	6.36E-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

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

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 12101 are presented in Table 16. The results of the unity rule calculations for the ROC for the subsurface samples are presented in Table 17, and the results for the QC sample are presented in Table 18.

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12101A-FSGS-001-SS	0.00E+00	6.64E-03	1.79E-02	0.00E+00	4.20E-05	0.025
L1-12101A-FSGS-002-SS	0.00E+00	3.06E-03	6.61E-03	0.00E+00	1.55E-05	0.010
L1-12101A-FSGS-003-SS	0.00E+00	2.76E-03	8.13E-03	0.00E+00	1.91E-05	0.011
L1-12101A-FSGS-004-SS	1.67E-02	1.82E-03	9.45E-03	3.59E-03	2.22E-05	0.032
L1-12101A-FSGS-005-SS	3.20E-02	1.25E-03	2.39E-02	6.89E-03	5.61E-05	0.064
L1-12101A-FSGS-006-SS	1.31E-02	1.58E-02	7.13E-03	2.82E-03	1.67E-05	0.039
L1-12101A-FSGS-007-SS	0.00E+00	7.27E-03	1.01E-02	0.00E+00	2.36E-05	0.017
L1-12101A-FSGS-008-SS	9.44E-03	0.00E+00	1.01E-02	2.03E-03	2.36E-05	0.022
L1-12101A-FSGS-009-SS	1.49E-02	1.43E-02	9.15E-03	3.22E-03	2.15E-05	0.042
L1-12101A-FSGS-010-SS	4.58E-03	9.23E-03	6.64E-03	9.87E-04	1.56E-05	0.021
L1-12101A-FSGS-011-SS	3.93E-02	1.33E-02	4.16E-02	8.47E-03	9.76E-05	0.103

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12101A-FSGS-012-SS	3.79E-02	2.37E-02	4.10E-02	8.15E-03	9.63E-05	0.111
L1-12101A-FSGS-013-SS	2.36E-02	4.05E-03	1.20E-02	5.07E-03	2.81E-05	0.045
L1-12101A-FSGS-016-SS	3.91E-02	1.73E-02	2.33E-02	8.43E-03	5.46E-05	0.088
L1-12101A-FSGS-017-SS	2.00E-02	0.00E+00	6.80E-03	4.30E-03	1.60E-05	0.031

Systematic Measurements

Number of Systematic Measurements =	17
# of Systematic Measurements with OpSOF $\geq$ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	3
Max Individual Systematic Measurement OpSOF =	0.200
Mean Systematic Measurement OpSOF =	0.055

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

MEASUREMENT ID	Fraction of the OpDCGLs for Subsurface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12101A-FSGS-002-SB	2.92E-02	8.97E-03	7.11E-02	2.37E-02	6.64E-04	0.134
L1-12101A-FSGS-008-SB	0.00E+00	1.23E-02	2.12E-02	0.00E+00	1.98E-04	0.034

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

MEASUREMENT ID	Fraction of the OpDCGLs for Subsurface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-12101A-FQGS-009-SS	0.00E+00	1.14E-02	8.76E-03	0.00E+00	2.05E-05	0.020

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	2.45E-02	1.82E-02	1.07E-01	0.00E+00	0.026	4.26	5.75E-03	1.44E-01
Cs-134	1.27E-02	7.01E-03	4.11E-02	0.00E+00	0.012	6.77	1.87E-03	4.68E-02
Cs-137	7.57E-02	3.65E-02	2.83E-01	2.40E-02	0.071	14.18	5.34E-03	1.33E-01
Ni-63	4.42E+00	3.28E+00	1.93E+01	0.00E+00	4.774	3572.1	1.24E-03	3.09E-02
Sr-90	1.51E-04	7.30E-05	5.66E-04	4.80E-05	0.000	12.09	1.25E-05	3.13E-04

The mean BcSOF for survey unit 12101 is 0.014, which equates to a dose of 0.355 mrem/yr TEDE.

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

8. QUALITY CONTROL

The on-site laboratory processed one (1) split sample, L1-12101A-FQGS-009-SS, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in Zion*Solutions* procedure ZS-LT-01, "*Quality Assurance Project Plan (for Characterization and FSS).*" The standard sample and QC sample did not both have positive results for gamma-emitting ROC; therefore, K-40 was used in the QC comparison. There was acceptable agreement between field split results. Refer to Attachment 5 for data and quality control analysis results.

9. INVESTIGATIONS AND RESULTS

No investigations were performed in survey unit 12101.

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 (DQA)

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 Operational DCGLs.

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 12101 has met the DQOs of the FSS plan. The ALARA criteria for soils as specified in Chapter 4 of the LTP were achieved. The EMC for soils was not needed for this survey unit and remediation was not required.

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

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

The mean B_CSOF, when the analytical results were compared to the B_CDCGLs, was 0.014, which results in a dose contribution from soil in survey unit 12101 of 0.355 mrem/year TEDE, based on the average concentration of the ROC in samples used for non-parametric statistical sampling.

The conclusion of this Release Record is that survey unit 12101 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"

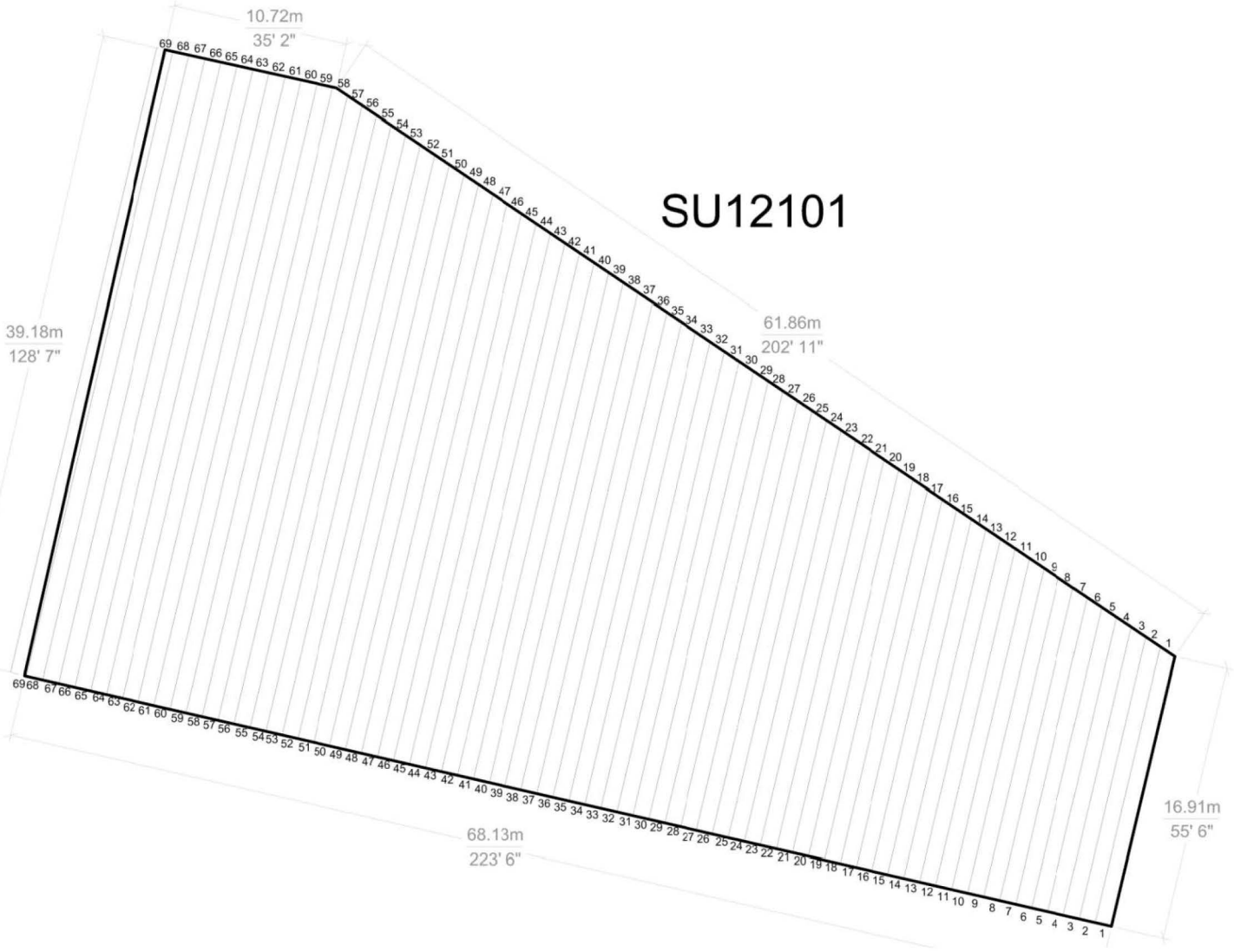
16. ATTACHMENTS

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 12101 Final Status Survey Boundaries and Systematic Sample Points

Survey Unit 12101 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	ES0118	216173	12101	GS051	2/25/2019 13:52	2209	1787	2426	No
44-10	ES0118	216173	12101	GS051	2/25/2019 13:54	2183	1787	2426	No
44-10	ES0118	216173	12101	GS051	2/25/2019 13:58	2119	1787	2426	No
44-10	ES0118	216173	12101	GS054	2/25/2019 14:08	2167	1787	2426	No
44-10	ES0118	216173	12101	GS054	2/25/2019 14:11	2144	1787	2426	No
44-10	ES0118	216173	12101	GS054	2/25/2019 14:13	2186	1787	2426	No
44-10	ES0118	216173	12101	GS054	2/25/2019 14:16	2062	1787	2426	No
44-10	PR372143	304712	12101	GS049	2/25/2019 13:50	2150	1707	2332	No
44-10	PR372143	304712	12101	GS049	2/25/2019 13:53	2216	1707	2332	No
44-10	PR372143	304712	12101	GS049	2/25/2019 13:57	1970	1707	2332	No
44-10	PR372143	304712	12101	GS049	2/25/2019 14:00	2034	1707	2332	No
44-10	PR372143	304712	12101	GS052	2/25/2019 14:08	2250	1707	2332	No
44-10	PR372143	304712	12101	GS052	2/25/2019 14:10	2142	1707	2332	No
44-10	PR372143	304712	12101	GS052	2/25/2019 14:13	2011	1707	2332	No
44-10	PR372143	304712	12101	GS052	2/25/2019 14:15	1939	1707	2332	No
44-10	PR372150	95361	12101	GS031	2/25/2019 13:23	2321	1878	2534	No
44-10	PR372150	95361	12101	GS031	2/25/2019 13:25	1958	1878	2534	No
44-10	PR372150	95361	12101	GS031	2/25/2019 13:27	1969	1878	2534	No
44-10	PR372150	95361	12101	GS032	2/25/2019 13:30	2088	1878	2534	No
44-10	PR372150	95361	12101	GS032	2/25/2019 13:32	2052	1878	2534	No
44-10	PR372150	95361	12101	GS032	2/25/2019 13:34	2146	1878	2534	No
44-10	PR372150	95361	12101	GS033	2/25/2019 13:37	2149	1878	2534	No
44-10	PR372150	95361	12101	GS033	2/25/2019 13:39	2134	1878	2534	No
44-10	PR372150	95361	12101	GS033	2/25/2019 13:41	2103	1878	2534	No
44-10	PR372150	95361	12101	GS034	2/25/2019 13:44	2046	1878	2534	No
44-10	PR372150	95361	12101	GS034	2/25/2019 13:46	2109	1878	2534	No
44-10	PR372150	95361	12101	GS034	2/25/2019 13:48	2301	1878	2534	No
44-10	PR372150	95361	12101	GS035	2/25/2019 13:51	2199	1878	2534	No
44-10	PR372150	95361	12101	GS035	2/25/2019 13:53	2186	1878	2534	No
44-10	PR372150	95361	12101	GS035	2/25/2019 13:55	2008	1878	2534	No
44-10	PR372150	95361	12101	GS036	2/25/2019 13:58	1979	1878	2534	No
44-10	PR372150	95361	12101	GS036	2/25/2019 14:01	2190	1878	2534	No
44-10	PR372150	95361	12101	GS036	2/25/2019 14:03	2345	1878	2534	No
44-10	PR372150	95361	12101	GS037	2/25/2019 14:06	2368	1878	2534	No
44-10	PR372150	95361	12101	GS037	2/25/2019 14:09	2217	1878	2534	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR372150	95361	12101	GS037	2/25/2019 14:11	1971	1878	2534	No
44-10	PR372150	95361	12101	GS038	2/25/2019 14:14	2101	1878	2534	No
44-10	PR372150	95361	12101	GS038	2/25/2019 14:16	2211	1878	2534	No
44-10	PR372150	95361	12101	GS038	2/25/2019 14:18	2198	1878	2534	No
44-10	PR372150	95361	12101	GS039	2/25/2019 14:20	2049	1878	2534	No
44-10	PR372150	95361	12101	GS039	2/25/2019 14:22	2280	1878	2534	No
44-10	PR372150	95361	12101	GS039	2/25/2019 14:24	1954	1878	2534	No
44-10	PR372150	95361	12101	GS040	2/25/2019 14:27	2016	1878	2534	No
44-10	PR372150	95361	12101	GS040	2/25/2019 14:29	2123	1878	2534	No
44-10	PR372150	95361	12101	GS040	2/25/2019 14:31	2204	1878	2534	No
44-10	PR363311	304718	12101	GS011	2/25/2019 13:26	2363	1865	2518	No
44-10	PR363311	304718	12101	GS011	2/25/2019 13:28	2007	1865	2518	No
44-10	PR363311	304718	12101	GS011	2/25/2019 13:30	2047	1865	2518	No
44-10	PR363311	304718	12101	GS012	2/25/2019 13:32	2043	1865	2518	No
44-10	PR363311	304718	12101	GS012	2/25/2019 13:34	2116	1865	2518	No
44-10	PR363311	304718	12101	GS012	2/25/2019 13:36	2273	1865	2518	No
44-10	PR363311	304718	12101	GS013	2/25/2019 13:38	2363	1865	2518	No
44-10	PR363311	304718	12101	GS013	2/25/2019 13:40	1998	1865	2518	No
44-10	PR363311	304718	12101	GS013	2/25/2019 13:42	1907	1865	2518	No
44-10	PR363311	304718	12101	GS014	2/25/2019 13:44	1872	1865	2518	No
44-10	PR363311	304718	12101	GS014	2/25/2019 13:46	2369	1865	2518	No
44-10	PR363311	304718	12101	GS014	2/25/2019 13:48	2297	1865	2518	No
44-10	PR363311	304718	12101	GS015	2/25/2019 13:50	2315	1865	2518	No
44-10	PR363311	304718	12101	GS015	2/25/2019 13:52	2007	1865	2518	No
44-10	PR363311	304718	12101	GS015	2/25/2019 13:54	2054	1865	2518	No
44-10	PR363311	304718	12101	GS016	2/25/2019 13:56	1961	1865	2518	No
44-10	PR363311	304718	12101	GS016	2/25/2019 13:58	2149	1865	2518	No
44-10	PR363311	304718	12101	GS016	2/25/2019 14:00	2254	1865	2518	No
44-10	PR363311	304718	12101	GS017	2/25/2019 14:02	2185	1865	2518	No
44-10	PR363311	304718	12101	GS017	2/25/2019 14:04	2270	1865	2518	No
44-10	PR363311	304718	12101	GS017	2/25/2019 14:06	2064	1865	2518	No
44-10	PR363311	304718	12101	GS018	2/25/2019 14:08	2024	1865	2518	No
44-10	PR363311	304718	12101	GS018	2/25/2019 14:10	2065	1865	2518	No
44-10	PR363311	304718	12101	GS018	2/25/2019 14:12	2220	1865	2518	No
44-10	PR363311	304718	12101	GS019	2/25/2019 14:14	2155	1865	2518	No
44-10	PR363311	304718	12101	GS019	2/25/2019 14:16	2094	1865	2518	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	12101	GS019	2/25/2019 14:18	2055	1865	2518	No
44-10	PR363311	304718	12101	GS020	2/25/2019 14:20	2069	1865	2518	No
44-10	PR363311	304718	12101	GS020	2/25/2019 14:22	2031	1865	2518	No
44-10	PR363311	304718	12101	GS020	2/25/2019 14:24	2109	1865	2518	No
44-10	PR311786	304713	12101	GS050	2/25/2019 13:51	2089	1740	2370	No
44-10	PR311786	304713	12101	GS050	2/25/2019 13:54	2169	1740	2370	No
44-10	PR311786	304713	12101	GS050	2/25/2019 13:58	1866	1740	2370	No
44-10	PR311786	304713	12101	GS050	2/25/2019 14:05	2185	1740	2370	No
44-10	PR311786	304713	12101	GS053	2/25/2019 14:09	2224	1740	2370	No
44-10	PR311786	304713	12101	GS053	2/25/2019 14:11	2044	1740	2370	No
44-10	PR311786	304713	12101	GS053	2/25/2019 14:13	1979	1740	2370	No
44-10	PR311786	304713	12101	GS053	2/25/2019 14:16	2213	1740	2370	No
44-10	PR375272	304730	12101	GS021	2/25/2019 13:11	2157	1660	2276	No
44-10	PR375272	304730	12101	GS021	2/25/2019 13:13	2098	1660	2276	No
44-10	PR375272	304730	12101	GS021	2/25/2019 13:15	2144	1660	2276	No
44-10	PR375272	304730	12101	GS022	2/25/2019 13:17	2023	1660	2276	No
44-10	PR375272	304730	12101	GS022	2/25/2019 13:19	2002	1660	2276	No
44-10	PR375272	304730	12101	GS022	2/25/2019 13:21	2110	1660	2276	No
44-10	PR375272	304730	12101	GS023	2/25/2019 13:24	2195	1660	2276	No
44-10	PR375272	304730	12101	GS023	2/25/2019 13:26	2075	1660	2276	No
44-10	PR375272	304730	12101	GS023	2/25/2019 13:28	2087	1660	2276	No
44-10	PR375272	304730	12101	GS024	2/25/2019 13:30	2104	1660	2276	No
44-10	PR375272	304730	12101	GS024	2/25/2019 13:32	2020	1660	2276	No
44-10	PR375272	304730	12101	GS024	2/25/2019 13:34	2153	1660	2276	No
44-10	PR375272	304730	12101	GS025	2/25/2019 13:36	2059	1660	2276	No
44-10	PR375272	304730	12101	GS025	2/25/2019 13:38	2164	1660	2276	No
44-10	PR375272	304730	12101	GS025	2/25/2019 13:40	2173	1660	2276	No
44-10	PR375272	304730	12101	GS026	2/25/2019 13:42	2219	1660	2276	No
44-10	PR375272	304730	12101	GS026	2/25/2019 13:44	1831	1660	2276	No
44-10	PR375272	304730	12101	GS026	2/25/2019 13:46	2117	1660	2276	No
44-10	PR375272	304730	12101	GS027	2/25/2019 13:48	1943	1660	2276	No
44-10	PR375272	304730	12101	GS027	2/25/2019 13:50	2212	1660	2276	No
44-10	PR375272	304730	12101	GS027	2/25/2019 13:52	2192	1660	2276	No
44-10	PR375272	304730	12101	GS028	2/25/2019 13:54	2122	1660	2276	No
44-10	PR375272	304730	12101	GS028	2/25/2019 13:56	2160	1660	2276	No
44-10	PR375272	304730	12101	GS028	2/25/2019 13:58	2166	1660	2276	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	PR375272	304730	12101	GS029	2/25/2019 14:00	2160	1660	2276	No
44-10	PR375272	304730	12101	GS029	2/25/2019 14:02	2115	1660	2276	No
44-10	PR375272	304730	12101	GS029	2/25/2019 14:04	1962	1660	2276	No
44-10	PR375272	304730	12101	GS030	2/25/2019 14:06	2203	1660	2276	No
44-10	PR375272	304730	12101	GS030	2/25/2019 14:08	2217	1660	2276	No
44-10	PR375272	304730	12101	GS030	2/25/2019 14:10	1963	1660	2276	No
44-10	PR316938	293136	12101	GS041	2/26/2019 9:33	2067	1721	2348	No
44-10	PR316938	293136	12101	GS041	2/26/2019 9:35	2021	1721	2348	No
44-10	PR316938	293136	12101	GS041	2/26/2019 9:38	1924	1721	2348	No
44-10	PR316938	293136	12101	GS041	2/26/2019 9:41	1944	1721	2348	No
44-10	PR316938	293136	12101	GS042	2/26/2019 9:45	1815	1721	2348	No
44-10	PR316938	293136	12101	GS042	2/26/2019 9:48	1914	1721	2348	No
44-10	PR316938	293136	12101	GS042	2/26/2019 9:50	2222	1721	2348	No
44-10	PR316938	293136	12101	GS042	2/26/2019 9:53	2126	1721	2348	No
44-10	PR316938	293136	12101	GS043	2/26/2019 9:57	2178	1721	2348	No
44-10	PR316938	293136	12101	GS043	2/26/2019 9:59	1958	1721	2348	No
44-10	PR316938	293136	12101	GS043	2/26/2019 10:01	1877	1721	2348	No
44-10	PR316938	293136	12101	GS043	2/26/2019 10:04	1881	1721	2348	No
44-10	PR316938	293136	12101	GS044	2/26/2019 10:07	1812	1721	2348	No
44-10	PR316938	293136	12101	GS044	2/26/2019 10:09	2006	1721	2348	No
44-10	PR316938	293136	12101	GS044	2/26/2019 10:12	2098	1721	2348	No
44-10	PR316938	293136	12101	GS044	2/26/2019 10:15	2126	1721	2348	No
44-10	PR372150	95361	12101	GS045	2/26/2019 9:36	2170	1823	2468	No
44-10	PR372150	95361	12101	GS045	2/26/2019 9:38	2059	1823	2468	No
44-10	PR372150	95361	12101	GS045	2/26/2019 9:40	1835	1823	2468	No
44-10	PR372150	95361	12101	GS045	2/26/2019 9:42	1882	1823	2468	No
44-10	PR372150	95361	12101	GS046	2/26/2019 9:45	1951	1823	2468	No
44-10	PR372150	95361	12101	GS046	2/26/2019 9:47	2391	1823	2468	No
44-10	PR372150	95361	12101	GS046	2/26/2019 9:49	2167	1823	2468	No
44-10	PR372150	95361	12101	GS046	2/26/2019 9:51	2241	1823	2468	No
44-10	PR372150	95361	12101	GS047	2/26/2019 9:53	2180	1823	2468	No
44-10	PR372150	95361	12101	GS047	2/26/2019 9:55	1948	1823	2468	No
44-10	PR372150	95361	12101	GS047	2/26/2019 9:57	2071	1823	2468	No
44-10	PR372150	95361	12101	GS047	2/26/2019 9:59	1869	1823	2468	No
44-10	PR372150	95361	12101	GS048	2/26/2019 10:02	1815	1823	2468	No
44-10	PR372150	95361	12101	GS048	2/26/2019 10:04	1975	1823	2468	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR372150	95361	12101	GS048	2/26/2019 10:06	2184	1823	2468	No
44-10	PR372150	95361	12101	GS048	2/26/2019 10:08	2221	1823	2468	No
44-10	PR363311	304718	12101	GS065	2/26/2019 12:49	2063	1731	2360	No
44-10	PR363311	304718	12101	GS065	2/26/2019 12:51	2035	1731	2360	No
44-10	PR363311	304718	12101	GS065	2/26/2019 12:53	1934	1731	2360	No
44-10	PR363311	304718	12101	GS065	2/26/2019 12:55	1858	1731	2360	No
44-10	PR363311	304718	12101	GS066	2/26/2019 12:57	1791	1731	2360	No
44-10	PR363311	304718	12101	GS066	2/26/2019 12:59	2222	1731	2360	No
44-10	PR363311	304718	12101	GS066	2/26/2019 13:01	2313	1731	2360	No
44-10	PR363311	304718	12101	GS066	2/26/2019 13:03	2018	1731	2360	No
44-10	PR363311	304718	12101	GS067	2/26/2019 13:05	2144	1731	2360	No
44-10	PR363311	304718	12101	GS067	2/26/2019 13:07	2113	1731	2360	No
44-10	PR363311	304718	12101	GS067	2/26/2019 13:09	1970	1731	2360	No
44-10	PR363311	304718	12101	GS067	2/26/2019 13:11	1840	1731	2360	No
44-10	PR363311	304718	12101	GS068	2/26/2019 13:13	1834	1731	2360	No
44-10	PR363311	304718	12101	GS068	2/26/2019 13:15	1939	1731	2360	No
44-10	PR363311	304718	12101	GS068	2/26/2019 13:17	2191	1731	2360	No
44-10	PR363311	304718	12101	GS068	2/26/2019 13:19	2159	1731	2360	No
44-10	PR363311	304718	12101	GS069	2/26/2019 13:21	2191	1731	2360	No
44-10	PR363311	304718	12101	GS069	2/26/2019 13:23	1878	1731	2360	No
44-10	PR363311	304718	12101	GS069	2/26/2019 13:25	1815	1731	2360	No
44-10	PR363311	304718	12101	GS069	2/26/2019 13:27	1934	1731	2360	No
44-10	PR311756	266669	12101	GS001	2/26/2019 9:37	1838	1587	2189	No
44-10	PR311756	266669	12101	GS001	2/26/2019 9:39	1850	1587	2189	No
44-10	PR311756	266669	12101	GS002	2/26/2019 9:43	1885	1587	2189	No
44-10	PR311756	266669	12101	GS002	2/26/2019 9:45	1717	1587	2189	No
44-10	PR311756	266669	12101	GS003	2/26/2019 9:48	1804	1587	2189	No
44-10	PR311756	266669	12101	GS003	2/26/2019 9:50	1716	1587	2189	No
44-10	PR311756	266669	12101	GS005	2/26/2019 10:00	1754	1587	2189	No
44-10	PR311756	266669	12101	GS005	2/26/2019 10:03	1841	1587	2189	No
44-10	PR311756	266669	12101	GS006	2/26/2019 10:05	1893	1587	2189	No
44-10	PR311756	266669	12101	GS006	2/26/2019 10:07	1854	1587	2189	No
44-10	PR311756	266669	12101	GS007	2/26/2019 10:10	2038	1587	2189	No
44-10	PR311756	266669	12101	GS007	2/26/2019 10:12	2075	1587	2189	No
44-10	PR311756	266669	12101	GS008	2/26/2019 10:14	2056	1587	2189	No
44-10	PR311756	266669	12101	GS008	2/26/2019 10:16	1882	1587	2189	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	PR311756	266669	12101	GS009	2/26/2019 12:38	1927	1587	2189	No
44-10	PR311756	266669	12101	GS009	2/26/2019 12:40	2055	1587	2189	No
44-10	PR311756	266669	12101	GS010	2/26/2019 12:43	1941	1587	2189	No
44-10	PR311756	266669	12101	GS010	2/26/2019 12:46	2014	1587	2189	No
44-10	PR363489	266668	12101	GS055	2/26/2019 9:26	1752	1741	2372	No
44-10	PR363489	266668	12101	GS055	2/26/2019 9:29	1935	1741	2372	No
44-10	PR363489	266668	12101	GS055	2/26/2019 9:31	2021	1741	2372	No
44-10	PR363489	266668	12101	GS055	2/26/2019 9:35	2108	1741	2372	No
44-10	PR363489	266668	12101	GS056	2/26/2019 9:39	2135	1741	2372	No
44-10	PR363489	266668	12101	GS056	2/26/2019 9:41	2036	1741	2372	No
44-10	PR363489	266668	12101	GS056	2/26/2019 9:43	1985	1741	2372	No
44-10	PR363489	266668	12101	GS056	2/26/2019 9:45	1841	1741	2372	No
44-10	PR363489	266668	12101	GS057	2/26/2019 9:49	1825	1741	2372	No
44-10	PR363489	266668	12101	GS057	2/26/2019 9:51	2028	1741	2372	No
44-10	PR363489	266668	12101	GS057	2/26/2019 9:53	1886	1741	2372	No
44-10	PR363489	266668	12101	GS057	2/26/2019 9:55	2033	1741	2372	No
44-10	PR363489	266668	12101	GS058	2/26/2019 9:57	2246	1741	2372	No
44-10	PR363489	266668	12101	GS058	2/26/2019 9:59	1979	1741	2372	No
44-10	PR363489	266668	12101	GS058	2/26/2019 10:01	1821	1741	2372	No
44-10	PR363489	266668	12101	GS058	2/26/2019 10:03	1831	1741	2372	No
44-10	PR363489	266668	12101	GS059	2/26/2019 10:06	1818	1741	2372	No
44-10	PR363489	266668	12101	GS059	2/26/2019 10:08	1974	1741	2372	No
44-10	PR363489	266668	12101	GS059	2/26/2019 10:10	1935	1741	2372	No
44-10	PR363489	266668	12101	GS059	2/26/2019 10:13	2077	1741	2372	No
44-10	PR375272	304730	12101	GS060	2/26/2019 9:32	2068	1631	2242	No
44-10	PR375272	304730	12101	GS060	2/26/2019 9:34	1913	1631	2242	No
44-10	PR375272	304730	12101	GS060	2/26/2019 9:36	1972	1631	2242	No
44-10	PR375272	304730	12101	GS060	2/26/2019 9:38	1795	1631	2242	No
44-10	PR375272	304730	12101	GS061	2/26/2019 9:40	1729	1631	2242	No
44-10	PR375272	304730	12101	GS061	2/26/2019 9:42	1800	1631	2242	No
44-10	PR375272	304730	12101	GS061	2/26/2019 9:44	1952	1631	2242	No
44-10	PR375272	304730	12101	GS061	2/26/2019 9:46	2053	1631	2242	No
44-10	PR375272	304730	12101	GS062	2/26/2019 9:48	2057	1631	2242	No
44-10	PR375272	304730	12101	GS062	2/26/2019 9:50	1954	1631	2242	No
44-10	PR375272	304730	12101	GS062	2/26/2019 9:52	1753	1631	2242	No
44-10	PR375272	304730	12101	GS062	2/26/2019 9:54	1819	1631	2242	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	PR375272	304730	12101	GS063	2/26/2019 9:56	1755	1631	2242	No
44-10	PR375272	304730	12101	GS063	2/26/2019 9:58	1832	1631	2242	No
44-10	PR375272	304730	12101	GS063	2/26/2019 10:00	1961	1631	2242	No
44-10	PR375272	304730	12101	GS063	2/26/2019 10:02	2114	1631	2242	No
44-10	PR375272	304730	12101	GS064	2/26/2019 10:04	2030	1631	2242	No
44-10	PR375272	304730	12101	GS064	2/26/2019 10:06	2070	1631	2242	No
44-10	PR375272	304730	12101	GS064	2/26/2019 10:08	1981	1631	2242	No
44-10	PR375272	304730	12101	GS064	2/26/2019 10:10	1916	1631	2242	No
44-10	PR311756	266669	12101	GS004	2/27/2019 8:38	1820	1630	2240	No
44-10	PR311756	266669	12101	GS004	2/27/2019 8:41	1976	1630	2240	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. 12101 **Description:** WWTF Sludge Drying Bed Area
Classification: 1 **Type I (α) Error:** 0.05 **Number of Samples:** 17

#	Fraction of the Release Criterion						Weighted Sum (W_s)	$1-W_s$	Sign
	Radionuclides of Concern					Activity or SOF			
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	(as applicable)			
1	0.00E+00	6.64E-03	1.79E-02	0.00E+00	4.20E-05	SOF	0.025	0.975	+
2	0.00E+00	3.06E-03	6.61E-03	0.00E+00	1.55E-05	SOF	0.010	0.990	+
3	0.00E+00	2.76E-03	8.13E-03	0.00E+00	1.91E-05	SOF	0.011	0.989	+
4	1.67E-02	1.82E-03	9.45E-03	3.59E-03	2.22E-05	SOF	0.032	0.968	+
5	3.20E-02	1.25E-03	2.39E-02	6.89E-03	5.61E-05	SOF	0.064	0.936	+
6	1.31E-02	1.58E-02	7.13E-03	2.82E-03	1.67E-05	SOF	0.039	0.961	+
7	0.00E+00	7.27E-03	1.01E-02	0.00E+00	2.36E-05	SOF	0.017	0.983	+
8	9.44E-03	0.00E+00	1.01E-02	2.03E-03	2.36E-05	SOF	0.022	0.978	+
9	1.49E-02	1.43E-02	9.15E-03	3.22E-03	2.15E-05	SOF	0.042	0.958	+
10	4.58E-03	9.23E-03	6.64E-03	9.87E-04	1.56E-05	SOF	0.021	0.979	+
11	3.93E-02	1.33E-02	4.16E-02	8.47E-03	9.76E-05	SOF	0.103	0.897	+
12	3.79E-02	2.37E-02	4.10E-02	8.15E-03	9.63E-05	SOF	0.111	0.889	+
13	2.36E-02	4.05E-03	1.20E-02	5.07E-03	2.81E-05	SOF	0.045	0.955	+
14	9.81E-02	3.14E-03	7.80E-02	2.11E-02	1.83E-04	SOF	0.200	0.800	+
15	3.28E-02	7.10E-04	4.27E-02	7.06E-03	1.00E-04	SOF	0.083	0.917	+
16	3.91E-02	1.73E-02	2.33E-02	8.43E-03	5.46E-05	SOF	0.088	0.912	+
17	2.00E-02	0.00E+00	6.80E-03	4.30E-03	1.60E-05	SOF	0.031	0.969	+

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) 3/20/19 (Date)

Peer Reviewed By (RE): R.J. Mandia (Print Name) / (Signature) 3-20-19 (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #: 12000	Survey Unit # 12101	Survey Unit Name: WWTF Sludge Drying Bed Area
Sample Plan#:	L1-12101A-F	

Sample Description: Comparison of split samples collected from surface soil sample location #9 and analyzed using gamma spectroscopy by on-site HpGe system. The standard sample was L1-12101A-FSGS-009SS, the comparison sample was L1-12101A-FQGS-009SS.

	STANDARD				COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
K-40	8.60E+00	4.26E-01	20.19	0.75 - 1.33	7.77E+00	4.65E-01	1.11	Y

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

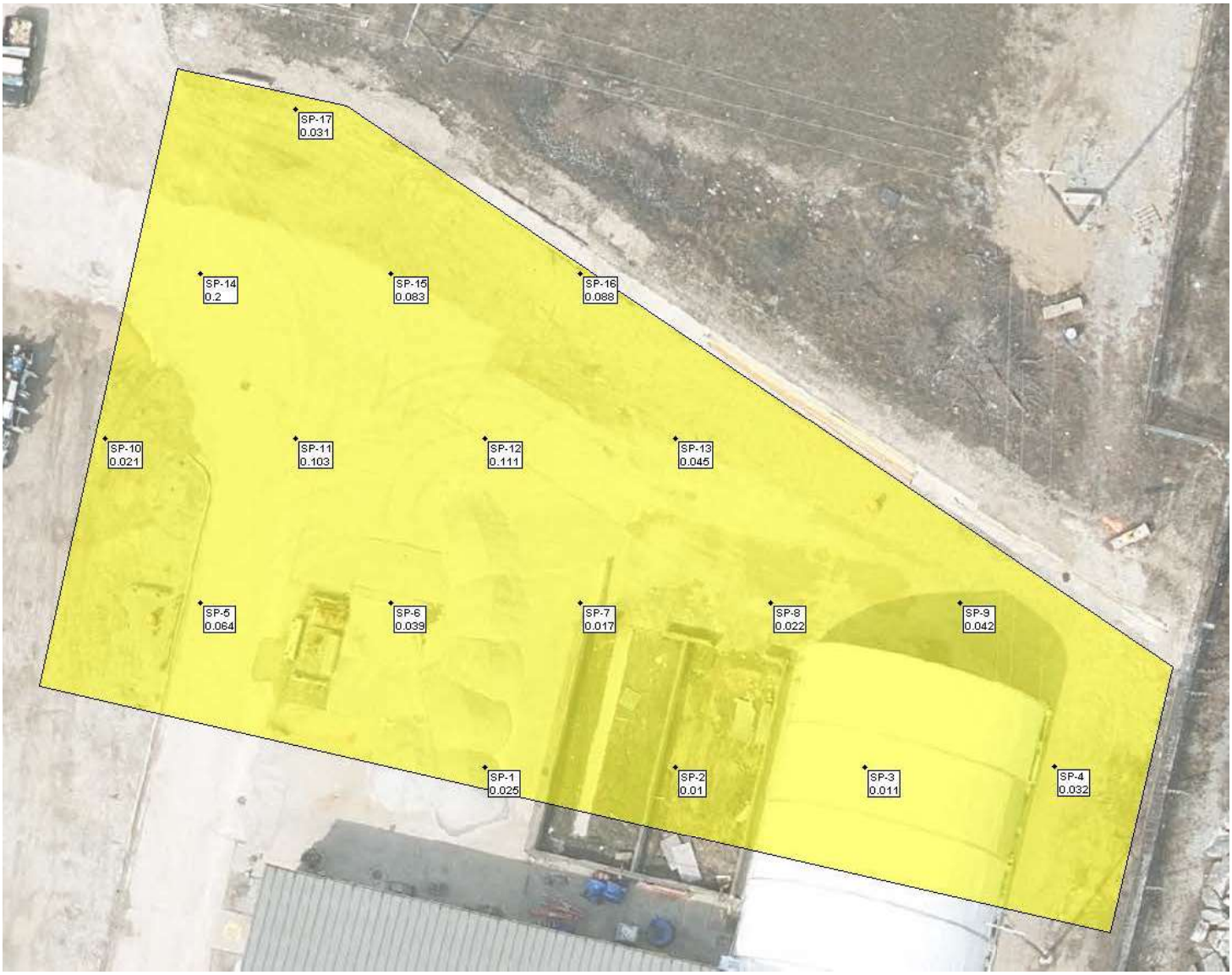
Table 4-1 from the QAPP is reproduced below to show acceptance criteria used to assess split samples.

Resolution	Acceptable Ratio
<4	0.4-2.5
4-7	0.5-2.0
8-15	0.6-1.66
16-50	0.75-1.33
51-200	0.80-1.25
>200	0.85-1.18

Performed by: T Bredon	Date: 3/20/19	Reveiwed by: R.J. Mundin	Date: 3-20-19

ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot

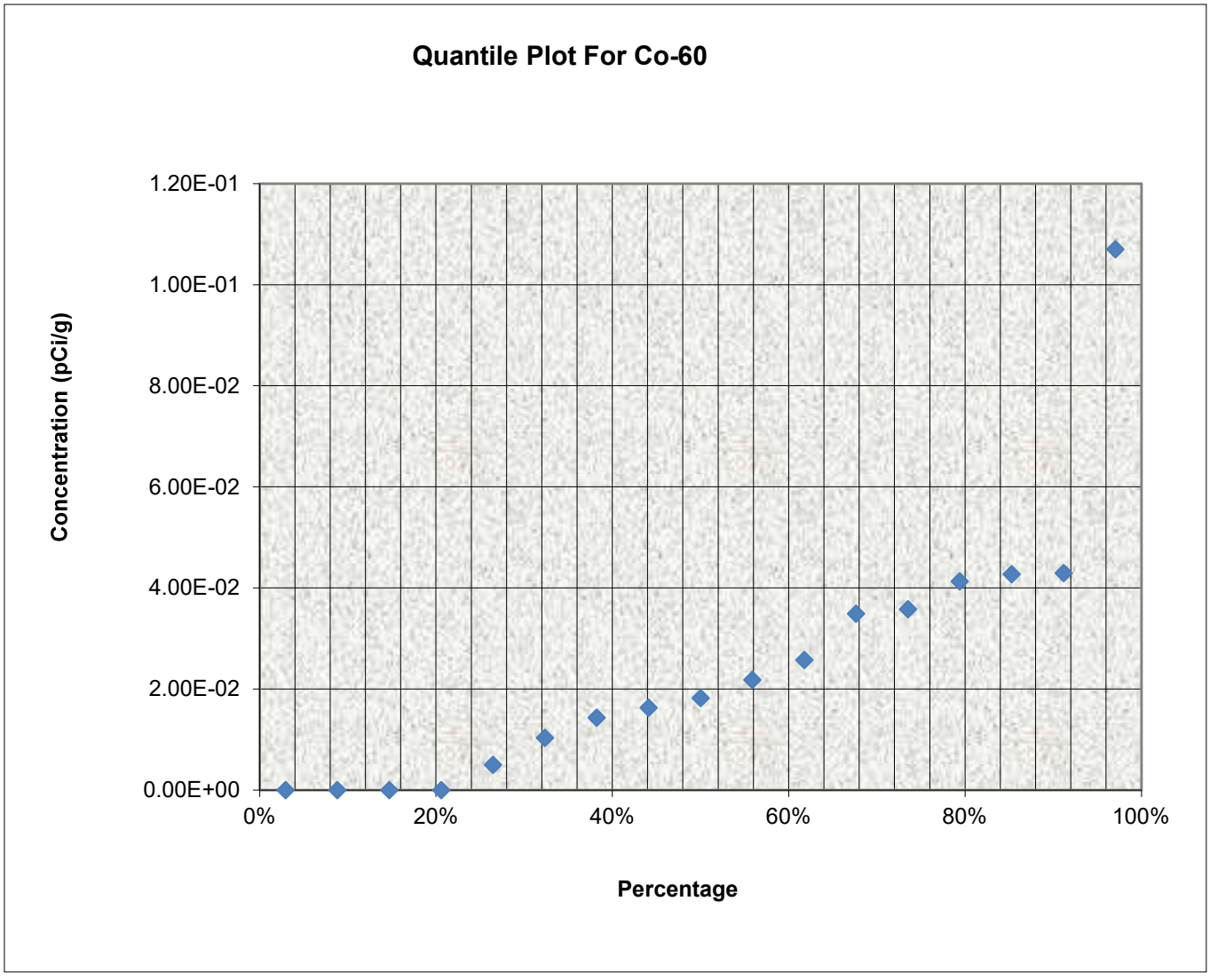


QUANTILE PLOT FOR Co-60

Survey Unit: 12101

Survey Unit Name: WWTF Sludge Drying Bed Area

Mean: 2.45E-02 pCi/g

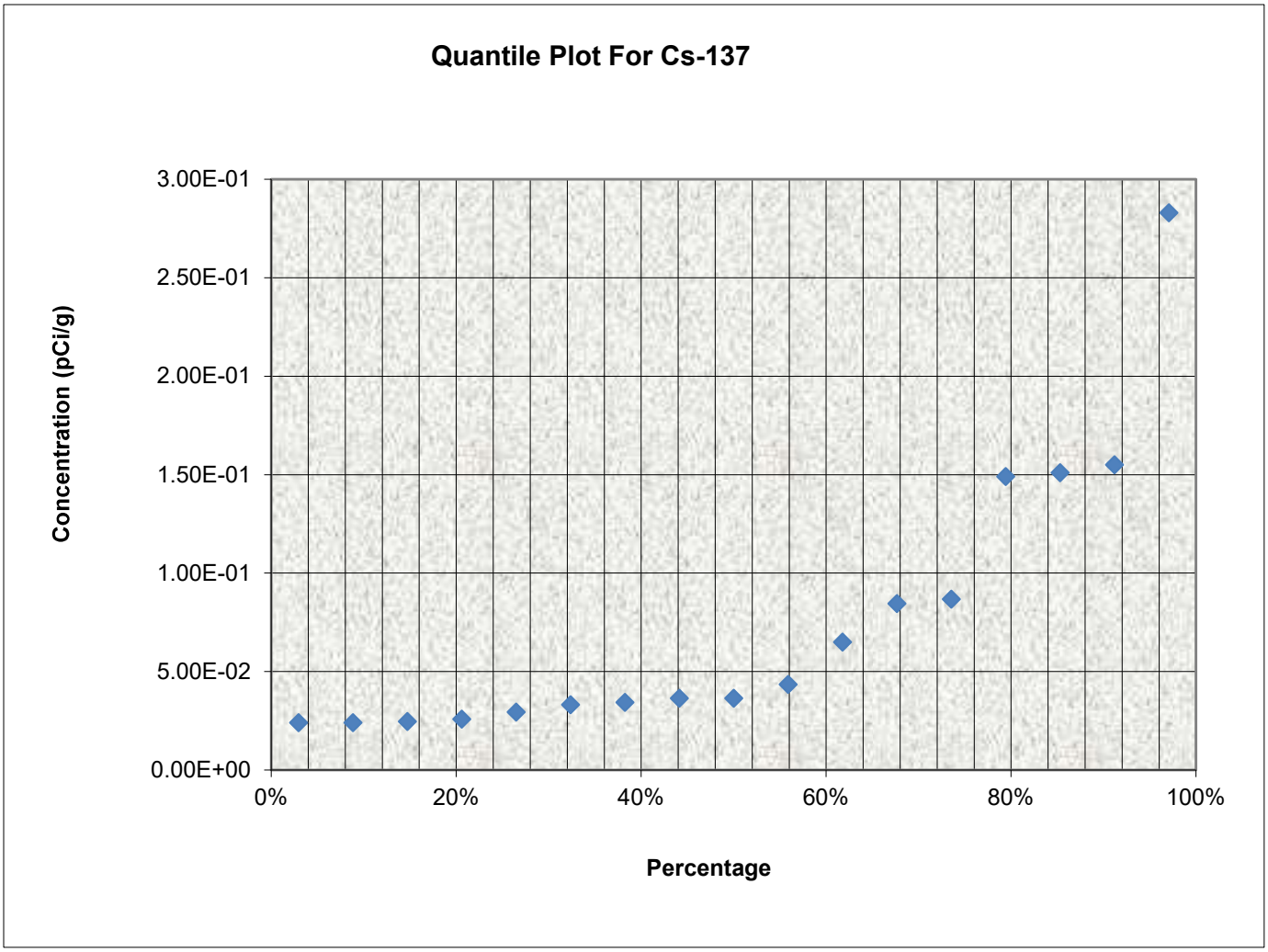


QUANTILE PLOT FOR Cs-137

Survey Unit: 12101

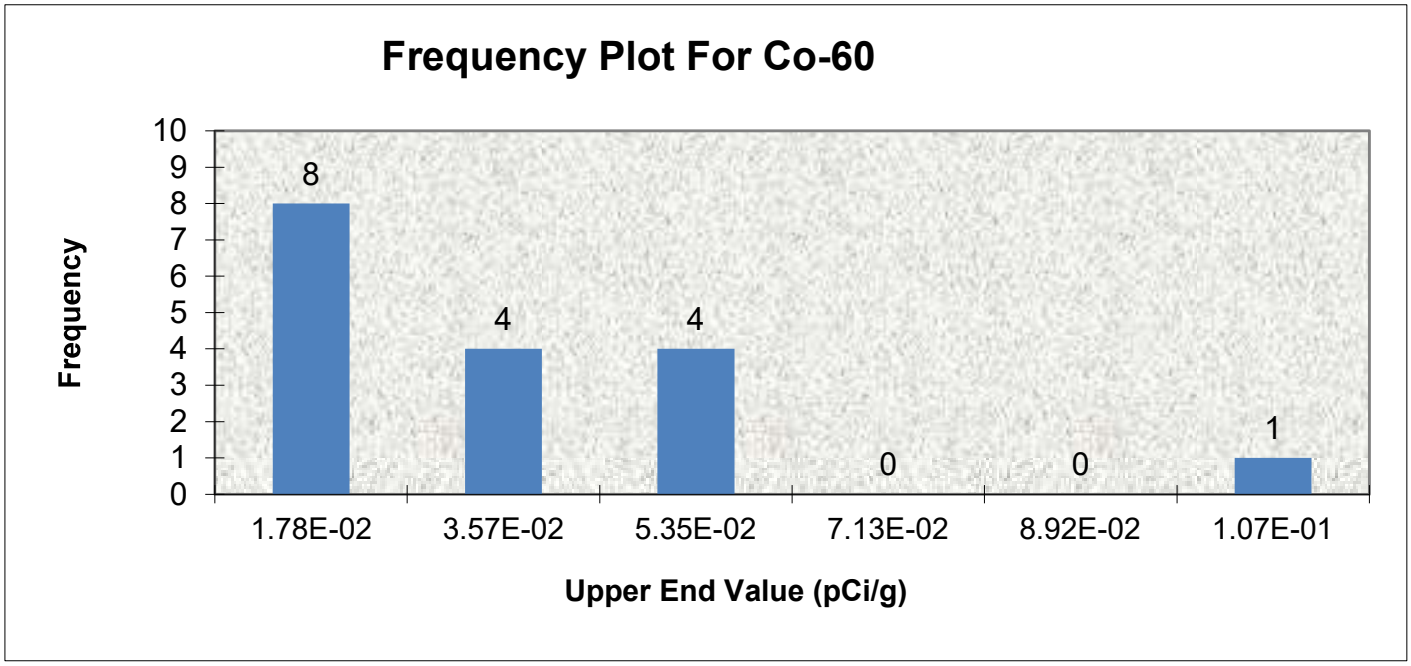
Survey Unit Name: WWTF Sludge Drying Bed Area

Mean: 7.57E-02 pCi/g



HISTOGRAM FOR Co-60

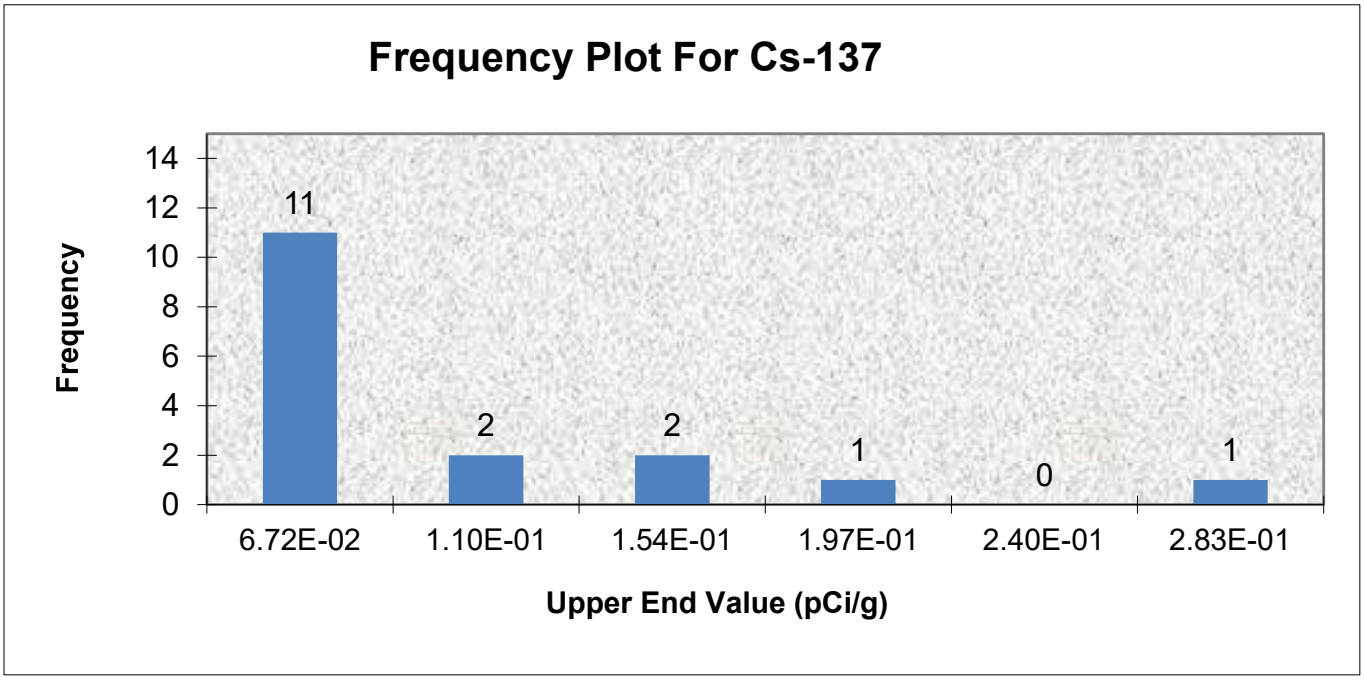
Survey Unit:	12101	
Survey Unit Name:	WWTF Sludge Drying Bed Area	
Mean:	2.45E-02	pCi/g
Median:	1.82E-02	pCi/g
ST DEV:	0.026	
Skew:	1.954	



Upper Value	Observation Frequency	Observation %
1.78E-02	8	47%
3.57E-02	4	24%
5.35E-02	4	24%
7.13E-02	0	0%
8.92E-02	0	0%
1.07E-01	1	6%
TOTAL	17	100%

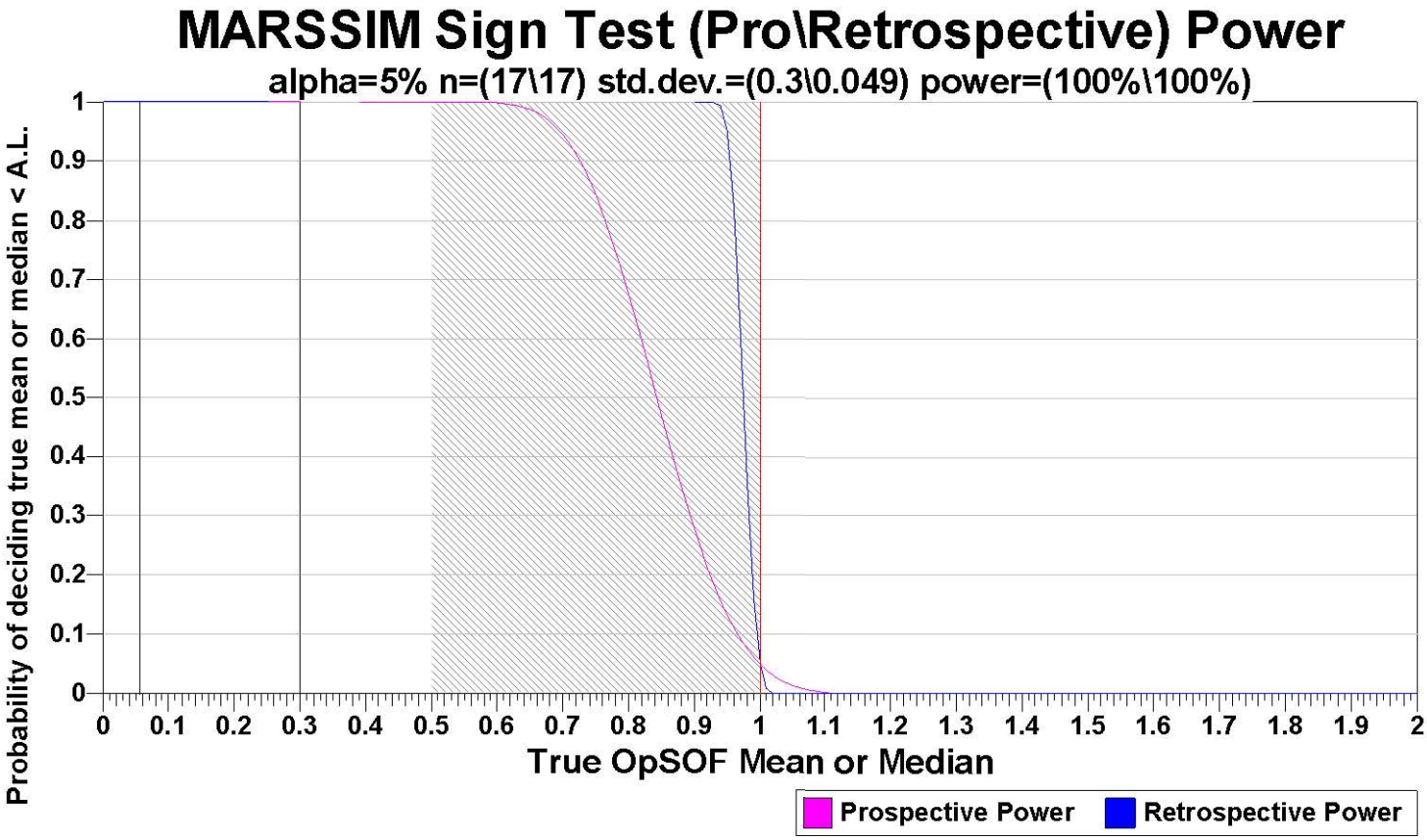
HISTOGRAM FOR Cs-137

Survey Unit:	12101	
Survey Unit Name:	WWTF Sludge Drying Bed Area	
Mean:	7.57E-02	pCi/g
Median:	3.65E-02	pCi/g
ST DEV:	0.071	
Skew:	1.836	



Upper Value	Observation Frequency	Observation %
6.72E-02	11	65%
1.10E-01	2	12%
1.54E-01	2	12%
1.97E-01	1	6%
2.40E-01	0	0%
2.83E-01	1	6%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Unit 12101



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 27-Feb-19-10008

L1-12101A-FSGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10008
Sample Description	: L1-12101A-FSGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.650E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:00:00AM
Acquisition Started	: 2/27/2019 5:50:22AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1800.6 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 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	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64276
Fill Height	: 1650.23 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 6:20:25AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500

JGraham

Analysis Report for 27-Feb-19-10008
L1-12101A-FSGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.24	305 -	315	309.49	8.98E+01	22.69	1.72E+02	0.77
2	238.67	946 -	959	954.28	3.21E+02	24.16	9.51E+01	1.39
3	295.18	1174 -	1184	1180.00	1.17E+02	15.96	5.78E+01	1.06
4	338.27	1346 -	1356	1352.14	5.45E+01	13.15	4.95E+01	1.11
5	351.81	1398 -	1415	1406.25	2.66E+02	20.66	4.95E+01	1.53
6	477.22	1902 -	1913	1907.35	2.51E+01	10.31	3.19E+01	0.41
7	583.10	2322 -	2339	2330.52	1.20E+02	15.09	3.33E+01	1.26
8	609.15	2427 -	2442	2434.65	1.64E+02	15.66	2.74E+01	1.13
9	661.24	2637 -	2650	2642.86	8.09E+01	11.66	2.01E+01	1.59
10	910.64	3630 -	3649	3640.02	9.10E+01	11.23	1.00E+01	1.26
11	968.48	3865 -	3879	3871.33	4.56E+01	10.22	2.04E+01	0.42
12	1237.70	4943 -	4954	4948.29	2.86E+01	7.85	1.24E+01	0.55
13	1459.93	5825 -	5850	5837.65	8.53E+02	30.14	1.30E+01	1.76

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.97	477.60	*	10.44	1.35E-01	5.64E-02
K-40	0.88	1460.82	*	10.66	9.37E+00	5.24E-01
Cs-137	0.97	661.66	*	85.10	6.50E-02	1.02E-02
Tl-208	0.99	583.19	*	85.00	8.86E-02	1.24E-02

Analysis Report for 27-Feb-19-10008

L1-12101A-FSGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.51E-01	2.78E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.14E-01	8.55E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.33E-01	2.63E-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	5.09E-01	1.41E-01
		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	2.47E-01	3.90E-02
		351.93	*	35.60	3.29E-01	3.67E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	5.53E-01	1.53E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.97	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.07E-01	5.28E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.00E-01	3.93E-02
		964.77		4.99		
		968.97	*	15.80	2.56E-01	5.85E-02
		1588.20		3.22		

Analysis Report for 27-Feb-19-10008

L1-12101A-FSGS-001SS

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	***Nuclide Id Confidence***	***Wt mean Activity (pCi/grams)***	***Wt mean Activity Uncertainty***	***Comments***
	BE-7	0.976	1.35E-01	5.64E-02	
	K-40	0.880	9.37E+00	5.24E-01	
	Cs-137	0.973	6.50E-02	1.02E-02	
	Tl-208	0.999	8.86E-02	1.24E-02	
X	Bi-211	0.916			
	Pb-212	1.000	2.51E-01	2.78E-02	
?	Pb212-XR	0.999	3.14E-01	8.55E-02	
	Bi-214	0.997	2.42E-01	2.59E-02	
	Pb-214	0.999	2.90E-01	2.67E-02	
?	Pb214-XR	0.999	5.53E-01	1.53E-01	
	Ac-228	0.978	2.65E-01	2.77E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 27-Feb-19-10008

L1-12101A-FSGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 6:20:25AM
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	8.50E-02	4.05E-02	4.05E-02
+	BE-7	477.60	*	10.44	1.35E-01	1.80E-01	1.80E-01
+	K-40	1460.82	*	10.66	9.37E+00	3.09E-01	3.09E-01
	Co-60	1173.23		99.85	-9.83E-03	3.23E-02	4.00E-02
		1332.49		99.98	-3.27E-02		3.23E-02
	Nb-94	702.65		99.81	-9.99E-03	3.10E-02	3.10E-02
		871.09		99.89	1.30E-02		3.33E-02
	Ag-108m	79.13		6.60	-1.84E-01	2.70E-02	8.31E-01
		433.94		90.50	-7.31E-03		2.70E-02
		614.28		89.80	9.36E-03		3.94E-02
		722.94		90.80	1.26E-02		3.65E-02
	Sb-125	176.31		6.84	3.49E-02	8.27E-02	3.19E-01
		380.45		1.52	7.94E-01		1.65E+00
		427.87		29.60	-2.75E-02		8.27E-02
		463.36		10.49	-1.11E-02		2.52E-01
		600.60		17.65	-8.09E-02		1.52E-01
		606.71		4.98	2.16E+00		9.98E-01
		635.95		11.22	-1.81E-01		2.27E-01
		671.44		1.79	6.37E-01		1.66E+00

Analysis Report for 27-Feb-19-10008

L1-12101A-FSGS-001SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	-5.79E-01	4.58E-02	2.00E+00
		81.00		32.90	-1.55E-01		1.26E-01
		276.40		7.16	-5.14E-01		3.00E-01
		302.85		18.34	1.17E-01		1.32E-01
		356.01		62.05	-2.51E-02		4.58E-02
		383.85		8.94	1.09E-01		2.85E-01
	Cs-134	475.36		1.48	-7.32E-02	3.44E-02	1.96E+00
		563.25		8.34	-4.52E-01		3.38E-01
		569.33		15.37	1.03E-01		1.86E-01
		604.72		97.62	-5.34E-03		4.56E-02
		795.86		85.46	1.15E-02		3.44E-02
		801.95		8.69	9.28E-02		3.25E-01
		1038.61		0.99	1.70E+00		3.67E+00
		1167.97		1.79	-5.37E-01		2.36E+00
		1365.19		3.02	-3.73E-01		9.18E-01
+	Cs-137	661.66	*	85.10	6.50E-02	2.26E-02	2.26E-02
	Eu-152	121.78		28.67	-7.57E-02	8.18E-02	8.18E-02
		244.70		7.61	3.11E-01		3.39E-01
		295.94		0.45	5.47E+00		7.04E+00
		344.28		26.60	2.44E-03		8.58E-02
		367.79		0.86	1.06E+00		3.02E+00
		411.12		2.24	2.40E-01		1.17E+00
		443.96		2.83	-3.83E-01		9.01E-01
		488.68		0.42	-1.43E-01		5.83E+00
		563.99		0.49	-6.80E+00		5.49E+00
		586.26		0.46	-1.30E+00		9.23E+00
		678.62		0.47	1.70E+00		6.35E+00
		688.67		0.86	1.22E+00		3.41E+00
		719.35		0.28	-4.60E+00		1.05E+01
		778.90		12.96	-2.32E-02		1.96E-01
		810.45		0.32	-2.02E+00		8.40E+00
		867.37		4.26	-1.93E-01		7.23E-01
		919.33		0.43	-2.30E+00		7.76E+00
		964.08		14.65	-1.78E-01		3.28E-01
		1085.87		10.24	1.13E-01		3.13E-01
		1089.74		1.73	6.37E-01		2.04E+00
		1112.07		13.69	-6.72E-02		2.95E-01
		1212.95		1.43	-2.33E+00		3.32E+00
		1249.94		0.19	-9.00E+00		2.27E+01
		1299.14		1.63	8.46E-01		2.27E+00
		1408.01		21.07	-1.80E-01		1.34E-01
		1457.64		0.50	1.98E+02		3.37E+01
		1528.10		0.28	5.16E+00		8.38E+00
	Eu-154	123.07		40.40	-3.08E-02	5.73E-02	5.73E-02
		247.93		6.89	-6.20E-02		3.10E-01
		591.76		4.95	2.68E-01		5.56E-01
		692.42		1.78	9.65E-01		1.74E+00
		723.30		20.06	2.63E-02		1.65E-01
		756.80		4.52	6.18E-01		7.04E-01
		873.18		12.08	-1.37E-03		2.76E-01
		996.29		10.48	-7.95E-02		3.34E-01

Analysis Report for 27-Feb-19-10008

L1-12101A-FSGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	2.26E-01	5.73E-02	2.11E-01
	1274.43	34.80	6.45E-02		1.21E-01
	1596.48	1.80	-6.65E-01		1.41E+00
Eu-155	45.30	1.31	1.28E+00	1.27E-01	8.17E+00
	60.01	1.22	-4.71E+00		9.06E+00
	86.55	30.70	1.36E-03		1.27E-01
	105.31	21.10	4.47E-02		1.39E-01
Ra-226	186.21	3.64	3.74E-01	6.94E-01	6.94E-01
Pa-231	27.36	10.30	1.12E+00	9.31E-01	9.31E-01
	283.69	1.70	2.84E-01		1.40E+00
	300.07	2.47	-2.46E+00		9.92E-01
	302.65	2.20	8.98E-01		1.11E+00
	330.06	1.40	2.46E+00		1.89E+00
U-235	143.76	10.96	-3.92E-02	4.48E-02	2.13E-01
	163.33	5.08	7.99E-02		4.52E-01
	185.71	57.20	4.71E-02		4.48E-02
	202.11	1.08	-3.65E-01		1.99E+00
	205.31	5.01	-4.46E-01		4.16E-01
Am-241	59.54	35.90	-5.64E-03	3.21E-01	3.21E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10009

L1-12101A-FSGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10009
Sample Description	: L1-12101A-FSGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.746E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:01:00AM
Acquisition Started	: 2/27/2019 5:50:30AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1800.7 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 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	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64277
Fill Height	: 1745.63 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 6:20:33AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500

JGraham

Analysis Report for 27-Feb-19-10009

L1-12101A-FSGS-002SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.15	306 -	316	309.90	5.27E+01	20.26	1.47E+02	0.56
	2	186.03	738 -	749	744.85	6.76E+01	18.73	1.12E+02	0.33
M	3	238.58	945 -	976	954.79	3.64E+02	51.69	1.26E+02	1.03
m	4	241.77	945 -	976	967.52	7.76E+01	14.41	1.37E+02	1.03
M	5	295.12	1173 -	1204	1180.70	1.48E+02	33.07	6.59E+01	1.17
m	6	300.12	1173 -	1204	1200.70	3.55E+01	11.36	6.57E+01	1.18
	7	338.24	1347 -	1360	1352.99	6.39E+01	15.25	6.11E+01	0.59
	8	351.73	1399 -	1415	1406.90	2.68E+02	21.28	5.92E+01	1.16
	9	510.66	2034 -	2050	2042.13	6.36E+01	16.74	6.84E+01	0.86
	10	583.18	2324 -	2339	2332.04	9.63E+01	14.68	3.97E+01	1.17
	11	609.10	2428 -	2445	2435.68	1.99E+02	17.58	3.44E+01	1.45
	12	661.37	2639 -	2649	2644.65	3.18E+01	9.83	2.72E+01	0.58
	13	911.05	3634 -	3651	3643.22	7.94E+01	13.10	2.76E+01	0.62
	14	968.67	3865 -	3880	3873.75	3.09E+01	11.82	3.61E+01	0.55
	15	1460.28	5827 -	5854	5841.48	8.14E+02	29.64	1.42E+01	1.78
	16	1763.76	7051 -	7064	7057.11	2.26E+01	6.17	5.44E+00	0.40

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
An Pk	0.98	511.00	*	100.00	3.55E-02	9.64E-03

Analysis Report for 27-Feb-19-10009

L1-12101A-FSGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.95	1460.82	*	10.66	8.24E+00	4.67E-01
Cs-137	0.98	661.66	*	85.10	2.40E-02	7.57E-03
Tl-208	1.00	583.19	*	85.00	6.72E-02	1.10E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.79E-01	4.57E-02
		300.09	*	3.30	4.08E-01	1.34E-01
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	2.43E-01	9.67E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.98	609.32	*	45.49	2.66E-01	2.85E-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	1.83E-01	5.06E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	3.61E-01	7.29E-02
		295.22	*	18.42	3.02E-01	7.16E-02
		351.93	*	35.60	3.19E-01	3.59E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	4.28E-01	1.72E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.99	186.21	*	3.64	5.56E-01	1.60E-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	2.34E-01	5.90E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.44E-01	4.16E-02
		964.77		4.99		
		968.97	*	15.80	1.61E-01	6.20E-02
		1588.20		3.22		
U-235	0.98	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.54E-02	1.02E-02
		202.11		1.08		

Analysis Report for 27-Feb-19-10009

L1-12101A-FSGS-002SS

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
U-235	0.98	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	0.982	3.55E-02	9.64E-03	
	K-40	0.954	8.24E+00	4.67E-01	
	Cs-137	0.987	2.40E-02	7.57E-03	
	Tl-208	1.000	6.72E-02	1.10E-02	
X	Bi-211	0.933			
	Pb-212	1.000	2.93E-01	4.32E-02	
?	Pb212-XR	1.000	2.43E-01	9.67E-02	
	Bi-214	0.985	2.46E-01	2.48E-02	
	Pb-214	0.995	3.23E-01	2.94E-02	
?	Pb214-XR	1.000	4.28E-01	1.72E-01	
?	Ra-226	0.995	5.56E-01	1.60E-01	
	Ac-228	0.996	2.22E-01	2.98E-02	
X	Pa-231	1.000			
?	U-235	0.988	3.54E-02	1.02E-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 27-Feb-19-10009

L1-12101A-FSGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 6:20:33AM
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	3.55E-02	2.94E-02	2.94E-02
	BE-7	477.60		10.44	1.67E-01	2.83E-01	2.83E-01
+	K-40	1460.82	*	10.66	8.24E+00	3.06E-01	3.06E-01
	Co-60	1173.23		99.85	-3.13E-03	3.07E-02	4.39E-02
		1332.49		99.98	-9.85E-03		3.07E-02
	Nb-94	702.65		99.81	4.67E-02	3.05E-02	3.80E-02
		871.09		99.89	7.15E-03		3.05E-02
	Ag-108m	79.13		6.60	8.10E-01	2.87E-02	1.07E+00
		433.94		90.50	-7.71E-03		2.87E-02
		614.28		89.80	7.36E-03		5.32E-02
		722.94		90.80	2.04E-02		3.88E-02
	Sb-125	176.31		6.84	2.36E-01	8.74E-02	3.86E-01
		380.45		1.52	-5.53E-01		1.64E+00
		427.87		29.60	4.66E-02		8.74E-02
		463.36		10.49	1.51E-01		2.74E-01
		600.60		17.65	-1.52E-02		1.81E-01
		606.71		4.98	2.38E+00		1.04E+00
		635.95		11.22	3.10E-02		2.53E-01
		671.44		1.79	1.27E-01		1.73E+00

Analysis Report for 27-Feb-19-10009

L1-12101A-FSGS-002SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	-5.97E-02	5.71E-02	2.60E+00
		81.00		32.90	-1.57E-01		1.80E-01
		276.40		7.16	-1.13E-01		3.69E-01
		302.85		18.34	-9.63E-02		1.46E-01
		356.01		62.05	2.69E-03		5.71E-02
		383.85		8.94	-1.88E-01		2.78E-01
	Cs-134	475.36		1.48	-6.28E-01	3.53E-02	1.90E+00
		563.25		8.34	-1.14E-01		3.40E-01
		569.33		15.37	2.71E-02		1.88E-01
		604.72		97.62	-2.80E-03		5.10E-02
		795.86		85.46	5.31E-03		3.53E-02
		801.95		8.69	-5.39E-01		3.54E-01
		1038.61		0.99	1.95E+00		3.67E+00
		1167.97		1.79	-2.07E+00		2.52E+00
		1365.19		3.02	-3.12E-01		9.16E-01
+	Cs-137	661.66	*	85.10	2.40E-02	2.28E-02	2.28E-02
	Eu-152	121.78		28.67	2.90E-02	9.45E-02	1.02E-01
		244.70		7.61	-3.75E-02		4.01E-01
		295.94		0.45	-5.67E-02		7.57E+00
		344.28		26.60	-1.30E-02		9.45E-02
		367.79		0.86	-4.36E+00		2.73E+00
		411.12		2.24	-5.32E-01		1.19E+00
		443.96		2.83	3.08E-01		9.52E-01
		488.68		0.42	-2.34E+00		6.09E+00
		563.99		0.49	1.94E+00		5.84E+00
		586.26		0.46	3.04E-01		8.81E+00
		678.62		0.47	-3.39E+00		5.96E+00
		688.67		0.86	1.96E+00		3.56E+00
		719.35		0.28	2.05E+00		1.09E+01
		778.90		12.96	-2.35E-01		2.39E-01
		810.45		0.32	8.39E+00		1.10E+01
		867.37		4.26	-1.12E-01		7.42E-01
		919.33		0.43	-1.86E+00		8.11E+00
		964.08		14.65	-4.46E-02		3.14E-01
		1085.87		10.24	-2.08E-01		3.62E-01
		1089.74		1.73	-4.65E-02		2.24E+00
		1112.07		13.69	-4.47E-01		2.99E-01
		1212.95		1.43	5.11E-01		3.56E+00
		1249.94		0.19	-9.26E+00		2.22E+01
		1299.14		1.63	-1.87E+00		2.37E+00
		1408.01		21.07	4.63E-02		1.39E-01
		1457.64		0.50	1.76E+02		3.06E+01
		1528.10		0.28	-2.16E+00		8.50E+00
	Eu-154	123.07		40.40	2.29E-02	7.26E-02	7.26E-02
		247.93		6.89	-2.36E-01		3.77E-01
		591.76		4.95	2.06E-01		6.12E-01
		692.42		1.78	-1.64E+00		1.67E+00
		723.30		20.06	1.14E-01		1.75E-01
		756.80		4.52	-5.69E-01		6.63E-01
		873.18		12.08	-3.60E-01		2.43E-01
		996.29		10.48	-2.57E-02		3.49E-01

Analysis Report for 27-Feb-19-10009

L1-12101A-FSGS-002SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	-1.93E-01	7.26E-02	1.92E-01
		1274.43		34.80	3.66E-02		1.14E-01
		1596.48		1.80	9.59E-01		1.66E+00
	Eu-155	45.30		1.31	2.20E+00	1.68E-01	1.51E+01
		60.01		1.22	-8.86E+00		1.52E+01
		86.55		30.70	5.92E-02		1.80E-01
		105.31		21.10	-9.60E-03		1.68E-01
+	Ra-226	186.21	*	3.64	5.56E-01	4.93E-01	4.93E-01
	Pa-231	27.36		10.30	1.58E+00	6.41E-01	1.71E+00
		283.69		1.70	-1.02E+00		1.45E+00
		300.07	*	2.47	5.45E-01		6.41E-01
		302.65		2.20	-8.75E-01		1.22E+00
		330.06		1.40	2.13E+00		2.03E+00
+	U-235	143.76		10.96	-3.23E-01	3.14E-02	2.39E-01
		163.33		5.08	1.18E-01		5.29E-01
		185.71	*	57.20	3.54E-02		3.14E-02
		202.11		1.08	-1.95E-01		2.46E+00
		205.31		5.01	-1.21E-01		5.30E-01
	Am-241	59.54		35.90	-4.07E-01	5.41E-01	5.41E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10010
L1-12101A-FSGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10010
Sample Description	: L1-12101A-FSGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.280E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:02:00AM
Acquisition Started	: 2/27/2019 6:23:35AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1800.6 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 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	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64278
Fill Height	: 1279.62 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 6:53:38AM
Peak Analysis From Channel : 120
Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500
JGraham

Analysis Report for 27-Feb-19-10010
L1-12101A-FSGS-003SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.99	295 -	315	300.49	6.95E+01	12.52	1.66E+02	0.76
m	2	77.30	295 -	315	309.74	1.02E+02	14.08	1.69E+02	0.76
	3	186.18	738 -	750	744.58	7.21E+01	19.29	1.14E+02	0.73
	4	209.06	832 -	841	836.00	2.28E+01	14.27	7.92E+01	0.89
M	5	238.64	948 -	970	954.16	3.70E+02	19.72	8.58E+01	1.11
m	6	241.47	948 -	970	965.43	8.63E+01	11.45	1.01E+02	1.12
	7	295.26	1174 -	1185	1180.32	1.28E+02	16.78	6.14E+01	1.04
	8	351.84	1399 -	1413	1406.36	2.24E+02	20.70	7.13E+01	1.20
	9	582.89	2322 -	2336	2329.69	1.16E+02	14.94	3.75E+01	0.99
	10	608.90	2426 -	2443	2433.63	2.07E+02	17.58	3.19E+01	1.03
	11	661.42	2637 -	2649	2643.56	3.41E+01	10.10	2.59E+01	0.78
	12	794.68	3172 -	3181	3176.34	1.33E+01	6.59	1.27E+01	0.88
	13	910.59	3632 -	3649	3639.81	9.06E+01	11.69	1.44E+01	0.40
	14	968.24	3863 -	3877	3870.38	4.04E+01	10.73	2.36E+01	1.06
	15	1119.37	4467 -	4482	4474.88	4.71E+01	9.42	1.39E+01	1.08
	16	1459.86	5824 -	5850	5837.38	7.06E+02	27.65	1.35E+01	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	0.86	1460.82	*	10.66	8.40E+00	4.91E-01

Analysis Report for 27-Feb-19-10010

L1-12101A-FSGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Cs-137	0.99	661.66	*	85.10	2.95E-02	8.90E-03
Tl-208	0.98	583.19	*	85.00	9.14E-02	1.30E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	3.06E-01	2.96E-02
		300.09		3.30		
Pb212-XR	0.99	74.82	*	10.28	4.53E-01	9.40E-02
		77.11	*	17.10	3.66E-01	6.30E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.79	609.32	*	45.49	3.16E-01	3.28E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	3.33E-01	6.79E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	4.32E-01	6.70E-02
		295.22	*	18.42	2.85E-01	4.38E-02
		351.93	*	35.60	2.95E-01	3.61E-02
		785.96		1.06		
Ra-226	1.00	186.21	*	3.64	6.26E-01	1.75E-01
Ac-228	0.96	129.07		2.42		
		209.25	*	3.89	1.96E-01	1.24E-01
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95	*	4.25	2.60E-01	1.30E-01
		911.20	*	25.80	3.22E-01	4.38E-02
		964.77		4.99		
		968.97	*	15.80	2.44E-01	6.58E-02
		1588.20		3.22		
U-235	0.97	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.98E-02	1.11E-02
		202.11		1.08		
		205.31		5.01		

Analysis Report for 27-Feb-19-10010

L1-12101A-FSGS-003SS

* = 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	0.863	8.40E+00	4.91E-01	
	Cs-137	0.991	2.95E-02	8.90E-03	
	Tl-208	0.986	9.14E-02	1.30E-02	
X	Bi-211	0.910			
	Pb-212	1.000	3.06E-01	2.96E-02	
	Pb212-XR	0.995	3.93E-01	5.23E-02	
	Bi-214	0.796	3.19E-01	2.96E-02	
	Pb-214	0.994	3.12E-01	2.57E-02	
X	Pb214-XR	0.995			
?	Ra-226	1.000	6.26E-01	1.75E-01	
	Ac-228	0.965	2.88E-01	3.38E-02	
?	U-235	0.976	3.98E-02	1.11E-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 27-Feb-19-10010

L1-12101A-FSGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 6:53:38AM
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	6.62E-02	4.02E-02	4.02E-02
	BE-7	477.60		10.44	1.99E-01	2.88E-01	2.88E-01
+	K-40	1460.82	*	10.66	8.40E+00	3.45E-01	3.45E-01
	Co-60	1173.23		99.85	-1.04E-02	3.45E-02	4.59E-02
		1332.49		99.98	-3.00E-02		3.45E-02
	Nb-94	702.65		99.81	2.78E-02	3.32E-02	3.32E-02
		871.09		99.89	1.07E-02		3.64E-02
	Ag-108m	79.13		6.60	1.53E-01	3.01E-02	8.71E-01
		433.94		90.50	9.69E-03		3.01E-02
		614.28		89.80	-1.60E-02		4.02E-02
		722.94		90.80	4.47E-02		4.19E-02
	Sb-125	176.31		6.84	-6.46E-03	9.30E-02	3.37E-01
		380.45		1.52	-5.75E-01		1.77E+00
		427.87		29.60	3.89E-02		9.30E-02
		463.36		10.49	3.77E-02		2.66E-01
		600.60		17.65	2.16E-02		1.78E-01
		606.71		4.98	-2.61E-01		1.17E+00
		635.95		11.22	-6.74E-02		2.28E-01
		671.44		1.79	-9.23E-01		1.46E+00

Analysis Report for 27-Feb-19-10010

L1-12101A-FSGS-003SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	3.62E-01	5.22E-02	2.12E+00
		81.00		32.90	-7.75E-02		1.35E-01
		276.40		7.16	-9.20E-03		3.37E-01
		302.85		18.34	6.60E-02		1.42E-01
		356.01		62.05	-3.27E-02		5.22E-02
		383.85		8.94	5.47E-03		3.02E-01
	Cs-134	475.36		1.48	-1.02E+00	3.89E-02	1.93E+00
		563.25		8.34	-6.15E-01		3.70E-01
		569.33		15.37	5.77E-03		1.97E-01
		604.72		97.62	4.78E-03		5.59E-02
		795.86		85.46	-3.00E-02		3.89E-02
		801.95		8.69	3.15E-01		4.08E-01
		1038.61		0.99	-4.21E-02		3.73E+00
		1167.97		1.79	1.52E+00		2.64E+00
		1365.19		3.02	5.62E-01		9.74E-01
+	Cs-137	661.66	*	85.10	2.95E-02	2.66E-02	2.66E-02
	Eu-152	121.78		28.67	5.57E-02	8.62E-02	8.62E-02
		244.70		7.61	-3.61E-01		3.74E-01
		295.94		0.45	3.06E+00		7.58E+00
		344.28		26.60	-2.97E-02		1.00E-01
		367.79		0.86	-2.31E+00		2.42E+00
		411.12		2.24	2.36E-02		1.17E+00
		443.96		2.83	-1.45E-01		9.64E-01
		488.68		0.42	2.26E-01		6.00E+00
		563.99		0.49	-1.44E+01		5.91E+00
		586.26		0.46	-5.43E+00		9.96E+00
		678.62		0.47	-7.94E-01		6.04E+00
		688.67		0.86	3.34E-01		3.38E+00
		719.35		0.28	3.26E+00		1.18E+01
		778.90		12.96	1.02E-01		2.50E-01
		810.45		0.32	-2.99E+00		9.96E+00
		867.37		4.26	4.81E-01		8.51E-01
		919.33		0.43	6.96E+00		7.86E+00
		964.08		14.65	-1.17E-02		3.46E-01
		1085.87		10.24	-2.70E-01		4.25E-01
		1089.74		1.73	2.27E-01		2.45E+00
		1112.07		13.69	-3.56E-01		2.90E-01
		1212.95		1.43	-1.73E+00		3.33E+00
		1249.94		0.19	-3.40E+00		2.29E+01
		1299.14		1.63	-8.10E-01		2.66E+00
		1408.01		21.07	-1.10E-01		1.36E-01
		1457.64		0.50	1.75E+02		3.35E+01
		1528.10		0.28	3.27E+00		7.27E+00
	Eu-154	123.07		40.40	1.63E-02	6.00E-02	6.00E-02
		247.93		6.89	-3.05E-01		3.26E-01
		591.76		4.95	1.58E-01		5.63E-01
		692.42		1.78	-1.28E+00		1.53E+00
		723.30		20.06	2.30E-01		1.93E-01
		756.80		4.52	4.92E-01		7.63E-01
		873.18		12.08	2.73E-01		3.01E-01
		996.29		10.48	2.01E-01		3.75E-01

Analysis Report for 27-Feb-19-10010

L1-12101A-FSGS-003SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	8.17E-02	6.00E-02	2.18E-01
		1274.43		34.80	-1.00E-01		1.31E-01
		1596.48		1.80	-5.24E-01		1.48E+00
	Eu-155	45.30		1.31	3.95E+00	1.34E-01	8.42E+00
		60.01		1.22	4.01E-01		8.30E+00
		86.55		30.70	-7.45E-02		1.34E-01
		105.31		21.10	1.00E-01		1.42E-01
+	Ra-226	186.21	*	3.64	6.26E-01	5.35E-01	5.35E-01
	Pa-231	27.36		10.30	1.29E+00	9.44E-01	9.44E-01
		283.69		1.70	5.01E-01		1.48E+00
		300.07		2.47	-1.37E+00		1.05E+00
		302.65		2.20	6.31E-01		1.19E+00
		330.06		1.40	-2.17E-02		1.90E+00
+	U-235	143.76		10.96	5.82E-02	3.40E-02	2.35E-01
		163.33		5.08	-3.70E-01		4.46E-01
		185.71	*	57.20	3.98E-02		3.40E-02
		202.11		1.08	5.80E-02		2.15E+00
		205.31		5.01	-2.25E-01		4.60E-01
	Am-241	59.54		35.90	-5.35E-02	2.87E-01	2.87E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10011

L1-12101A-FSGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10011
Sample Description	: L1-12101A-FSGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.616E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:03:00AM
Acquisition Started	: 2/27/2019 6:23:43AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1800.7 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 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	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64279
Fill Height	: 1615.60 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 6:53:46AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500

JGraham

Analysis Report for 27-Feb-19-10011
L1-12101A-FSGS-004SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	186.00	737 -	749	744.71	1.13E+02	19.53	1.02E+02	1.25
M	2	238.53	946 -	975	954.57	3.63E+02	50.11	1.21E+02	1.00
m	3	241.81	946 -	975	967.70	7.55E+01	14.54	1.18E+02	1.00
	4	295.16	1174 -	1187	1180.87	1.29E+02	18.42	7.57E+01	0.90
	5	338.23	1344 -	1361	1352.98	7.87E+01	17.43	6.93E+01	1.12
	6	351.77	1398 -	1417	1407.07	2.46E+02	22.58	7.50E+01	1.17
	7	510.67	2036 -	2049	2042.15	6.55E+01	14.50	5.25E+01	1.33
	8	582.97	2321 -	2340	2331.21	1.17E+02	14.90	2.99E+01	1.26
	9	609.08	2426 -	2445	2435.58	1.83E+02	18.11	4.12E+01	1.42
	10	727.05	2901 -	2914	2907.31	4.55E+01	9.71	1.75E+01	1.49
	11	910.95	3635 -	3650	3642.82	8.51E+01	13.23	2.99E+01	0.59
	12	968.29	3865 -	3879	3872.25	3.84E+01	10.20	2.26E+01	0.91
	13	1460.28	5827 -	5854	5841.49	8.75E+02	30.38	1.05E+01	1.98
	14	1763.33	7049 -	7062	7055.38	2.95E+01	6.80	5.53E+00	0.34

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.98	511.00	*	100.00	3.70E-02	8.58E-03
K-40	0.95	1460.82	*	10.66	9.03E+00	5.02E-01
Tl-208	0.99	583.19	*	85.00	8.27E-02	1.16E-02

Analysis Report for 27-Feb-19-10011

L1-12101A-FSGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	4.74E-01	1.05E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.81E-01	4.50E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.48E-01	2.88E-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	3.54E-01	7.39E-02
		295.22	*	18.42	2.66E-01	4.35E-02
		351.93	*	35.60	2.96E-01	3.61E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	9.35E-01	1.79E-01
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.91E-01	6.88E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.65E-01	4.28E-02
		964.77		4.99		
		968.97	*	15.80	2.03E-01	5.48E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	5.95E-02	1.14E-02
		202.11		1.08		
		205.31		5.01		

Analysis Report for 27-Feb-19-10011

L1-12101A-FSGS-004SS

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	***Nuclide Id Confidence***	***Wt mean Activity (pCi/grams)***	***Wt mean Activity Uncertainty***	***Comments***
	An Pk	0.982	3.70E-02	8.58E-03	
	K-40	0.954	9.03E+00	5.02E-01	
	Tl-208	0.993	8.27E-02	1.16E-02	
X	Bi-211	0.925			
	Bi-212	0.992	4.74E-01	1.05E-01	
	Pb-212	0.998	2.81E-01	4.50E-02	
	Bi-214	0.996	2.48E-01	2.88E-02	
	Pb-214	0.997	2.93E-01	2.60E-02	
?	Ra-226	0.993	9.35E-01	1.79E-01	
	Ac-228	0.983	2.51E-01	3.03E-02	
?	U-235	0.991	5.95E-02	1.14E-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 27-Feb-19-10011

L1-12101A-FSGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 6:53:46AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
14	1763.33	1.63730E-02	23.06		

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	3.70E-02	2.47E-02	2.47E-02
	BE-7	477.60		10.44	3.51E-02	2.87E-01	2.87E-01
+	K-40	1460.82	*	10.66	9.03E+00	2.71E-01	2.71E-01
	Co-60	1173.23		99.85	1.82E-02	3.30E-02	4.37E-02
		1332.49		99.98	8.48E-04		3.30E-02
	Nb-94	702.65		99.81	-3.35E-03	3.20E-02	3.20E-02
		871.09		99.89	8.91E-03		3.29E-02
	Ag-108m	79.13		6.60	-6.13E-01	3.03E-02	1.19E+00
		433.94		90.50	4.38E-03		3.03E-02
		614.28		89.80	2.79E-03		5.14E-02
		722.94		90.80	-2.40E-02		4.12E-02
	Sb-125	176.31		6.84	-2.58E-01	8.82E-02	3.77E-01
		380.45		1.52	1.49E-01		1.78E+00
		427.87		29.60	1.62E-02		8.82E-02
		463.36		10.49	1.71E-01		2.77E-01
		600.60		17.65	-1.39E-01		1.56E-01
		606.71		4.98	2.50E+00		1.01E+00
		635.95		11.22	-9.79E-02		2.66E-01

Analysis Report for 27-Feb-19-10011

L1-12101A-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-9.04E-01	8.82E-02	1.61E+00
Ba-133	79.61	2.65	-2.85E-01	5.75E-02	2.87E+00
	81.00	32.90	-4.58E-01		1.94E-01
	276.40	7.16	3.32E-01		3.75E-01
	302.85	18.34	9.81E-02		1.46E-01
	356.01	62.05	1.28E-02		5.75E-02
	383.85	8.94	-9.74E-02		3.04E-01
Cs-134	475.36	1.48	1.76E+00	3.97E-02	2.00E+00
	563.25	8.34	1.57E-01		3.49E-01
	569.33	15.37	2.10E-02		1.88E-01
	604.72	97.62	3.16E-03		4.92E-02
	795.86	85.46	-6.49E-03		3.97E-02
	801.95	8.69	2.79E-02		3.86E-01
	1038.61	0.99	-4.47E-02		3.46E+00
	1167.97	1.79	-7.19E-01		2.39E+00
	1365.19	3.02	4.16E-01		1.06E+00
Cs-137	661.66	85.10	3.43E-02	4.04E-02	4.04E-02
Eu-152	121.78	28.67	-3.05E-02	9.24E-02	1.03E-01
	244.70	7.61	2.33E-02		4.08E-01
	295.94	0.45	8.16E+00		7.50E+00
	344.28	26.60	1.82E-02		9.24E-02
	367.79	0.86	2.84E+00		2.96E+00
	411.12	2.24	-2.56E-01		1.29E+00
	443.96	2.83	-8.73E-02		9.76E-01
	488.68	0.42	2.68E-01		6.17E+00
	563.99	0.49	6.67E-01		5.89E+00
	586.26	0.46	-8.45E-01		8.70E+00
	678.62	0.47	1.78E+00		6.44E+00
	688.67	0.86	-2.60E+00		3.55E+00
	719.35	0.28	-3.21E+00		1.11E+01
	778.90	12.96	-4.25E-02		2.39E-01
	810.45	0.32	-5.34E+00		9.14E+00
	867.37	4.26	-1.36E+00		7.08E-01
	919.33	0.43	-2.14E+01		7.86E+00
	964.08	14.65	5.41E-01		3.45E-01
	1085.87	10.24	3.67E-01		4.03E-01
	1089.74	1.73	3.31E+00		2.53E+00
	1112.07	13.69	-6.21E-01		3.06E-01
	1212.95	1.43	1.64E-01		3.30E+00
	1249.94	0.19	1.04E+00		2.36E+01
	1299.14	1.63	-1.49E+00		2.43E+00
	1408.01	21.07	-6.90E-02		1.52E-01
	1457.64	0.50	1.92E+02		3.21E+01
	1528.10	0.28	1.91E+00		7.86E+00
Eu-154	123.07	40.40	3.98E-02	7.43E-02	7.43E-02
	247.93	6.89	-1.37E-01		3.69E-01
	591.76	4.95	2.44E-01		5.51E-01
	692.42	1.78	1.28E+00		1.83E+00
	723.30	20.06	-8.56E-02		1.88E-01
	756.80	4.52	-1.91E-02		6.46E-01
	873.18	12.08	-4.85E-02		2.71E-01

Analysis Report for 27-Feb-19-10011

L1-12101A-FSGS-004SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	1.32E-01	7.43E-02	3.71E-01
		1004.76		18.01	7.40E-02		2.10E-01
		1274.43		34.80	1.05E-01		1.18E-01
		1596.48		1.80	-9.48E-01		1.44E+00
	Eu-155	45.30		1.31	-2.44E+00	1.62E-01	1.39E+01
		60.01		1.22	-2.36E+01		1.63E+01
		86.55		30.70	1.62E-05		1.75E-01
		105.31		21.10	3.05E-02		1.62E-01
+	Ra-226	186.21	*	3.64	9.35E-01	4.86E-01	4.86E-01
	Pa-231	27.36		10.30	2.05E+00	1.10E+00	1.71E+00
		283.69		1.70	-1.05E+00		1.41E+00
		300.07		2.47	-1.20E-01		1.10E+00
		302.65		2.20	7.83E-01		1.21E+00
		330.06		1.40	2.01E-01		2.02E+00
+	U-235	143.76		10.96	-2.52E-02	3.09E-02	2.66E-01
		163.33		5.08	-2.26E-01		5.12E-01
		185.71	*	57.20	5.95E-02		3.09E-02
		202.11		1.08	1.16E+00		2.57E+00
		205.31		5.01	-1.58E-01		5.53E-01
	Am-241	59.54		35.90	-2.59E-01	5.76E-01	5.76E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10012
L1-12101A-FSGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10012
Sample Description	: L1-12101A-FSGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.684E+03 grams
Facility	Default
Sample Taken On	: 2/ 25/ 2019 9:04:00AM
Acquisition Started	: 2/ 27/ 2019 6:56:38AM
Procedure	:130G_SOIL_1
Operator	:Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 27000 seconds
Real Time	: 27008 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	: 1.000keV
Energy Calibration Used Done On	: 1/ 24/ 2019
Efficiency Calibration Used Done On	: 2/ 27/ 2019
Efficiency Calibration Description	:
Sample Number	: 64282
Fill Height	: 1684.04 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/ 22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/ 27/ 2019 7:45:15AM
Peak Analysis From Channel : 120
Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500
JGraham

Analysis Report for 27-Feb-19-10012
L1-12101A-FSGS-005SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.99	294 -	315	300.49	1.25E+02	33.65	1.87E+02	0.96
m	2	77.24	294 -	315	309.49	1.96E+02	48.71	2.25E+02	0.96
	3	186.02	739 -	751	743.94	6.41E+01	21.69	1.54E+02	0.55
	4	238.74	949 -	960	954.54	3.98E+02	28.66	1.67E+02	1.02
	5	269.90	1074 -	1084	1079.01	2.67E+01	14.85	7.93E+01	0.44
	6	295.13	1171 -	1187	1179.79	1.82E+02	21.93	9.54E+01	0.75
	7	351.84	1398 -	1413	1406.38	2.90E+02	22.23	6.80E+01	1.28
	8	462.91	1845 -	1855	1850.18	2.07E+01	11.51	4.63E+01	0.64
	9	477.42	1902 -	1915	1908.15	6.33E+01	13.35	4.17E+01	0.93
	10	558.15	2224 -	2238	2230.81	3.87E+01	13.34	4.83E+01	1.04
	11	582.89	2322 -	2337	2329.68	1.25E+02	16.41	4.80E+01	1.04
	12	609.10	2428 -	2443	2434.46	1.91E+02	19.05	5.60E+01	1.42
	13	661.23	2634 -	2650	2642.81	1.63E+02	17.28	4.34E+01	1.48
	14	910.66	3631 -	3649	3640.10	9.93E+01	14.25	3.07E+01	1.26
	15	968.57	3865 -	3878	3871.70	6.27E+01	12.69	3.53E+01	0.87
	16	1459.92	5824 -	5850	5837.60	9.32E+02	31.25	1.02E+01	1.94

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

No background subtract performed on this spectrum

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	2.27E-01	5.05E-02

Analysis Report for 27-Feb-19-10012

L1-12101A-FSGS-005SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.87	1460.82	*	10.66	6.79E+00	3.72E-01
Cs-137	0.97	661.66	*	85.10	8.68E-02	1.06E-02
Tl-208	0.98	583.19	*	85.00	6.14E-02	8.86E-03
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.07E-01	2.24E-02
		300.09		3.30		
Pb212-XR	0.99	74.82	*	10.28	5.28E-01	1.52E-01
		77.11	*	17.10	4.56E-01	1.23E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.81E-01	2.10E-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	2.54E-01	3.68E-02
		351.93	*	35.60	2.39E-01	2.65E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	3.51E-01	1.22E-01
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24	*	3.46	1.88E-01	1.06E-01
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00	*	4.40	1.68E-01	9.42E-02
		794.95		4.25		
		911.20	*	25.80	2.17E-01	3.26E-02
		964.77		4.99		
		968.97	*	15.80	2.33E-01	4.84E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	2.23E-02	7.77E-03
		202.11		1.08		
		205.31		5.01		

Analysis Report for 27-Feb-19-10012

L1-12101A-FSGS-005SS

* = 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 1.000 sigma

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.994	2.27E-01	5.05E-02	
	K-40	0.877	6.79E+00	3.72E-01	
X	Sb-125	0.996			
	Cs-137	0.971	8.68E-02	1.06E-02	
	Tl-208	0.986	6.14E-02	8.86E-03	
X	Bi-211	0.909			
	Pb-212	0.998	2.07E-01	2.24E-02	
	Pb212-XR	0.997	4.84E-01	9.55E-02	
	Bi-214	0.997	1.81E-01	2.10E-02	
	Pb-214	0.999	2.44E-01	2.15E-02	
X	Pb214-XR	0.997			
?	Ra-226	0.994	3.51E-01	1.22E-01	
	Ac-228	0.980	2.17E-01	2.52E-02	
?	U-235	0.990	2.23E-02	7.77E-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 1.000 sigma

Analysis Report for 27-Feb-19-10012
L1-12101A-FSGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/ 27/ 2019 7:45:15AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
10	558.15	1.43263E-02	34.48		

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

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	5.77E-02	3.10E-02	3.10E-02
+	BE-7	477.60	*	10.44	2.27E-01	1.41E-01	1.41E-01
+	K-40	1460.82	*	10.66	6.79E+00	1.87E-01	1.87E-01
	Co-60	1173.23		99.85	3.49E-02	2.76E-02	3.73E-02
		1332.49		99.98	-4.35E-03		2.76E-02
	Nb-94	702.65		99.81	4.16E-03	2.16E-02	2.16E-02
		871.09		99.89	4.89E-03		2.21E-02
	Ag-108m	79.13		6.60	-1.49E-01	2.25E-02	6.45E-01
		433.94		90.50	-1.46E-03		2.25E-02
		614.28		89.80	-7.23E-03		3.08E-02
		722.94		90.80	1.26E-02		2.99E-02
	Sb-125	176.31		6.84	1.34E-01	7.37E-02	2.52E-01
		380.45		1.52	3.35E-01		1.22E+00
		427.87		29.60	7.86E-02		7.37E-02
		463.36	*	10.49	7.07E-02		1.32E-01
		600.60		17.65	5.99E-02		1.19E-01
		606.71		4.98	-5.91E-01		7.53E-01
		635.95		11.22	-6.14E-02		1.84E-01

Analysis Report for 27-Feb-19-10012

L1-12101A-FSGS-005SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	2.29E-01	7.37E-02	1.08E+00
	Ba-133	79.61		2.65	-3.08E-01	3.55E-02	1.57E+00
		81.00		32.90	-1.63E-01		9.77E-02
		276.40		7.16	9.51E-02		2.70E-01
		302.85		18.34	2.65E-02		9.99E-02
		356.01		62.05	-1.85E-02		3.55E-02
		383.85		8.94	-2.38E-01		1.98E-01
	Cs-134	475.36		1.48	9.72E-01	2.92E-02	1.59E+00
		563.25		8.34	-1.47E-02		2.66E-01
		569.33		15.37	6.98E-02		1.44E-01
		604.72		97.62	-2.87E-02		3.43E-02
		795.86		85.46	2.17E-03		2.92E-02
		801.95		8.69	-3.50E-02		2.42E-01
		1038.61		0.99	-1.18E-01		2.98E+00
		1167.97		1.79	1.49E+00		2.16E+00
		1365.19		3.02	-7.31E-02		6.92E-01
+	Cs-137	661.66	*	85.10	8.68E-02	2.26E-02	2.26E-02
	Eu-152	121.78		28.67	2.80E-02	6.64E-02	6.64E-02
		244.70		7.61	2.02E-01		2.82E-01
		295.94		0.45	7.22E+00		5.36E+00
		344.28		26.60	1.33E-02		7.10E-02
		367.79		0.86	6.27E-01		2.09E+00
		411.12		2.24	3.42E-01		9.57E-01
		443.96		2.83	-6.00E-01		6.92E-01
		488.68		0.42	-1.28E+00		4.79E+00
		563.99		0.49	-3.64E+00		4.37E+00
		586.26		0.46	-1.99E+00		6.82E+00
		678.62		0.47	2.55E+00		4.70E+00
		688.67		0.86	-1.79E+00		2.70E+00
		719.35		0.28	-1.60E+00		8.26E+00
		778.90		12.96	-1.98E-01		1.74E-01
		810.45		0.32	3.54E+00		6.89E+00
		867.37		4.26	2.45E-01		5.32E-01
		919.33		0.43	1.28E+00		5.86E+00
		964.08		14.65	-1.93E-02		2.66E-01
		1085.87		10.24	-1.68E-01		2.92E-01
		1089.74		1.73	1.28E+00		1.76E+00
		1112.07		13.69	-1.85E-01		2.08E-01
		1212.95		1.43	1.47E+00		2.49E+00
		1249.94		0.19	-6.32E+00		1.64E+01
		1299.14		1.63	1.05E+00		1.69E+00
		1408.01		21.07	9.97E-02		1.18E-01
		1457.64		0.50	1.46E+02		2.34E+01
		1528.10		0.28	5.13E+00		6.63E+00
	Eu-154	123.07		40.40	4.78E-02	4.80E-02	4.80E-02
		247.93		6.89	3.35E-02		2.60E-01
		591.76		4.95	1.31E-01		4.21E-01
		692.42		1.78	-2.03E-01		1.28E+00
		723.30		20.06	3.17E-02		1.35E-01
		756.80		4.52	-7.78E-02		4.83E-01
		873.18		12.08	-7.91E-02		1.92E-01

Analysis Report for 27-Feb-19-10012

L1-12101A-FSGS-005SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-1.02E-01	4.80E-02	2.27E-01
		1004.76		18.01	5.29E-02		1.51E-01
		1274.43		34.80	-7.24E-02		8.10E-02
		1596.48		1.80	-4.53E-02		1.18E+00
	Eu-155	45.30		1.31	-5.26E-01	1.07E-01	6.36E+00
		60.01		1.22	-3.86E+00		6.86E+00
		86.55		30.70	9.17E-02		1.07E-01
		105.31		21.10	-1.20E-02		1.10E-01
+	Ra-226	186.21	*	3.64	3.51E-01	3.90E-01	3.90E-01
	Pa-231	27.36		10.30	7.62E-01	7.17E-01	7.17E-01
		283.69		1.70	-5.75E-01		1.08E+00
		300.07		2.47	-2.62E-01		7.51E-01
		302.65		2.20	-1.11E-01		8.22E-01
		330.06		1.40	6.77E-01		1.40E+00
+	U-235	143.76		10.96	1.49E-02	2.48E-02	1.78E-01
		163.33		5.08	-3.10E-02		3.57E-01
		185.71	*	57.20	2.23E-02		2.48E-02
		202.11		1.08	-9.70E-02		1.68E+00
		205.31		5.01	-3.23E-01		3.52E-01
	Am-241	59.54		35.90	-7.82E-03	2.43E-01	2.43E-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 27-Feb-19-10013

L1-12101A-FSGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10013
Sample Description	: L1-12101A-FSGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.518E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:05:00AM
Acquisition Started	: 2/27/2019 6:56:45AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 2700.0 seconds
Real Time	: 2701.0 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64283
Fill Height	: 1518.26 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 7:45:38AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500

JGraham

Analysis Report for 27-Feb-19-10013

L1-12101A-FSGS-006SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.69	293 -	314	300.08	9.25E+01	14.07	2.14E+02	1.01
m	2	77.10	293 -	314	309.70	1.30E+02	15.67	2.04E+02	1.01
	3	92.70	368 -	379	372.03	8.79E+01	24.49	2.02E+02	0.71
	4	185.85	736 -	749	744.14	1.50E+02	25.62	1.84E+02	1.41
M	5	238.56	947 -	972	954.72	4.78E+02	62.36	1.49E+02	1.01
m	6	241.61	947 -	972	966.91	1.09E+02	17.94	1.57E+02	1.02
	7	295.19	1171 -	1189	1180.98	1.87E+02	26.00	1.45E+02	1.13
	8	338.21	1348 -	1363	1352.89	1.12E+02	19.85	9.34E+01	0.92
	9	351.71	1399 -	1417	1406.84	3.51E+02	25.27	8.61E+01	1.21
	10	477.31	1903 -	1915	1908.81	6.33E+01	13.64	4.67E+01	1.20
	11	583.14	2323 -	2341	2331.86	1.66E+02	18.85	5.63E+01	0.86
	12	609.06	2425 -	2443	2435.51	2.90E+02	20.70	4.06E+01	1.28
	13	661.32	2636 -	2651	2644.47	5.00E+01	13.50	4.40E+01	0.67
	14	726.98	2901 -	2914	2907.01	4.88E+01	11.00	2.62E+01	0.86
	15	910.71	3633 -	3651	3641.90	1.29E+02	16.08	3.82E+01	1.57
	16	964.22	3850 -	3862	3855.97	3.23E+01	9.60	2.28E+01	1.01
	17	1119.92	4468 -	4487	4478.97	6.54E+01	15.50	4.96E+01	0.43
	18	1460.32	5825 -	5855	5841.64	1.28E+03	37.56	2.70E+01	1.69
	19	1763.94	7051 -	7064	7057.84	3.05E+01	8.26	1.35E+01	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

Analysis Report for 27-Feb-19-10013

L1-12101A-FSGS-006SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.98	477.60	*	10.44	2.22E-01	5.03E-02
K-40	0.96	1460.82	*	10.66	8.95E+00	4.69E-01
Cs-137	0.98	661.66	*	85.10	2.59E-02	7.16E-03
Tl-208	1.00	583.19	*	85.00	7.91E-02	1.02E-02
Bi-212	0.98	39.86		1.06		
		727.33	*	6.67	3.43E-01	7.99E-02
		785.37		1.10		
		1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.50E-01	3.83E-02
		300.09		3.30		
Pb212-XR	0.99	74.82	*	10.28	5.39E-01	9.89E-02
		77.11	*	17.10	4.04E-01	6.40E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.98	609.32	*	45.49	2.67E-01	2.49E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.73E-01	6.56E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49	*	15.30	1.71E-01	4.69E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	3.45E-01	6.31E-02
		295.22	*	18.42	2.60E-01	4.17E-02
		351.93	*	35.60	2.85E-01	3.07E-02
		785.96		1.06		
Ra-226	0.98	186.21	*	3.64	8.41E-01	1.59E-01
Ac-228	0.72	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.78E-01	5.45E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.72E-01	3.60E-02
		964.77	*	4.99	3.65E-01	1.10E-01
		968.97		15.80		
		1588.20		3.22		
Ac228-XR	0.95	89.96		1.90		
		93.35	*	3.10	9.25E-01	2.99E-01
Th-234	0.99	92.38		2.13		

Analysis Report for 27-Feb-19-10013

L1-12101A-FSGS-006SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Th-234	0.99	92.80	*	2.10	1.44E+00	4.49E-01
		112.81		0.21		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	5.35E-02	1.01E-02
		202.11		1.08		
		205.31		5.01		
U235-XR	0.96	89.96		3.47		
		93.35	*	5.60	5.12E-01	1.52E-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
	BE-7	0.986	2.22E-01	5.03E-02	
	K-40	0.960	8.95E+00	4.69E-01	
	Cs-137	0.982	2.59E-02	7.16E-03	
	Tl-208	1.000	7.91E-02	1.02E-02	
X	Bi-211	0.936			
	Bi-212	0.987	3.43E-01	7.99E-02	
	Pb-212	0.999	2.50E-01	3.83E-02	
	Pb212-XR	0.999	4.44E-01	5.37E-02	
	Bi-214	0.986	2.48E-01	2.08E-02	
	Pb-214	0.993	2.85E-01	2.30E-02	
X	Pb214-XR	0.999			
?	Ra-226	0.980	8.41E-01	1.59E-01	
	Ac-228	0.728	2.80E-01	2.90E-02	
?	Ac228-XR	0.959	9.25E-01	2.99E-01	
?	Th-234	0.999	1.44E+00	4.49E-01	
?	U-235	0.998	5.35E-02	1.01E-02	
?	U235-XR	0.964	5.12E-01	1.52E-01	

Analysis Report for 27-Feb-19-10013

L1-12101A-FSGS-006SS

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

Errors quoted at 1.000sigma

Analysis Report for 27-Feb-19-10013

L1-12101A-FSGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 7:45:38AM
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	3.55E-02	3.09E-02	3.09E-02
+	BE-7	477.60	*	10.44	2.22E-01	1.42E-01	1.42E-01
+	K-40	1460.82	*	10.66	8.95E+00	2.92E-01	2.92E-01
	Co-60	1173.23		99.85	1.43E-03	3.10E-02	3.70E-02
		1332.49		99.98	1.43E-02		3.10E-02
	Nb-94	702.65		99.81	1.09E-02	2.32E-02	2.70E-02
		871.09		99.89	-1.03E-03		2.32E-02
	Ag-108m	79.13		6.60	-4.68E-01	2.30E-02	8.42E-01
		433.94		90.50	-7.76E-03		2.30E-02
		614.28		89.80	-1.84E-02		4.35E-02
		722.94		90.80	-3.88E-03		3.29E-02
	Sb-125	176.31		6.84	1.01E-01	7.38E-02	2.97E-01
		380.45		1.52	-1.71E+00		1.34E+00
		427.87		29.60	2.42E-02		7.38E-02
		463.36		10.49	1.62E-01		2.28E-01
		600.60		17.65	2.89E-02		1.31E-01
		606.71		4.98	2.51E+00		8.24E-01
		635.95		11.22	7.67E-02		2.04E-01
		671.44		1.79	-8.96E-01		1.30E+00

Analysis Report for 27-Feb-19-10013

L1-12101A-FSGS-006SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	-1.38E+00	4.43E-02	2.06E+00
		81.00		32.90	-2.35E-01		1.38E-01
		276.40		7.16	1.51E-01		3.12E-01
		302.85		18.34	4.65E-02		1.22E-01
		356.01		62.05	-1.40E-02		4.43E-02
		383.85		8.94	7.20E-02		2.44E-01
	Cs-134	475.36		1.48	6.97E-01	3.13E-02	1.74E+00
		563.25		8.34	1.07E-01		2.70E-01
		569.33		15.37	-6.97E-02		1.51E-01
		604.72		97.62	-6.40E-04		4.02E-02
		795.86		85.46	2.74E-02		3.13E-02
		801.95		8.69	-3.99E-01		3.13E-01
		1038.61		0.99	6.51E-01		2.92E+00
		1167.97		1.79	-6.97E-01		1.97E+00
		1365.19		3.02	-6.07E-02		8.42E-01
+	Cs-137	661.66	*	85.10	2.59E-02	2.17E-02	2.17E-02
	Eu-152	121.78		28.67	3.49E-02	7.61E-02	8.79E-02
		244.70		7.61	-3.17E-01		3.14E-01
		295.94		0.45	6.75E+00		6.11E+00
		344.28		26.60	-2.88E-02		7.61E-02
		367.79		0.86	7.72E-02		2.35E+00
		411.12		2.24	-8.47E-01		9.99E-01
		443.96		2.83	2.19E-01		7.27E-01
		488.68		0.42	-1.12E-01		5.36E+00
		563.99		0.49	-6.80E-01		4.49E+00
		586.26		0.46	1.25E+00		7.37E+00
		678.62		0.47	-1.76E+00		5.06E+00
		688.67		0.86	-1.03E+00		2.83E+00
		719.35		0.28	1.53E+00		9.66E+00
		778.90		12.96	-1.79E-01		2.06E-01
		810.45		0.32	-3.33E+00		7.90E+00
		867.37		4.26	-1.38E-01		5.79E-01
		919.33		0.43	-1.57E+00		6.32E+00
		964.08		14.65	5.89E-01		2.63E-01
		1085.87		10.24	-2.40E-01		3.03E-01
		1089.74		1.73	-3.98E-01		1.91E+00
		1112.07		13.69	5.62E-02		2.40E-01
		1212.95		1.43	-1.39E+00		2.87E+00
		1249.94		0.19	-8.49E+00		1.85E+01
		1299.14		1.63	3.92E-01		2.01E+00
		1408.01		21.07	5.04E-02		1.28E-01
		1457.64		0.50	1.93E+02		2.63E+01
		1528.10		0.28	-6.22E+00		7.08E+00
	Eu-154	123.07		40.40	-7.75E-03	6.13E-02	6.13E-02
		247.93		6.89	8.70E-03		2.93E-01
		591.76		4.95	1.86E-01		4.68E-01
		692.42		1.78	8.83E-01		1.38E+00
		723.30		20.06	-6.35E-02		1.48E-01
		756.80		4.52	-7.24E-01		5.34E-01
		873.18		12.08	-1.81E-01		1.87E-01
		996.29		10.48	7.68E-03		2.96E-01

Analysis Report for 27-Feb-19-10013

L1-12101A-FSGS-006SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	4.26E-02	6.13E-02	1.61E-01
		1274.43		34.80	5.16E-02		1.03E-01
		1596.48		1.80	-1.03E+00		1.29E+00
	Eu-155	45.30		1.31	-7.72E+00	1.26E-01	1.12E+01
		60.01		1.22	-6.60E+00		1.28E+01
		86.55		30.70	5.02E-02		1.34E-01
		105.31		21.10	4.25E-02		1.26E-01
+	Ra-226	186.21	*	3.64	8.41E-01	4.44E-01	4.44E-01
	Pa-231	27.36		10.30	1.56E+00	9.54E-01	1.31E+00
		283.69		1.70	1.78E-01		1.23E+00
		300.07		2.47	1.31E-01		9.54E-01
		302.65		2.20	1.29E+00		1.03E+00
		330.06		1.40	4.67E-02		1.51E+00
+	U-235	143.76		10.96	-1.82E-02	2.82E-02	2.13E-01
		163.33		5.08	-3.94E-02		3.92E-01
		185.71	*	57.20	5.35E-02		2.82E-02
		202.11		1.08	9.17E-02		1.96E+00
		205.31		5.01	-2.17E-01		4.25E-01
	Am-241	59.54		35.90	-3.61E-01	4.47E-01	4.47E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10014
L1-12101A-FSGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10014
Sample Description	: L1-12101A-FSGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.721E03 grams
Facility	:Default
Sample Taken On	: 2/25/2019 9:06:00AM
Acquisition Started	: 2/27/2019 8:03:17AM
Procedure	:130G_SOIL_1
Operator	:Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1800.6 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
EnergyCalibration Used Done On	: 1/24/2019
EfficiencyCalibration Used Done On	: 2/27/2019
EfficiencyCalibration Description	:
Sample Number	: 64286
Fill Height	: 1720.51 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 8:33:20AM
Peak Analysis From Channel : 120
Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500
JGraham

Analysis Report for 27-Feb-19-10014

L1-12101A-FSGS-007SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.97	294 -	315	300.42	8.81E+01	27.33	1.50E+02	0.89
m	2	77.23	294 -	315	309.44	1.12E+02	33.70	1.63E+02	0.89
	3	186.15	738 -	749	744.49	6.71E+01	19.16	1.20E+02	0.64
	4	238.66	946 -	959	954.22	3.23E+02	24.68	1.04E+02	1.11
	5	295.26	1171 -	1189	1180.32	1.59E+02	20.85	8.17E+01	0.98
	6	338.35	1347 -	1360	1352.49	5.55E+01	15.48	6.55E+01	1.00
	7	351.89	1398 -	1415	1406.56	2.22E+02	20.54	6.17E+01	1.11
	8	510.63	2033 -	2051	2040.90	8.66E+01	16.64	5.64E+01	0.59
	9	558.24	2224 -	2237	2231.16	3.20E+01	10.44	2.80E+01	0.50
	10	582.86	2320 -	2337	2329.57	1.15E+02	14.74	3.15E+01	1.30
	11	608.97	2428 -	2440	2433.92	1.60E+02	15.54	3.01E+01	1.11
	12	661.33	2636 -	2648	2643.20	4.58E+01	9.93	2.02E+01	1.05
	13	727.19	2899 -	2912	2906.51	3.91E+01	8.42	1.09E+01	1.25
	14	910.52	3631 -	3646	3639.53	6.10E+01	11.57	2.40E+01	1.69
	15	968.43	3864 -	3877	3871.12	4.73E+01	10.47	2.27E+01	0.70
	16	1459.85	5823 -	5849	5837.33	8.29E+02	29.85	1.38E+01	1.82

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

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	0.97	511.00	*	100.00	5.07E-02	1.03E-02

Analysis Re port for 27-Fe b- 19- 10014

L1-12101A-FSGS-007SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.85	1460.82	*	10.66	9.01E+00	5.08E-01
Cs-137	0.98	661.66	*	85.10	3.65E-02	8.22E-03
Tl-208	0.98	583.19	*	85.00	8.40E-02	1.19E-02
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	4.25E-01	9.48E-02
		785.37		1.10		
		1620.50		1.47		
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.51E-01	2.80E-02
		300.09		3.30		
Pb212-XR	0.99	74.82	*	10.28	5.57E-01	1.82E-01
		77.11	*	17.10	3.90E-01	1.24E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.26E-01	2.58E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	3.34E-01	5.12E-02
		351.93	*	35.60	2.74E-01	3.35E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	5.51E-01	1.63E-01
Ac-228	0.96	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.10E-01	6.10E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.99E-01	3.88E-02
		964.77		4.99		
		968.97	*	15.80	2.63E-01	5.94E-02
		1588.20		3.22		
U-235	0.97	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.51E-02	1.04E-02
		202.11		1.08		

Analysis Report for 27-Feb-19-10014

L1-12101A-FSGS-007SS

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
U-235	0.97	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 1.000 sigma

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.979	5.07E-02	1.03E-02	
	K-40	0.859	9.01E+00	5.08E-01	
	Cs-137	0.983	3.65E-02	8.22E-03	
	Tl-208	0.983	8.40E-02	1.19E-02	
X	Bi-211	0.899			
	Bi-212	0.998	4.25E-01	9.48E-02	
	Pb-212	1.000	2.51E-01	2.80E-02	
	Pb212-XR	0.998	4.43E-01	1.03E-01	
	Bi-214	0.992	2.26E-01	2.58E-02	
	Pb-214	1.000	2.92E-01	2.80E-02	
X	Pb214-XR	0.998			
?	Ra-226	0.999	5.51E-01	1.63E-01	
	Ac-228	0.969	2.16E-01	2.87E-02	
?	U-235	0.978	3.51E-02	1.04E-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 1.000 sigma

Analysis Report for 27-Feb-19-10014
L1-12101A-FSGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 8:33:20AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
9	558.24	1.77778E-02	32.63		

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

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	5.07E-02	2.91E-02	2.91E-02
	BE-7	477.60		10.44	2.02E-01	2.71E-01	2.71E-01
+	K-40	1460.82	*	10.66	9.01E+00	3.21E-01	3.21E-01
	Co-60	1173.23		99.85	-1.79E-03	3.20E-02	4.43E-02
		1332.49		99.98	-1.46E-02		3.20E-02
	Nb-94	702.65		99.81	-1.58E-03	2.86E-02	2.86E-02
		871.09		99.89	2.72E-02		3.37E-02
	Ag-108m	79.13		6.60	1.44E-02	2.83E-02	8.27E-01
		433.94		90.50	6.88E-03		2.83E-02
		614.28		89.80	-4.13E-02		3.91E-02
		722.94		90.80	-3.00E-03		3.94E-02
	Sb-125	176.31		6.84	1.95E-01	8.51E-02	3.26E-01
		380.45		1.52	-4.04E-01		1.51E+00
		427.87		29.60	-2.96E-02		8.51E-02
		463.36		10.49	2.07E-01		2.72E-01
		600.60		17.65	2.35E-02		1.61E-01
		606.71		4.98	1.72E+00		1.00E+00
		635.95		11.22	-4.85E-02		2.43E-01

Analysis Re port for 27-Fe b- 19- 10014

L1-12101A-FSGS-007SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-1.38E+00	8.51E-02	1.44E+00
	Ba-133	79.61		2.65	-9.24E-02	4.58E-02	2.02E+00
		81.00		32.90	-5.91E-02		1.32E-01
		276.40		7.16	-2.50E-01		3.48E-01
		302.85		18.34	5.27E-02		1.32E-01
		356.01		62.05	1.85E-02		4.58E-02
		383.85		8.94	-5.52E-02		2.59E-01
	Cs-134	475.36		1.48	3.58E-01	3.47E-02	1.94E+00
		563.25		8.34	-1.45E-01		3.31E-01
		569.33		15.37	4.80E-02		1.89E-01
		604.72		97.62	-3.82E-02		4.73E-02
		795.86		85.46	1.26E-02		3.47E-02
		801.95		8.69	6.20E-02		3.65E-01
		1038.61		0.99	2.27E+00		3.67E+00
		1167.97		1.79	5.91E-01		2.40E+00
		1365.19		3.02	3.97E-01		1.05E+00
+	Cs-137	661.66	*	85.10	3.65E-02	2.20E-02	2.20E-02
	Eu-152	121.78		28.67	1.71E-02	8.67E-02	9.07E-02
		244.70		7.61	2.46E-01		3.66E-01
		295.94		0.45	7.39E+00		7.22E+00
		344.28		26.60	-2.75E-02		8.67E-02
		367.79		0.86	-2.45E-01		2.77E+00
		411.12		2.24	1.84E-01		1.08E+00
		443.96		2.83	-2.63E-01		8.61E-01
		488.68		0.42	3.35E+00		6.41E+00
		563.99		0.49	-3.76E+00		5.31E+00
		586.26		0.46	-4.02E+00		9.06E+00
		678.62		0.47	5.43E+00		6.18E+00
		688.67		0.86	6.10E-02		3.45E+00
		719.35		0.28	9.13E+00		1.08E+01
		778.90		12.96	-7.39E-02		2.36E-01
		810.45		0.32	-3.45E+00		9.01E+00
		867.37		4.26	-4.19E-01		8.17E-01
		919.33		0.43	-3.87E+00		7.16E+00
		964.08		14.65	-4.63E-02		3.37E-01
		1085.87		10.24	4.94E-01		4.00E-01
		1089.74		1.73	-2.56E+00		2.18E+00
		1112.07		13.69	-1.28E-01		3.06E-01
		1212.95		1.43	1.35E+00		3.52E+00
		1249.94		0.19	-4.71E+00		2.16E+01
		1299.14		1.63	-1.80E-01		2.54E+00
		1408.01		21.07	-1.13E-01		1.69E-01
		1457.64		0.50	1.91E+02		3.30E+01
		1528.10		0.28	1.95E+00		8.30E+00
	Eu-154	123.07		40.40	5.15E-02	6.57E-02	6.57E-02
		247.93		6.89	-6.49E-02		3.37E-01
		591.76		4.95	-6.05E-02		5.10E-01
		692.42		1.78	-3.63E-01		1.56E+00
		723.30		20.06	-2.30E-02		1.79E-01
		756.80		4.52	-3.60E-01		6.84E-01
		873.18		12.08	7.96E-02		2.87E-01

Analysis Report for 27-Feb-19-10014

L1-12101A-FSGS-007SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	2.19E-02	6.57E-02	3.29E-01
		1004.76		18.01	1.60E-02		1.97E-01
		1274.43		34.80	1.28E-02		1.28E-01
		1596.48		1.80	1.17E+00		1.57E+00
	Eu-155	45.30		1.31	-3.93E+00	1.34E-01	8.16E+00
		60.01		1.22	-1.01E+00		8.97E+00
		86.55		30.70	3.65E-02		1.40E-01
		105.31		21.10	-3.35E-02		1.34E-01
+	Ra-226	186.21	*	3.64	5.51E-01	5.06E-01	5.06E-01
	Pa-231	27.36		10.30	8.64E-01	9.32E-01	9.32E-01
		283.69		1.70	-1.47E+00		1.28E+00
		300.07		2.47	-1.70E-01		9.92E-01
		302.65		2.20	5.79E-01		1.10E+00
		330.06		1.40	1.67E+00		2.01E+00
+	U-235	143.76		10.96	3.97E-02	3.22E-02	2.29E-01
		163.33		5.08	2.74E-02		4.42E-01
		185.71	*	57.20	3.51E-02		3.22E-02
		202.11		1.08	8.04E-01		2.16E+00
		205.31		5.01	-5.14E-01		4.37E-01
	Am-241	59.54		35.90	9.11E-02	3.13E-01	3.13E-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 27-Feb-19-10015

L1-12101A-FSGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10015
Sample Description	: L1-12101A-FSGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.887E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:07:00AM
Acquisition Started	: 2/27/2019 8:03:24AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 2700.0 seconds
Real Time	: 2701.0 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64287
Fill Height	: 1887.22 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 9:09:08AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500

JGraham

Analysis Report for 27-Feb-19-10015

L1-12101A-FSGS-008SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.99	296 -	314	301.29	7.51E+01	34.85	1.89E+02	0.91
m	2	77.08	296 -	314	309.62	1.42E+02	53.06	3.30E+02	0.92
	3	185.86	736 -	750	744.17	1.24E+02	28.19	2.33E+02	1.34
	4	209.17	833 -	843	837.31	5.30E+01	19.77	1.41E+02	0.71
M	5	238.48	948 -	973	954.37	5.55E+02	64.59	1.69E+02	1.13
m	6	241.66	948 -	973	967.10	1.20E+02	18.91	1.69E+02	1.14
	7	295.18	1171 -	1190	1180.93	2.41E+02	26.92	1.38E+02	0.90
	8	338.21	1347 -	1360	1352.90	8.20E+01	20.61	1.23E+02	1.14
	9	351.77	1396 -	1417	1407.08	3.70E+02	28.91	1.24E+02	1.42
	10	409.39	1633 -	1642	1637.33	1.97E+01	11.57	4.93E+01	0.48
	11	477.31	1903 -	1916	1908.82	6.30E+01	13.39	4.20E+01	1.25
	12	510.38	2035 -	2050	2041.01	7.32E+01	19.69	1.02E+02	1.46
	13	583.12	2322 -	2339	2331.81	1.79E+02	18.59	5.15E+01	1.20
	14	609.01	2427 -	2445	2435.31	2.94E+02	21.20	4.64E+01	1.46
	15	661.50	2635 -	2651	2645.18	7.34E+01	15.22	5.06E+01	1.12
	16	727.31	2902 -	2915	2908.33	3.41E+01	12.61	4.49E+01	0.74
	17	910.95	3634 -	3653	3642.83	1.34E+02	17.60	5.00E+01	1.58
	18	968.75	3868 -	3881	3874.09	5.96E+01	12.54	3.54E+01	0.93
	19	1119.76	4471 -	4484	4478.31	4.93E+01	12.26	3.67E+01	0.72
	20	1460.32	5825 -	5855	5841.65	1.40E+03	38.40	1.58E+01	1.79

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Analysis Report for 27-Feb-19-10015

L1-12101A-FSGS-008SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.94	511.00	*	100.00	2.69E-02	7.47E-03
BE-7	0.98	477.60	*	10.44	2.13E-01	4.76E-02
K-40	0.96	1460.82	*	10.66	9.27E+00	4.76E-01
Cs-137	0.99	661.66	*	85.10	3.65E-02	7.88E-03
Tl-208	0.99	583.19	*	85.00	8.20E-02	9.85E-03
Bi-212	1.00	39.86		1.06		
		727.33	*	6.67	2.30E-01	8.61E-02
		785.37		1.10		
		1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.82E-01	3.99E-02
		300.09		3.30		
Bi-214	0.81	609.32	*	45.49	2.59E-01	2.43E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	1.96E-01	4.94E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	3.67E-01	6.51E-02
		295.22	*	18.42	3.25E-01	4.46E-02
		351.93	*	35.60	2.91E-01	3.25E-02
		785.96		1.06		
Pb214-XR	0.99	74.82	*	5.80	7.51E-01	3.59E-01
		77.11	*	9.70	7.67E-01	2.99E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.98	186.21	*	3.64	6.78E-01	1.63E-01
Ac-228	0.99	129.07		2.42		
		209.25	*	3.89	2.84E-01	1.08E-01
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.98E-01	5.23E-02
		409.46	*	1.92	3.18E-01	1.88E-01
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.70E-01	3.74E-02
		964.77		4.99		
		968.97	*	15.80	2.04E-01	4.39E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		

Analysis Report for 27-Feb-19-10015

L1-12101A-FSGS-008SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
U-235	0.99	185.71	*	57.20	4.31E-02	1.04E-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	0.940	2.69E-02	7.47E-03	
	BE-7	0.986	2.13E-01	4.76E-02	
	K-40	0.960	9.27E+00	4.76E-01	
	Cs-137	0.996	3.65E-02	7.88E-03	
	Tl-208	0.999	8.20E-02	9.85E-03	
X	Bi-211	0.924			
	Bi-212	1.000	2.30E-01	8.61E-02	
	Pb-212	0.996	2.82E-01	3.99E-02	
X	Pb212-XR	0.998			
	Bi-214	0.811	2.47E-01	2.18E-02	
	Pb-214	0.995	3.11E-01	2.43E-02	
	Pb214-XR	0.998	7.60E-01	2.30E-01	
?	Ra-226	0.981	6.78E-01	1.63E-01	
	Ac-228	0.995	2.36E-01	2.42E-02	
?	U-235	0.997	4.31E-02	1.04E-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 27-Feb-19-10015

L1-12101A-FSGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 9:09:08AM
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	2.69E-02	2.32E-02	2.32E-02
+	BE-7	477.60	*	10.44	2.13E-01	1.33E-01	1.33E-01
+	K-40	1460.82	*	10.66	9.27E+00	2.19E-01	2.19E-01
	Co-60	1173.23		99.85	-3.28E-02	2.75E-02	3.67E-02
		1332.49		99.98	-5.09E-03		2.75E-02
	Nb-94	702.65		99.81	6.61E-03	2.56E-02	2.72E-02
		871.09		99.89	-1.19E-02		2.56E-02
	Ag-108m	79.13		6.60	-5.21E-01	2.47E-02	8.78E-01
		433.94		90.50	7.25E-03		2.47E-02
		614.28		89.80	2.89E-03		4.21E-02
		722.94		90.80	-9.18E-03		3.22E-02
	Sb-125	176.31		6.84	1.39E-01	7.64E-02	2.99E-01
		380.45		1.52	3.03E-01		1.39E+00
		427.87		29.60	-1.54E-02		7.64E-02
		463.36		10.49	2.24E-01		2.28E-01
		600.60		17.65	-8.15E-03		1.38E-01
		606.71		4.98	1.97E+00		8.14E-01
		635.95		11.22	-5.94E-02		2.07E-01
		671.44		1.79	8.54E-01		1.35E+00

Analysis Report for 27-Feb-19-10015

L1-12101A-FSGS-008SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	-1.86E+00	4.41E-02	2.11E+00
		81.00		32.90	-1.90E-01		1.44E-01
		276.40		7.16	-5.08E-02		2.99E-01
		302.85		18.34	1.44E-01		1.20E-01
		356.01		62.05	-1.36E-02		4.41E-02
		383.85		8.94	7.44E-02		2.35E-01
	Cs-134	475.36		1.48	2.55E-01	3.29E-02	1.66E+00
		563.25		8.34	6.08E-02		2.65E-01
		569.33		15.37	-7.56E-02		1.44E-01
		604.72		97.62	-8.34E-03		4.00E-02
		795.86		85.46	1.03E-02		3.29E-02
		801.95		8.69	-3.83E-01		2.96E-01
		1038.61		0.99	6.30E-01		3.09E+00
		1167.97		1.79	5.62E-02		1.96E+00
		1365.19		3.02	2.61E-01		7.08E-01
+	Cs-137	661.66	*	85.10	3.65E-02	2.27E-02	2.27E-02
	Eu-152	121.78		28.67	-2.69E-03	7.81E-02	8.78E-02
		244.70		7.61	-1.34E-01		3.13E-01
		295.94		0.45	8.96E+00		6.15E+00
		344.28		26.60	-6.55E-03		7.81E-02
		367.79		0.86	-4.16E-01		2.26E+00
		411.12		2.24	5.07E-01		1.01E+00
		443.96		2.83	-4.20E-02		7.39E-01
		488.68		0.42	-4.85E+00		4.97E+00
		563.99		0.49	1.67E+00		4.54E+00
		586.26		0.46	-2.66E+00		7.34E+00
		678.62		0.47	1.65E+00		4.81E+00
		688.67		0.86	-4.53E-01		2.74E+00
		719.35		0.28	-1.56E+00		8.77E+00
		778.90		12.96	-2.51E-01		1.80E-01
		810.45		0.32	1.37E+00		7.57E+00
		867.37		4.26	-1.08E+00		6.01E-01
		919.33		0.43	2.33E+00		7.10E+00
		964.08		14.65	-1.75E-02		2.62E-01
		1085.87		10.24	-1.05E-01		3.09E-01
		1089.74		1.73	-1.59E+00		1.81E+00
		1112.07		13.69	-1.24E-01		2.45E-01
		1212.95		1.43	-6.36E+00		2.54E+00
		1249.94		0.19	-1.17E+01		1.96E+01
		1299.14		1.63	-1.62E+00		1.92E+00
		1408.01		21.07	-4.58E-02		1.12E-01
		1457.64		0.50	1.95E+02		2.60E+01
		1528.10		0.28	-2.28E+00		6.45E+00
	Eu-154	123.07		40.40	2.45E-02	6.16E-02	6.16E-02
		247.93		6.89	-3.26E-02		3.03E-01
		591.76		4.95	2.05E-01		5.04E-01
		692.42		1.78	7.32E-01		1.40E+00
		723.30		20.06	-5.76E-02		1.45E-01
		756.80		4.52	3.18E-02		5.22E-01
		873.18		12.08	3.23E-02		2.06E-01
		996.29		10.48	9.21E-02		2.83E-01

Analysis Report for 27-Feb-19-10015

L1-12101A-FSGS-008SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	1.95E-02	6.16E-02	1.71E-01
		1274.43		34.80	-6.75E-02		9.45E-02
		1596.48		1.80	-1.70E+00		1.15E+00
	Eu-155	45.30		1.31	-1.91E+00	1.34E-01	1.24E+01
		60.01		1.22	-8.81E+00		1.34E+01
		86.55		30.70	-3.18E-02		1.37E-01
		105.31		21.10	6.26E-03		1.34E-01
+	Ra-226	186.21	*	3.64	6.78E-01	4.95E-01	4.95E-01
	Pa-231	27.36		10.30	1.44E+00	9.59E-01	1.27E+00
		283.69		1.70	-1.28E+00		1.16E+00
		300.07		2.47	1.65E-01		9.59E-01
		302.65		2.20	8.95E-01		9.91E-01
		330.06		1.40	1.57E+00		1.62E+00
+	U-235	143.76		10.96	-2.10E-01	3.15E-02	2.09E-01
		163.33		5.08	-4.76E-02		4.05E-01
		185.71	*	57.20	4.31E-02		3.15E-02
		202.11		1.08	2.48E-01		2.04E+00
		205.31		5.01	6.12E-02		4.31E-01
	Am-241	59.54		35.90	-3.32E-01	4.70E-01	4.70E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10016
L1-12101A-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10016
Sample Description	: L1-12101A-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.786E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:08:00AM
Acquisition Started	: 2/27/2019 10:17:41AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 4500.0 seconds
Real Time	: 4507.9 seconds
Dead Time	: 0.17 %
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	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64293
Fill Height	: 1786.47 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 12:04:58PM
Peak Analysis From Channel : 120
Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500
JGraham

Analysis Report for 27-Feb-19-10016

L1-12101A-FSGS-009SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.93	296	315	300.45	1.21E+02	36.60	2.75E+02	0.67
m	2	77.16	296	315	309.35	1.34E+02	38.98	3.84E+02	0.68
	3	185.85	735	751	743.70	2.04E+02	40.84	4.68E+02	0.96
	4	209.28	833	843	837.33	5.03E+01	27.81	3.00E+02	0.64
M	5	238.61	949	976	954.54	8.09E+02	31.15	2.37E+02	1.00
m	6	241.85	949	976	967.48	1.81E+02	17.15	2.38E+02	1.00
M	7	295.19	1173	1207	1180.65	3.22E+02	20.19	1.74E+02	1.22
m	8	300.14	1173	1207	1200.45	6.11E+01	12.57	1.99E+02	1.23
	9	327.74	1307	1314	1310.77	2.42E+01	15.23	1.04E+02	0.64
	10	338.25	1345	1359	1352.79	1.48E+02	26.12	1.86E+02	0.77
	11	351.84	1401	1416	1407.11	4.64E+02	31.48	1.70E+02	1.19
	12	477.49	1902	1914	1909.37	6.91E+01	16.95	8.29E+01	1.00
	13	510.52	2032	2051	2041.42	1.73E+02	26.56	1.52E+02	1.41
	14	583.13	2323	2337	2331.72	2.35E+02	21.69	8.24E+01	1.12
	15	609.17	2429	2446	2435.86	3.68E+02	24.76	7.38E+01	1.14
	16	661.27	2637	2655	2644.16	9.47E+01	19.74	8.63E+01	1.72
	17	726.99	2899	2912	2906.98	3.28E+01	14.73	6.62E+01	0.93
	18	911.07	3635	3654	3643.26	1.91E+02	19.33	5.25E+01	1.24
	19	968.82	3867	3883	3874.26	7.31E+01	18.03	7.69E+01	0.99
	20	1120.11	4469	4488	4479.52	8.62E+01	17.54	6.28E+01	1.64
	21	1460.52	5827	5855	5841.93	1.80E+03	42.97	1.09E+01	1.69
	22	1763.60	7048	7064	7055.41	6.14E+01	9.72	1.06E+01	1.54

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Analysis Report for 27-Feb-19-10016

L1-12101A-FSGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.96	511.00	*	100.00	4.46E-02	7.50E-03
BE-7	0.99	477.60	*	10.44	1.63E-01	4.17E-02
K-40	0.98	1460.82	*	10.66	8.60E+00	4.26E-01
Cs-137	0.97	661.66	*	85.10	3.32E-02	7.21E-03
Tl-208	0.99	583.19	*	85.00	7.59E-02	8.36E-03
Bi-212	0.98	39.86		1.06		
		727.33	*	6.67	1.57E-01	7.10E-02
		785.37		1.10		
		1620.50		1.47		
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.82E-01	2.53E-02
		300.09	*	3.30	3.20E-01	7.07E-02
Pb212-XR	0.99	74.82	*	10.28	5.51E-01	1.76E-01
		77.11	*	17.10	3.24E-01	9.99E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.98	609.32	*	45.49	2.29E-01	2.07E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.46E-01	5.10E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49	*	15.30	2.37E-01	3.87E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	3.83E-01	4.74E-02
		295.22	*	18.42	2.99E-01	3.04E-02
		351.93	*	35.60	2.53E-01	2.65E-02
		785.96		1.06		
Ra-226	0.98	186.21	*	3.64	7.64E-01	1.65E-01
Ac-228	0.99	129.07		2.42		
		209.25	*	3.89	1.85E-01	1.03E-01
		270.24		3.46		
		328.00	*	2.95	1.51E-01	9.61E-02
		338.32	*	11.27	2.48E-01	4.81E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.75E-01	3.02E-02
		964.77		4.99		
		968.97	*	15.80	1.79E-01	4.48E-02
		1588.20		3.22		

Analysis Report for 27-Feb-19-10016

L1-12101A-FSGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.86E-02	1.05E-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	0.964	4.46E-02	7.50E-03	
	BE-7	0.998	1.63E-01	4.17E-02	
	K-40	0.986	8.60E+00	4.26E-01	
	Cs-137	0.976	3.32E-02	7.21E-03	
	Tl-208	0.999	7.59E-02	8.36E-03	
X	Bi-211	0.909			
	Bi-212	0.988	1.57E-01	7.10E-02	
	Pb-212	1.000	2.87E-01	2.38E-02	
	Pb212-XR	0.999	3.80E-01	8.69E-02	
	Bi-214	0.981	2.32E-01	1.72E-02	
	Pb-214	0.999	2.89E-01	1.84E-02	
X	Pb214-XR	0.999			
?	Ra-226	0.980	7.64E-01	1.65E-01	
	Ac-228	0.998	2.39E-01	2.12E-02	
X	Pa-231	1.000			
?	U-235	0.998	4.86E-02	1.05E-02	

Analysis Report for 27-Feb-19-10016

L1-12101A-FSGS-009SS

? = 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 27-Feb-19-10016

L1-12101A-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 12:04:58PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	4.46E-02	2.10E-02	2.10E-02
+	BE-7	477.60	*	10.44	1.63E-01	1.25E-01	1.25E-01
+	K-40	1460.82	*	10.66	8.60E+00	1.29E-01	1.29E-01
	Co-60	1173.23		99.85	1.63E-02	2.51E-02	3.09E-02
		1332.49		99.98	-6.06E-04		2.51E-02
	Nb-94	702.65		99.81	-9.77E-03	2.06E-02	2.06E-02
		871.09		99.89	8.62E-03		2.12E-02
	Ag-108m	79.13		6.60	-1.78E-01	2.01E-02	7.94E-01
		433.94		90.50	-5.23E-03		2.01E-02
		614.28		89.80	-7.42E-03		2.73E-02
		722.94		90.80	2.60E-03		2.58E-02
	Sb-125	176.31		6.84	-1.86E-02	6.32E-02	2.60E-01
		380.45		1.52	1.80E-02		1.09E+00
		427.87		29.60	2.09E-02		6.32E-02
		463.36		10.49	1.02E-01		1.90E-01
		600.60		17.65	3.54E-02		1.12E-01
		606.71		4.98	-2.35E-01		6.49E-01
		635.95		11.22	-1.95E-01		1.52E-01
		671.44		1.79	3.78E-01		1.05E+00

Analysis Report for 27-Feb-19-10016

L1-12101A-FSGS-009SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	4.42E-02	3.60E-02	1.91E+00
		81.00		32.90	-5.99E-02		1.34E-01
		276.40		7.16	2.01E-01		2.54E-01
		302.85		18.34	-1.53E-02		9.48E-02
		356.01		62.05	1.41E-02		3.60E-02
		383.85		8.94	-8.87E-03		1.90E-01
	Cs-134	475.36		1.48	1.24E+00	2.65E-02	1.41E+00
		563.25		8.34	7.11E-02		2.21E-01
		569.33		15.37	-6.20E-02		1.18E-01
		604.72		97.62	-2.05E-02		3.05E-02
		795.86		85.46	2.48E-02		2.65E-02
		801.95		8.69	-5.49E-02		2.38E-01
		1038.61		0.99	-1.55E+00		2.38E+00
		1167.97		1.79	2.54E+00		1.79E+00
		1365.19		3.02	3.44E-01		7.63E-01
+	Cs-137	661.66	*	85.10	3.32E-02	2.15E-02	2.15E-02
	Eu-152	121.78		28.67	-3.11E-02	6.37E-02	7.32E-02
		244.70		7.61	-2.57E-02		2.60E-01
		295.94		0.45	-2.76E-01		4.90E+00
		344.28		26.60	-2.02E-02		6.37E-02
		367.79		0.86	1.25E+00		1.95E+00
		411.12		2.24	-6.18E-02		7.96E-01
		443.96		2.83	3.41E-02		6.53E-01
		488.68		0.42	-4.31E-01		4.35E+00
		563.99		0.49	-5.22E-01		3.77E+00
		586.26		0.46	-8.69E+00		6.17E+00
		678.62		0.47	4.83E-01		4.03E+00
		688.67		0.86	-3.71E-01		2.21E+00
		719.35		0.28	-4.10E+00		7.40E+00
		778.90		12.96	2.89E-02		1.53E-01
		810.45		0.32	-6.09E-01		6.45E+00
		867.37		4.26	-1.66E-01		4.88E-01
		919.33		0.43	-3.02E+00		4.52E+00
		964.08		14.65	1.22E-02		2.13E-01
		1085.87		10.24	1.74E-01		2.68E-01
		1089.74		1.73	-2.22E-01		1.56E+00
		1112.07		13.69	-1.22E-01		1.91E-01
		1212.95		1.43	-1.46E-02		2.20E+00
		1249.94		0.19	7.32E+00		1.66E+01
		1299.14		1.63	5.19E-01		1.48E+00
		1408.01		21.07	1.97E-02		1.04E-01
		1457.64		0.50	1.83E+02		2.11E+01
		1528.10		0.28	4.55E+00		5.55E+00
	Eu-154	123.07		40.40	3.82E-02	5.27E-02	5.27E-02
		247.93		6.89	-2.51E-01		2.43E-01
		591.76		4.95	-5.49E-02		3.99E-01
		692.42		1.78	-1.67E-02		1.06E+00
		723.30		20.06	2.81E-02		1.17E-01
		756.80		4.52	1.31E-01		4.41E-01
		873.18		12.08	5.16E-02		1.75E-01
		996.29		10.48	5.64E-02		2.32E-01

Analysis Report for 27-Feb-19-10016

L1-12101A-FSGS-009SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	4.66E-02	5.27E-02	1.36E-01
		1274.43		34.80	-3.85E-02		7.65E-02
		1596.48		1.80	-7.02E-01		1.04E+00
	Eu-155	45.30		1.31	-2.56E+00	1.27E-01	1.41E+01
		60.01		1.22	-6.21E+00		1.46E+01
		86.55		30.70	5.21E-02		1.27E-01
		105.31		21.10	-4.87E-02		1.33E-01
+	Ra-226	186.21	*	3.64	7.64E-01	4.96E-01	4.96E-01
	Pa-231	27.36		10.30	3.03E+00	4.93E-01	1.62E+00
		283.69		1.70	3.39E-01		9.96E-01
		300.07	*	2.47	4.28E-01		4.93E-01
		302.65		2.20	1.27E-01		7.95E-01
		330.06		1.40	1.94E-01		1.30E+00
+	U-235	143.76		10.96	3.50E-02	3.16E-02	1.84E-01
		163.33		5.08	4.47E-03		3.61E-01
		185.71	*	57.20	4.86E-02		3.16E-02
		202.11		1.08	-1.68E-01		1.56E+00
		205.31		5.01	-2.92E-01		3.36E-01
	Am-241	59.54		35.90	-4.81E-02	5.20E-01	5.20E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10017

L1-12101A-FQGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10017
Sample Description	: L1-12101A-FQGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.376E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:08:00AM
Acquisition Started	: 2/27/2019 12:07:14PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1802.9 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 1/29/2019
Efficiency Calibration Used Done On	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64322
Fill Height	: 1376.29 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 12:37:20PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500

JGraham

Analysis Report for 27-Feb-19-10017

L1-12101A-FQGS-009SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.17	305 -	314	309.40	4.15E+01	18.02	1.25E+02	0.50
M	2	238.61	948 -	972	954.54	2.45E+02	17.78	1.13E+02	0.87
m	3	241.93	948 -	972	967.81	4.22E+01	9.60	8.39E+01	0.87
	4	295.19	1175 -	1188	1180.68	9.17E+01	16.18	6.13E+01	0.80
	5	338.37	1344 -	1359	1353.26	6.11E+01	14.33	4.79E+01	0.80
	6	351.87	1400 -	1416	1407.21	1.83E+02	20.34	7.39E+01	1.04
	7	401.40	1602 -	1609	1605.21	1.30E+01	6.42	1.40E+01	0.59
	8	477.69	1906 -	1914	1910.17	2.80E+01	8.28	1.90E+01	0.39
	9	510.82	2033 -	2052	2042.62	9.10E+01	17.55	6.20E+01	0.38
	10	583.12	2324 -	2339	2331.71	9.30E+01	14.18	3.60E+01	0.86
	11	609.25	2427 -	2442	2436.18	1.45E+02	14.97	2.62E+01	0.95
	12	910.81	3635 -	3651	3642.22	6.31E+01	11.06	1.89E+01	0.40
	13	1460.40	5829 -	5854	5841.45	6.03E+02	24.85	3.39E+00	1.84

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	6.24E-02	1.28E-02
BE-7	0.99	477.60	*	10.44	1.75E-01	5.34E-02
K-40	0.97	1460.82	*	10.66	7.77E+00	4.65E-01
Tl-208	0.99	583.19	*	85.00	7.99E-02	1.31E-02

Analysis Report for 27-Feb-19-10017

L1-12101A-FQGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.24E-01	2.43E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	2.57E-01	1.15E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	2.39E-01	2.86E-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	2.34E-01	5.64E-02
		295.22	*	18.42	2.24E-01	4.34E-02
		351.93	*	35.60	2.63E-01	3.60E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	4.52E-01	2.03E-01
		87.35		2.24		
		89.78		0.82		
Rn-219	0.99	271.23		10.80		
		401.81	*	6.60	1.11E-01	5.59E-02
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.69E-01	6.69E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.42E-01	4.38E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

Analysis Report for 27-Feb-19-10017

L1-12101A-FQGS-009SS

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	***Nuclide Id Confidence***	***Wt mean Activity (pCi/grams)***	***Wt mean Activity Uncertainty***	***Comments***
	An Pk	0.995	6.24E-02	1.28E-02	
	BE-7	0.999	1.75E-01	5.34E-02	
	K-40	0.972	7.77E+00	4.65E-01	
	Tl-208	0.999	7.99E-02	1.31E-02	
X	Bi-211	0.903			
	Pb-212	1.000	2.24E-01	2.43E-02	
?	Pb212-XR	1.000	2.57E-01	1.15E-01	
	Bi-214	1.000	2.39E-01	2.86E-02	
	Pb-214	1.000	2.44E-01	2.49E-02	
?	Pb214-XR	1.000	4.52E-01	2.03E-01	
	Rn-219	0.990	1.11E-01	5.59E-02	
	Ac-228	0.993	2.50E-01	3.66E-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 27-Feb-19-10017

L1-12101A-FQGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 12:37:20PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	6.24E-02	3.62E-02	3.62E-02
+	BE-7	477.60	*	10.44	1.75E-01	1.53E-01	1.53E-01
+	K-40	1460.82	*	10.66	7.77E+00	2.06E-01	2.06E-01
	Co-60	1173.23		99.85	-2.30E-02	3.44E-02	5.17E-02
		1332.49		99.98	-2.72E-03		3.44E-02
	Nb-94	702.65		99.81	6.23E-04	3.11E-02	3.11E-02
		871.09		99.89	-9.00E-03		3.60E-02
	Ag-108m	79.13		6.60	1.18E-01	3.34E-02	1.26E+00
		433.94		90.50	1.28E-02		3.34E-02
		614.28		89.80	-6.31E-02		4.30E-02
		722.94		90.80	-2.54E-02		4.16E-02
	Sb-125	176.31		6.84	1.13E-01	1.05E-01	4.22E-01
		380.45		1.52	8.05E-01		1.91E+00
		427.87		29.60	5.91E-02		1.05E-01
		463.36		10.49	2.49E-01		3.14E-01
		600.60		17.65	-2.63E-02		1.53E-01
		606.71		4.98	1.95E+00		1.06E+00
		635.95		11.22	1.68E-02		2.99E-01
		671.44		1.79	-1.32E-01		1.59E+00

Analysis Report for 27-Feb-19-10017

L1-12101A-FQGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	1.57E-01	5.53E-02	3.03E+00
	81.00	32.90	-9.25E-02		2.02E-01
	276.40	7.16	1.94E-01		3.82E-01
	302.85	18.34	1.49E-01		1.56E-01
	356.01	62.05	-2.65E-02		5.53E-02
	383.85	8.94	8.91E-02		3.35E-01
Cs-134	475.36	1.48	2.69E-01	4.58E-02	2.14E+00
	563.25	8.34	-7.58E-02		3.46E-01
	569.33	15.37	-3.73E-02		1.83E-01
	604.72	97.62	5.03E-03		4.97E-02
	795.86	85.46	1.98E-02		4.58E-02
	801.95	8.69	-7.85E-02		3.99E-01
	1038.61	0.99	3.72E+00		3.85E+00
	1167.97	1.79	2.47E+00		2.97E+00
	1365.19	3.02	-4.88E-01		1.08E+00
Cs-137	661.66	85.10	3.18E-02	4.11E-02	4.11E-02
Eu-152	121.78	28.67	3.13E-02	1.01E-01	1.13E-01
	244.70	7.61	-1.18E-01		4.13E-01
	295.94	0.45	1.35E+00		7.40E+00
	344.28	26.60	-5.41E-03		1.01E-01
	367.79	0.86	1.31E+00		3.04E+00
	411.12	2.24	9.96E-01		1.42E+00
	443.96	2.83	-5.92E-01		1.01E+00
	488.68	0.42	-1.60E+00		6.93E+00
	563.99	0.49	-2.61E+00		5.87E+00
	586.26	0.46	-4.38E-01		1.02E+01
	678.62	0.47	-3.09E+00		5.83E+00
	688.67	0.86	1.37E+00		3.66E+00
	719.35	0.28	-2.61E+00		1.17E+01
	778.90	12.96	-2.30E-02		2.81E-01
	810.45	0.32	6.34E+00		1.08E+01
	867.37	4.26	-1.84E-01		8.57E-01
	919.33	0.43	-6.69E+00		9.26E+00
	964.08	14.65	2.20E-01		3.28E-01
	1085.87	10.24	-1.35E-01		3.86E-01
	1089.74	1.73	2.45E-01		2.40E+00
	1112.07	13.69	-1.48E-01		3.11E-01
	1212.95	1.43	2.99E-01		3.65E+00
	1249.94	0.19	-1.13E+01		2.18E+01
	1299.14	1.63	6.07E-01		2.83E+00
	1408.01	21.07	-6.50E-02		1.79E-01
	1457.64	0.50	1.60E+02		3.33E+01
	1528.10	0.28	3.04E+00		9.85E+00
Eu-154	123.07	40.40	-2.24E-02	7.70E-02	7.70E-02
	247.93	6.89	9.01E-02		3.95E-01
	591.76	4.95	-2.14E-01		5.92E-01
	692.42	1.78	-2.54E-01		1.79E+00
	723.30	20.06	6.19E-02		1.93E-01
	756.80	4.52	-3.88E-01		6.97E-01
	873.18	12.08	9.31E-02		3.11E-01
	996.29	10.48	-3.60E-01		3.46E-01

Analysis Report for 27-Feb-19-10017

L1-12101A-FQGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-4.17E-02	7.70E-02	1.82E-01
	1274.43	34.80	-5.28E-02		1.21E-01
	1596.48	1.80	-5.33E-01		2.04E+00
Eu-155	45.30	1.31	-4.49E+00	1.92E-01	2.05E+01
	60.01	1.22	-3.93E+00		2.21E+01
	86.55	30.70	1.56E-02		1.92E-01
	105.31	21.10	5.56E-02		2.04E-01
Ra-226	186.21	3.64	7.18E-01	8.37E-01	8.37E-01
Pa-231	27.36	10.30	3.58E+00	1.12E+00	2.74E+00
	283.69	1.70	3.03E-01		1.54E+00
	300.07	2.47	-2.38E-01		1.12E+00
	302.65	2.20	7.19E-01		1.29E+00
	330.06	1.40	8.90E-01		2.11E+00
U-235	143.76	10.96	-2.47E-02	5.24E-02	2.84E-01
	163.33	5.08	-6.35E-02		5.84E-01
	185.71	57.20	1.84E-02		5.24E-02
	202.11	1.08	-3.03E-01		2.49E+00
	205.31	5.01	-3.36E-01		5.61E-01
Am-241	59.54	35.90	-1.84E-01	7.84E-01	7.84E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10018
L1-12101A-FSGS010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10018
Sample Description	: L1-12101A-FSGS010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.726E+03 grams
Facility	Default
Sample Taken On	: 2/ 25/ 2019 9:09:00AM
Acquisition Started	: 2/ 27/ 2019 9:19:35 AM
Procedure	:130G_SOIL_1
Operator	:Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 18000 seconds
Real Time	: 1803.1 seconds
Dead Time	: 0.17 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000keV
Energy Calibration Used Done On	: 1/ 29/ 2019
Efficiency Calibration Used Done On	: 2/ 27/ 2019
Efficiency Calibration Description	:
Sample Number	: 64291
Fill Height	: 1725.99 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/ 30/ 2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/ 27/ 2019 9:49:40AM
Peak Analysis From Channel : 120
Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500
JGraham

Analysis Report for 27-Feb-19-10018
L1-12101A-FSGS010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.28	306 -	316	309.86	5.94E+01	20.39	1.48E+02	0.48
2	238.61	948 -	959	954.54	2.83E+02	24.42	1.25E+02	1.06
3	295.10	1173 -	1189	1180.32	9.60E+01	20.07	9.80E+01	0.66
4	338.27	1346 -	1358	1352.83	6.24E+01	12.50	3.56E+01	0.51
5	344.05	1371 -	1383	1375.95	2.97E+01	10.98	3.43E+01	0.78
6	351.88	1398 -	1416	1407.23	1.98E+02	20.46	6.46E+01	1.06
7	583.09	2324 -	2339	2331.56	1.05E+02	13.06	2.18E+01	1.05
8	609.21	2427 -	2444	2436.00	1.79E+02	15.84	2.22E+01	1.18
9	910.96	3637 -	3652	3642.78	7.14E+01	11.72	2.16E+01	0.49
10	968.56	3865 -	3879	3873.21	3.86E+01	10.43	2.44E+01	0.58
11	1460.46	5829 -	5854	5841.66	6.67E+02	26.10	3.35E+00	1.44

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

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	8.05E+00	4.70E-01
Tl-208	0.99	583.19	*	85.00	8.56E-02	1.18E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.48E-01	2.93E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		

Analysis Report for 27-Feb-19-10018

L1-12101A-FSGS010SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	77.11	*	17.10	3.57E-01	1.28E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.82	609.32	*	45.49	2.80E-01	3.00E-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	2.24E-01	5.01E-02
		351.93	*	35.60	2.72E-01	3.54E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	6.29E-01	2.27E-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	2.62E-01	5.67E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.59E-01	4.39E-02
		964.77		4.99		
		968.97	*	15.80	2.38E-01	6.51E-02
		1588.20		3.22		

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

Analysis Report for 27-Feb-19-10018

L1-12101A-FSGS010SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.979	8.05E+00	4.70E-01	
	Tl-208	0.998	8.56E-02	1.18E-02	
X	Bi-211	0.901			
	Pb-212	1.000	2.48E-01	2.93E-02	
?	Pb212-XR	0.997	3.57E-01	1.28E-01	
	Bi-214	0.824	2.80E-01	3.00E-02	
	Pb-214	0.999	2.56E-01	2.89E-02	
?	Pb214-XR	0.997	6.29E-01	2.27E-01	
	Ac-228	0.992	2.55E-01	3.06E-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 1.000 sigma

Analysis Report for 27-Feb-19-10018
L1-12101A-FSGS010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/ 27/ 2019 9:49:40AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
5	344.05	1.64865E-02	37.01	Tol.	Eu-152

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.97E-02	4.29E-02	4.29E-02
	BE-7	477.60		10.44	1.38E-01	3.04E-01	3.04E-01
+	K-40	1460.82	*	10.66	8.05E+00	1.91E-01	1.91E-01
	Co-60	1173.23		99.85	3.11E-03	3.80E-02	5.15E-02
		1332.49		99.98	5.00E-03		3.80E-02
	Nb-94	702.65		99.81	2.16E-02	3.24E-02	3.24E-02
		871.09		99.89	-5.15E-03		3.30E-02
	Ag-108m	79.13		6.60	-1.21E-01	3.23E-02	1.28E+00
		433.94		90.50	2.35E-03		3.23E-02
		614.28		89.80	-2.74E-02		4.56E-02
		722.94		90.80	1.71E-03		4.08E-02
	Sb-125	176.31		6.84	1.03E-02	9.62E-02	4.12E-01
		380.45		1.52	1.10E+00		1.94E+00
		427.87		29.60	-6.83E-02		9.62E-02
		463.36		10.49	1.13E-01		2.84E-01
		600.60		17.65	1.53E-02		1.74E-01
		606.71		4.98	2.69E+00		1.10E+00
		635.95		11.22	1.44E-01		2.78E-01

Analysis Report for 27-Feb-19-10018

L1-12101A-FSGS010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.13E-01	9.62E-02	1.84E+00
Ba-133	79.61	2.65	-1.53E-01	5.66E-02	3.05E+00
	81.00	32.90	-1.67E-01		2.12E-01
	276.40	7.16	1.89E-01		4.12E-01
	302.85	18.34	5.07E-02		1.52E-01
	356.01	62.05	1.72E-03		5.66E-02
	383.85	8.94	-1.82E-01		3.18E-01
Cs-134	475.36	1.48	1.74E+00	3.81E-02	2.07E+00
	563.25	8.34	-1.84E-01		3.60E-01
	569.33	15.37	4.88E-03		1.96E-01
	604.72	97.62	-1.95E-03		5.21E-02
	795.86	85.46	1.60E-02		3.81E-02
	801.95	8.69	-2.93E-01		3.28E-01
	1038.61	0.99	3.53E+00		3.86E+00
	1167.97	1.79	-7.78E-01		2.80E+00
	1365.19	3.02	-5.65E-01		1.18E+00
Cs-137	661.66	85.10	2.41E-02	4.37E-02	4.37E-02
Eu-152	121.78	28.67	-3.71E-03	9.96E-02	1.12E-01
	244.70	7.61	1.18E-01		4.20E-01
	295.94	0.45	1.71E+00		7.63E+00
	344.28	26.60	7.57E-02		9.96E-02
	367.79	0.86	-2.57E-01		2.94E+00
	411.12	2.24	-1.05E-01		1.35E+00
	443.96	2.83	-3.59E-01		1.01E+00
	488.68	0.42	-1.26E+00		6.87E+00
	563.99	0.49	2.63E+00		6.27E+00
	586.26	0.46	1.20E+00		9.70E+00
	678.62	0.47	-1.23E+00		5.69E+00
	688.67	0.86	-2.90E+00		3.19E+00
	719.35	0.28	-1.57E+00		1.11E+01
	778.90	12.96	-8.00E-03		2.41E-01
	810.45	0.32	5.37E+00		1.08E+01
	867.37	4.26	-2.56E-01		8.07E-01
	919.33	0.43	2.68E+00		8.23E+00
	964.08	14.65	1.51E-01		3.49E-01
	1085.87	10.24	-1.56E-01		3.56E-01
	1089.74	1.73	-1.12E+00		2.22E+00
	1112.07	13.69	-5.95E-02		3.35E-01
	1212.95	1.43	-8.43E-01		3.77E+00
	1249.94	0.19	1.49E+01		2.24E+01
	1299.14	1.63	-6.52E-01		2.44E+00
	1408.01	21.07	-3.27E-02		1.45E-01
	1457.64	0.50	1.63E+02		3.26E+01
	1528.10	0.28	3.32E-01		1.17E+01
Eu-154	123.07	40.40	-1.71E-02	7.89E-02	7.89E-02
	247.93	6.89	8.83E-02		4.19E-01
	591.76	4.95	5.82E-01		6.46E-01
	692.42	1.78	-6.32E-01		1.72E+00
	723.30	20.06	8.22E-02		1.87E-01
	756.80	4.52	-8.77E-03		7.68E-01
	873.18	12.08	2.78E-02		2.76E-01

Analysis Report for 27-Feb-19-10018

L1-12101A-FSGS010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.51E-01	7.89E-02	3.82E-01
	1004.76	18.01	-5.63E-02		2.17E-01
	1274.43	34.80	3.86E-02		1.42E-01
	1596.48	1.80	-4.22E-01		1.55E+00
Eu-155	45.30	1.31	1.29E+01	2.05E-01	2.36E+01
	60.01	1.22	5.19E-01		2.30E+01
	86.55	30.70	1.06E-02		2.07E-01
	105.31	21.10	6.18E-02		2.05E-01
Ra-226	186.21	3.64	5.82E-01	8.51E-01	8.51E-01
Pa-231	27.36	10.30	4.19E+00	1.12E+00	2.80E+00
	283.69	1.70	1.79E-01		1.77E+00
	300.07	2.47	3.96E-01		1.12E+00
	302.65	2.20	5.67E-01		1.26E+00
	330.06	1.40	7.22E-01		2.00E+00
U-235	143.76	10.96	-2.30E-01	5.39E-02	2.92E-01
	163.33	5.08	-1.62E-01		5.85E-01
	185.71	57.20	2.83E-02		5.39E-02
	202.11	1.08	2.13E-01		2.50E+00
	205.31	5.01	-1.73E-01		5.57E-01
Am-241	59.54	35.90	-3.24E-01	8.05E-01	8.05E-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 27-Feb-19-10019

L1-12101A-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10019
Sample Description	: L1-12101A-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.857E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:10:00AM
Acquisition Started	: 2/27/2019 9:19:42AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 2700.0 seconds
Real Time	: 2701.0 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64292
Fill Height	: 1856.54 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 10:31:53AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500

JGraham

Analysis Report for 27-Feb-19-10019

L1-12101A-FSGS-011SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	76.98	306 -	316	309.22	7.46E+01	24.84	2.25E+02	0.82
	2	121.77	482 -	496	488.13	1.22E+02	28.89	2.47E+02	0.36
	3	185.88	735 -	750	744.24	1.05E+02	29.86	2.62E+02	1.04
	4	238.61	945 -	960	954.90	4.59E+02	34.32	2.40E+02	1.07
	5	295.04	1175 -	1187	1180.40	1.53E+02	20.86	1.07E+02	0.98
	6	328.08	1308 -	1317	1312.39	3.23E+01	13.14	6.17E+01	0.77
M	7	338.11	1347 -	1384	1352.49	9.59E+01	12.54	9.73E+01	1.13
m	8	344.26	1347 -	1384	1377.06	6.01E+01	10.76	1.11E+02	1.14
	9	351.84	1398 -	1417	1407.34	3.55E+02	26.76	1.04E+02	1.32
	10	511.00	2037 -	2049	2043.47	4.89E+01	16.40	8.31E+01	0.62
	11	582.94	2323 -	2338	2331.09	1.60E+02	18.45	6.00E+01	1.18
	12	609.13	2426 -	2444	2435.80	2.84E+02	21.27	4.98E+01	1.37
	13	661.46	2635 -	2653	2645.00	3.03E+02	22.53	6.07E+01	1.29
	14	910.75	3634 -	3650	3642.06	1.02E+02	15.29	4.12E+01	1.11
M	15	964.33	3850 -	3882	3856.41	4.60E+01	8.07	3.10E+01	1.49
m	16	968.76	3850 -	3882	3874.12	7.42E+01	9.41	3.85E+01	1.50
	17	1119.89	4471 -	4486	4478.84	4.00E+01	12.88	4.20E+01	1.14
	18	1172.86	4683 -	4700	4690.82	6.88E+01	13.57	3.52E+01	0.40
	19	1332.11	5321 -	5337	5328.31	6.54E+01	11.65	2.26E+01	0.93
	20	1460.33	5826 -	5854	5841.70	1.01E+03	33.08	1.87E+01	1.82
	21	1763.73	7051 -	7064	7057.00	3.50E+01	7.55	8.03E+00	1.35

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

Analysis Report for 27-Feb-19-10019

L1-12101A-FSGS-011SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	1.00	511.00	*	100.00	1.81E-02	6.18E-03
K-40	0.96	1460.82	*	10.66	6.70E+00	3.65E-01
Co-60	0.97	1173.23	*	99.85	4.23E-02	8.51E-03
		1332.49	*	99.98	4.34E-02	7.92E-03
Cs-137	0.99	661.66	*	85.10	1.51E-01	1.44E-02
Eu-152	0.99	121.78	*	28.67	9.35E-02	2.40E-02
		244.70		7.61		
		295.94	*	0.45	8.48E+00	1.34E+00
		344.28	*	26.60	6.24E-02	1.23E-02
		367.79		0.86		
		411.12		2.24		
		443.96		2.83		
		488.68		0.42		
		563.99		0.49		
		586.26		0.46		
		678.62		0.47		
		688.67		0.86		
		719.35		0.28		
		778.90		12.96		
		810.45		0.32		
		867.37		4.26		
		919.33		0.43		
		964.08	*	14.65	1.70E-01	3.06E-02
		1085.87		10.24		
		1089.74		1.73		
		1112.07		13.69		
		1212.95		1.43		
		1249.94		0.19		
		1299.14		1.63		
		1408.01		21.07		
		1457.64		0.50		
		1528.10		0.28		
Tl-208	0.99	583.19	*	85.00	7.36E-02	9.57E-03
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.33E-01	2.57E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.30E-01	8.01E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.98	609.32	*	45.49	2.51E-01	2.41E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	1.60E-01	5.18E-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		

Analysis Report for 27-Feb-19-10019

L1-12101A-FSGS-011SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.98	1661.27		1.05		
		1729.59		2.88		
		1764.49	*	15.30	1.87E-01	4.10E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.06E-01	3.26E-02
		351.93	*	35.60	2.80E-01	3.07E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	4.05E-01	1.42E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.98	186.21	*	3.64	5.74E-01	1.70E-01
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00	*	2.95	2.92E-01	1.22E-01
		338.32	*	11.27	2.32E-01	3.58E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.06E-01	3.22E-02
		964.77	*	4.99	5.00E-01	9.02E-02
		968.97	*	15.80	2.55E-01	3.42E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.65E-02	1.08E-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

Analysis Report for 27-Feb-19-10019

L1-12101A-FSGS-011SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	1.000	1.81E-02	6.18E-03	
	K-40	0.962	6.70E+00	3.65E-01	
X	Co-57	0.988			
	Co-60	0.978	4.29E-02	5.80E-03	
	Cs-137	0.994	1.51E-01	1.44E-02	
	Eu-152	0.999	7.11E-02	1.03E-02	
	Tl-208	0.991	7.36E-02	9.57E-03	
X	Bi-211	0.910			
	Pb-212	1.000	2.33E-01	2.57E-02	
?	Pb212-XR	0.999	2.30E-01	8.01E-02	
	Bi-214	0.982	2.24E-01	1.93E-02	
	Pb-214	0.998	2.44E-01	2.23E-02	
?	Pb214-XR	0.999	4.05E-01	1.42E-01	
?	Ra-226	0.982	5.74E-01	1.70E-01	
	Ac-228	0.986	2.34E-01	1.89E-02	
?	U-235	0.997	3.65E-02	1.08E-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 27-Feb-19-10019

L1-12101A-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 10:31:53AM
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	1.81E-02	1.96E-02	1.96E-02
	BE-7	477.60		10.44	-1.49E-02	2.27E-01	2.27E-01
+	K-40	1460.82	*	10.66	6.70E+00	2.32E-01	2.32E-01
+	Co-60	1173.23	*	99.85	4.23E-02	2.08E-02	2.41E-02
		1332.49	*	99.98	4.34E-02		2.08E-02
	Nb-94	702.65		99.81	-3.96E-02	2.44E-02	2.44E-02
		871.09		99.89	1.18E-02		2.68E-02
	Ag-108m	79.13		6.60	5.77E-01	2.41E-02	8.53E-01
		433.94		90.50	1.10E-02		2.41E-02
		614.28		89.80	-1.24E-02		4.18E-02
		722.94		90.80	1.36E-02		2.93E-02
	Sb-125	176.31		6.84	5.57E-02	7.21E-02	2.99E-01
		380.45		1.52	-5.19E-01		1.40E+00
		427.87		29.60	-1.76E-02		7.21E-02
		463.36		10.49	4.41E-03		2.41E-01
		600.60		17.65	1.35E-01		1.43E-01
		606.71		4.98	2.29E+00		8.16E-01
		635.95		11.22	-5.86E-02		2.04E-01
		671.44		1.79	3.78E-01		1.37E+00

Analysis Report for 27-Feb-19-10019

L1-12101A-FSGS-011SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	-6.06E-02	4.45E-02	2.08E+00
		81.00		32.90	-1.02E-01		1.45E-01
		276.40		7.16	2.40E-02		3.01E-01
		302.85		18.34	5.45E-02		1.23E-01
		356.01		62.05	-1.32E-02		4.45E-02
		383.85		8.94	2.96E-01		2.48E-01
	Cs-134	475.36		1.48	6.56E-01	3.28E-02	1.54E+00
		563.25		8.34	1.26E-01		2.86E-01
		569.33		15.37	1.54E-02		1.48E-01
		604.72		97.62	8.22E-04		3.99E-02
		795.86		85.46	2.31E-02		3.28E-02
		801.95		8.69	-3.10E-01		3.03E-01
		1038.61		0.99	1.74E+00		2.82E+00
		1167.97		1.79	-2.55E-01		2.29E+00
		1365.19		3.02	1.26E-01		7.87E-01
+	Cs-137	661.66	*	85.10	1.51E-01	2.56E-02	2.56E-02
+	Eu-152	121.78	*	28.67	9.35E-02	5.55E-02	7.16E-02
		244.70		7.61	2.13E-01		3.11E-01
		295.94	*	0.45	8.48E+00		3.31E+00
		344.28	*	26.60	6.24E-02		5.55E-02
		367.79		0.86	9.23E-01		2.45E+00
		411.12		2.24	1.06E+00		1.00E+00
		443.96		2.83	9.84E-02		7.87E-01
		488.68		0.42	-8.47E-01		5.19E+00
		563.99		0.49	-4.87E-01		4.75E+00
		586.26		0.46	-2.57E+00		7.58E+00
		678.62		0.47	2.10E+00		4.92E+00
		688.67		0.86	-4.95E-01		2.58E+00
		719.35		0.28	-7.69E-01		8.46E+00
		778.90		12.96	5.54E-02		1.98E-01
		810.45		0.32	1.55E+00		7.87E+00
		867.37		4.26	-2.62E-01		6.46E-01
		919.33		0.43	1.16E+00		5.68E+00
		964.08	*	14.65	1.70E-01		1.09E-01
		1085.87		10.24	2.32E-01		3.12E-01
		1089.74		1.73	-2.33E-01		1.83E+00
		1112.07		13.69	2.84E-02		2.33E-01
		1212.95		1.43	4.39E-01		2.43E+00
		1249.94		0.19	3.83E+00		1.80E+01
		1299.14		1.63	1.35E+00		1.87E+00
		1408.01		21.07	1.42E-03		1.27E-01
		1457.64		0.50	1.39E+02		2.22E+01
		1528.10		0.28	1.41E+00		5.42E+00
	Eu-154	123.07		40.40	5.01E-02	6.56E-02	6.56E-02
		247.93		6.89	2.21E-01		3.09E-01
		591.76		4.95	-1.80E-01		4.95E-01
		692.42		1.78	1.69E+00		1.38E+00
		723.30		20.06	8.59E-02		1.33E-01
		756.80		4.52	1.43E-01		5.78E-01
		873.18		12.08	-1.84E-01		2.15E-01
		996.29		10.48	1.36E-01		2.87E-01

Analysis Report for 27-Feb-19-10019

L1-12101A-FSGS-011SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	-8.68E-02	6.56E-02	1.60E-01
		1274.43		34.80	-7.09E-02		8.39E-02
		1596.48		1.80	6.27E-01		1.30E+00
	Eu-155	45.30		1.31	2.91E+00	1.28E-01	1.22E+01
		60.01		1.22	-8.26E+00		1.28E+01
		86.55		30.70	7.66E-02		1.42E-01
		105.31		21.10	9.75E-03		1.28E-01
+	Ra-226	186.21	*	3.64	5.74E-01	5.35E-01	5.35E-01
	Pa-231	27.36		10.30	2.66E+00	9.50E-01	1.47E+00
		283.69		1.70	-6.36E-01		1.19E+00
		300.07		2.47	-2.22E-01		9.50E-01
		302.65		2.20	3.47E-01		1.02E+00
		330.06		1.40	-8.78E-02		1.56E+00
+	U-235	143.76		10.96	-8.07E-02	3.41E-02	2.12E-01
		163.33		5.08	-1.41E-01		4.18E-01
		185.71	*	57.20	3.65E-02		3.41E-02
		202.11		1.08	-9.46E-01		1.96E+00
		205.31		5.01	-5.45E-01		4.25E-01
	Am-241	59.54		35.90	-1.82E-01	4.52E-01	4.52E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10020
L1-12101A-FSGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10020
Sample Description	: L1-12101A-FSGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.505E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:11:00AM
Acquisition Started	: 2/27/2019 10:18:02AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1800.6 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 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	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64294
Fill Height	: 1505.48 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 10:48:05AM
Peak Analysis From Channel : 120
Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500
JGraham

Analysis Report for 27-Feb-19-10020

L1-12101A-FSGS-012SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	75.11	294 -	315	300.98	6.28E+01	11.65	1.53E+02	0.94
m	2	77.20	294 -	315	309.32	1.20E+02	13.91	1.47E+02	0.95
	3	238.71	947 -	960	954.41	2.71E+02	25.73	1.42E+02	1.09
	4	295.24	1174 -	1186	1180.24	9.18E+01	17.45	8.02E+01	0.95
	5	338.45	1346 -	1356	1352.89	6.72E+01	13.94	5.28E+01	0.36
	6	351.91	1399 -	1413	1406.64	1.89E+02	18.57	5.43E+01	1.02
	7	462.95	1847 -	1854	1850.35	2.09E+01	6.66	1.11E+01	0.97
	8	510.75	2034 -	2050	2041.37	7.55E+01	14.33	4.15E+01	0.92
	9	582.93	2323 -	2335	2329.84	8.06E+01	12.78	3.14E+01	1.32
	10	609.09	2425 -	2442	2434.38	1.43E+02	16.79	4.26E+01	1.40
	11	661.35	2634 -	2652	2643.29	1.81E+02	16.91	3.07E+01	1.40
	12	674.76	2692 -	2701	2696.91	1.03E+01	5.47	8.67E+00	0.84
	13	910.73	3633 -	3648	3640.37	7.22E+01	12.24	2.58E+01	1.38
	14	1172.61	4680 -	4694	4687.88	3.39E+01	11.00	3.01E+01	0.32
	15	1331.53	5317 -	5331	5323.77	4.08E+01	8.38	1.02E+01	0.28
	16	1460.01	5824 -	5850	5837.96	6.08E+02	25.85	1.36E+01	1.79
	17	1587.57	6343 -	6354	6348.60	9.43E+00	3.70	1.57E+00	0.55

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 27-Feb-19-10020

L1-12101A-FSGS-012SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	4.55E-02	9.17E-03
K-40	0.89	1460.82	*	10.66	6.86E+00	4.16E-01
Co-60	0.90	1173.23	*	99.85	3.50E-02	1.15E-02
		1332.49	*	99.98	4.57E-02	9.57E-03
Cs-137	0.98	661.66	*	85.10	1.49E-01	1.65E-02
Tl-208	0.98	583.19	*	85.00	6.08E-02	1.03E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.16E-01	2.69E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.08E-01	2.74E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.97E-01	4.06E-02
		351.93	*	35.60	2.38E-01	3.02E-02
		785.96		1.06		
Pb214-XR	0.99	74.82	*	5.80	7.09E-01	1.54E-01
		77.11	*	9.70	7.50E-01	1.21E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.60E-01	5.81E-02
		409.46		1.92		
		463.00	*	4.40	2.60E-01	8.52E-02
		794.95		4.25		
		911.20	*	25.80	2.44E-01	4.26E-02
		964.77		4.99		
		968.97		15.80		
		1588.20	*	3.22	3.75E-01	1.48E-01

Analysis Report for 27-Feb-19-10020

L1-12101A-FSGS-012SS

* = 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	0.990	4.55E-02	9.17E-03	
	K-40	0.899	6.86E+00	4.16E-01	
	Co-60	0.901	4.13E-02	7.34E-03	
X	Sb-125	0.417			
	Cs-137	0.985	1.49E-01	1.65E-02	
	Tl-208	0.989	6.08E-02	1.03E-02	
X	Bi-211	0.894			
	Pb-212	0.999	2.16E-01	2.69E-02	
X	Pb212-XR	0.995			
	Bi-214	0.996	2.08E-01	2.74E-02	
	Pb-214	1.000	2.23E-01	2.42E-02	
	Pb214-XR	0.995	7.34E-01	9.50E-02	
	Ac-228	0.986	2.56E-01	3.12E-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 27-Feb-19-10020

L1-12101A-FSGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 10:48:05AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
12	674.76	5.73830E-03	52.93		

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	4.55E-02	2.50E-02	2.50E-02
	BE-7	477.60		10.44	2.90E-01	3.14E-01	3.14E-01
+	K-40	1460.82	*	10.66	6.86E+00	3.27E-01	3.27E-01
+	Co-60	1173.23	*	99.85	3.50E-02	2.39E-02	3.57E-02
		1332.49	*	99.98	4.57E-02		2.39E-02
	Nb-94	702.65		99.81	-1.75E-02	2.78E-02	2.78E-02
		871.09		99.89	1.03E-04		3.02E-02
	Ag-108m	79.13		6.60	1.09E-02	2.97E-02	8.02E-01
		433.94		90.50	5.87E-03		2.97E-02
		614.28		89.80	-4.13E-03		4.17E-02
		722.94		90.80	2.13E-02		3.77E-02
	Sb-125	176.31		6.84	-2.44E-02	8.61E-02	3.26E-01
		380.45		1.52	1.64E-01		1.63E+00
		427.87		29.60	-1.34E-02		8.61E-02
		463.36	*	10.49	1.09E-01		1.01E-01
		600.60		17.65	-6.67E-02		1.50E-01
		606.71		4.98	2.08E+00		9.84E-01
		635.95		11.22	1.06E-01		2.53E-01

Analysis Report for 27-Feb-19-10020

L1-12101A-FSGS-012SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	1.06E+00	8.61E-02	1.53E+00
	Ba-133	79.61		2.65	-4.78E-01	4.49E-02	1.92E+00
		81.00		32.90	-8.55E-02		1.24E-01
		276.40		7.16	5.58E-02		3.32E-01
		302.85		18.34	7.84E-02		1.32E-01
		356.01		62.05	-1.13E-02		4.49E-02
		383.85		8.94	-5.59E-02		2.75E-01
	Cs-134	475.36		1.48	1.38E+00	4.26E-02	2.13E+00
		563.25		8.34	-3.12E-01		3.45E-01
		569.33		15.37	-6.05E-02		1.78E-01
		604.72		97.62	-4.18E-03		4.50E-02
		795.86		85.46	4.11E-02		4.26E-02
		801.95		8.69	-3.03E-02		3.65E-01
		1038.61		0.99	1.21E+00		3.79E+00
		1167.97		1.79	7.72E-01		3.01E+00
		1365.19		3.02	-3.50E-01		9.01E-01
+	Cs-137	661.66	*	85.10	1.49E-01	3.09E-02	3.09E-02
	Eu-152	121.78		28.67	4.79E-02	8.92E-02	8.92E-02
		244.70		7.61	2.49E-01		3.69E-01
		295.94		0.45	5.73E+00		7.06E+00
		344.28		26.60	7.07E-03		9.78E-02
		367.79		0.86	-6.17E-01		2.70E+00
		411.12		2.24	-9.94E-01		1.14E+00
		443.96		2.83	-4.86E-01		9.05E-01
		488.68		0.42	2.18E-01		6.63E+00
		563.99		0.49	-4.77E+00		5.50E+00
		586.26		0.46	-7.31E+00		9.04E+00
		678.62		0.47	-1.48E+00		5.90E+00
		688.67		0.86	-4.43E-02		3.14E+00
		719.35		0.28	-6.75E+00		1.03E+01
		778.90		12.96	7.23E-02		2.38E-01
		810.45		0.32	-9.32E+00		9.62E+00
		867.37		4.26	-1.37E-01		7.39E-01
		919.33		0.43	1.23E+00		7.60E+00
		964.08		14.65	1.87E-01		3.17E-01
		1085.87		10.24	-2.32E-01		3.42E-01
		1089.74		1.73	7.75E-01		2.09E+00
		1112.07		13.69	-4.09E-02		2.73E-01
		1212.95		1.43	-4.07E-01		3.42E+00
		1249.94		0.19	7.81E+00		2.41E+01
		1299.14		1.63	-6.90E-01		2.06E+00
		1408.01		21.07	-1.22E-02		1.59E-01
		1457.64		0.50	1.49E+02		2.94E+01
		1528.10		0.28	3.97E+00		7.62E+00
	Eu-154	123.07		40.40	1.20E-02	6.09E-02	6.09E-02
		247.93		6.89	-1.89E-01		3.31E-01
		591.76		4.95	4.11E-01		5.41E-01
		692.42		1.78	-1.94E-01		1.50E+00
		723.30		20.06	1.56E-01		1.73E-01
		756.80		4.52	4.10E-01		5.95E-01
		873.18		12.08	6.76E-02		2.55E-01

Analysis Report for 27-Feb-19-10020

L1-12101A-FSGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-6.12E-02	6.09E-02	3.10E-01
	1004.76	18.01	-4.69E-02		1.79E-01
	1274.43	34.80	-3.12E-02		1.13E-01
	1596.48	1.80	-3.82E-01		1.24E+00
Eu-155	45.30	1.31	1.51E+00	1.32E-01	7.99E+00
	60.01	1.22	1.10E+00		8.69E+00
	86.55	30.70	7.35E-02		1.32E-01
	105.31	21.10	1.13E-02		1.33E-01
Ra-226	186.21	3.64	4.39E-01	6.78E-01	6.78E-01
Pa-231	27.36	10.30	1.27E+00	9.41E-01	9.41E-01
	283.69	1.70	-3.54E-01		1.41E+00
	300.07	2.47	-4.12E-01		9.84E-01
	302.65	2.20	5.56E-01		1.10E+00
	330.06	1.40	3.82E-01		1.84E+00
U-235	143.76	10.96	2.92E-02	4.40E-02	2.22E-01
	163.33	5.08	2.42E-01		4.47E-01
	185.71	57.20	4.24E-02		4.40E-02
	202.11	1.08	3.63E-01		2.11E+00
	205.31	5.01	-1.98E-01		4.68E-01
Am-241	59.54	35.90	-9.44E-02	2.99E-01	2.99E-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 27-Feb-19-10021
L1-12101A-FSGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10021
Sample Description	: L1-12101A-FSGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.754E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:12:00AM
Acquisition Started	: 2/27/2019 10:21:10AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 3600.0 seconds
Real Time	: 3604.8 seconds
Dead Time	: 0.13 %
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	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64295
Fill Height	: 1753.91 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 11:43:58AM
Peak Analysis From Channel : 120
Peak Analysis To Channel : 4096

DATA VALIDATED 2/27/19 1500
JGraham

Analysis Report for 27-Feb-19-10021

L1-12101A-FSGS-013SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.05	151 -	158	154.69	1.94E+02	37.51	5.94E+02	0.92
	2	186.07	368 -	376	372.44	1.65E+02	34.11	4.67E+02	1.19
M	3	238.62	473 -	488	477.42	7.58E+02	30.11	2.95E+02	1.18
m	4	241.79	473 -	488	483.75	1.80E+02	17.02	2.92E+02	1.19
	5	295.24	585 -	595	590.53	3.04E+02	31.09	2.77E+02	1.31
	6	338.32	671 -	681	676.60	1.82E+02	27.32	2.37E+02	1.39
	7	351.85	698 -	708	703.65	5.11E+02	31.62	2.06E+02	1.45
	8	462.96	922 -	929	925.68	3.40E+01	15.31	9.70E+01	1.12
	9	510.79	1015 -	1026	1021.27	2.31E+02	23.55	1.29E+02	1.96
	10	583.01	1159 -	1171	1165.62	2.36E+02	23.70	1.24E+02	1.47
	11	609.19	1214 -	1223	1217.96	3.68E+02	24.26	9.77E+01	1.56
	12	661.57	1316 -	1327	1322.67	1.28E+02	18.60	8.71E+01	1.43
	13	727.04	1449 -	1459	1453.56	5.50E+01	15.52	7.80E+01	1.19
	14	910.98	1814 -	1827	1821.40	1.82E+02	19.08	6.63E+01	1.64
	15	968.93	1933 -	1943	1937.33	9.89E+01	16.60	7.21E+01	1.73
	16	1120.26	2235 -	2245	2240.07	8.99E+01	16.24	7.21E+01	1.80
	17	1460.53	2913 -	2928	2921.11	1.76E+03	42.25	9.99E+00	2.11
	18	1763.92	3524 -	3536	3528.69	7.08E+01	10.43	1.43E+01	1.60

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Analysis Report for 27-Feb-19-10021

L1-12101A-FSGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	5.81E-02	7.12E-03
K-40	0.98	1460.82	*	10.66	7.97E+00	3.96E-01
Cs-137	0.99	661.66	*	85.10	4.35E-02	6.84E-03
Tl-208	0.99	583.19	*	85.00	7.41E-02	8.67E-03
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	2.54E-01	7.31E-02
		785.37		1.10		
		1620.50		1.47		
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.60E-01	2.34E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	3.15E-01	6.89E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.22E-01	1.98E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.44E-01	4.52E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49	*	15.30	2.57E-01	3.93E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	3.75E-01	4.64E-02
		295.22	*	18.42	2.79E-01	3.62E-02
		351.93	*	35.60	2.74E-01	2.77E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	5.55E-01	1.24E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.99	186.21	*	3.64	6.02E-01	1.34E-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	2.99E-01	5.12E-02
		409.46		1.92		
		463.00	*	4.40	1.77E-01	8.10E-02
		794.95		4.25		
		911.20	*	25.80	2.51E-01	2.84E-02
		964.77		4.99		
		968.97	*	15.80	2.32E-01	4.02E-02

Analysis Report for 27-Feb-19-10021

L1-12101A-FSGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Ac-228	0.99	1588.20		3.22		
U-235	0.98	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.83E-02	8.52E-03
		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	0.993	5.81E-02	7.12E-03	
	K-40	0.986	7.97E+00	3.96E-01	
X	Sb-125	0.418			
	Cs-137	0.999	4.35E-02	6.84E-03	
	Tl-208	0.995	7.41E-02	8.67E-03	
X	Bi-211	0.907			
	Bi-212	0.991	2.54E-01	7.31E-02	
	Pb-212	1.000	2.60E-01	2.34E-02	
?	Pb212-XR	1.000	3.15E-01	6.89E-02	
	Bi-214	0.992	2.31E-01	1.65E-02	
	Pb-214	0.999	2.94E-01	1.99E-02	
?	Pb214-XR	1.000	5.55E-01	1.24E-01	
?	Ra-226	0.997	6.02E-01	1.34E-01	
	Ac-228	0.997	2.49E-01	2.05E-02	
?	U-235	0.986	3.83E-02	8.52E-03	

Analysis Report for 27-Feb-19-10021

L1-12101A-FSGS-013SS

? = 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 27-Feb-19-10021

L1-12101A-FSGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 11:43:58AM
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	5.81E-02	1.61E-02	1.61E-02
	BE-7	477.60		10.44	8.85E-02	1.66E-01	1.66E-01
+	K-40	1460.82	*	10.66	7.97E+00	9.74E-02	9.74E-02
	Co-60	1173.23		99.85	2.57E-02	2.36E-02	2.82E-02
		1332.49		99.98	7.59E-03		2.36E-02
	Nb-94	702.65		99.81	-5.02E-03	1.74E-02	1.74E-02
		871.09		99.89	7.52E-03		1.98E-02
	Ag-108m	79.13		6.60	-1.08E-01	1.80E-02	5.41E-01
		433.94		90.50	1.23E-03		1.80E-02
		614.28		89.80	-2.28E-02		2.66E-02
		722.94		90.80	-5.44E-03		2.23E-02
	Sb-125	176.31		6.84	1.69E-02	5.33E-02	2.59E-01
		380.45		1.52	-1.15E-01		9.45E-01
		427.87		29.60	1.32E-03		5.33E-02
		463.36	*	10.49	7.44E-02		1.12E-01
		600.60		17.65	-1.76E-02		1.03E-01
		606.71		4.98	-6.81E-01		6.49E-01
		635.95		11.22	8.73E-03		1.58E-01
		671.44		1.79	3.37E-01		9.81E-01

Analysis Report for 27-Feb-19-10021

L1-12101A-FSGS-013SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	-4.29E-01	3.53E-02	1.25E+00
		81.00		32.90	-1.01E-01		8.63E-02
		276.40		7.16	2.81E-02		2.24E-01
		302.85		18.34	3.65E-02		8.76E-02
		356.01		62.05	-3.68E-02		3.53E-02
		383.85		8.94	3.46E-02		1.67E-01
	Cs-134	475.36		1.48	-5.29E-02	2.33E-02	1.13E+00
		563.25		8.34	8.53E-02		2.08E-01
		569.33		15.37	-1.87E-02		1.09E-01
		604.72		97.62	-5.40E-02		2.88E-02
		795.86		85.46	7.01E-03		2.33E-02
		801.95		8.69	-9.44E-02		2.04E-01
		1038.61		0.99	9.07E-01		2.20E+00
		1167.97		1.79	-2.80E-01		1.56E+00
		1365.19		3.02	1.14E-01		6.45E-01
+	Cs-137	661.66	*	85.10	4.35E-02	1.80E-02	1.80E-02
	Eu-152	121.78		28.67	-8.48E-03	5.65E-02	5.65E-02
		244.70		7.61	-1.26E-01		2.35E-01
		295.94		0.45	-1.28E+00		4.63E+00
		344.28		26.60	-7.75E-02		5.97E-02
		367.79		0.86	1.44E+00		1.87E+00
		411.12		2.24	5.47E-01		7.73E-01
		443.96		2.83	-1.49E-01		5.42E-01
		488.68		0.42	-3.63E-01		3.88E+00
		563.99		0.49	1.78E+00		3.54E+00
		586.26		0.46	-2.33E+00		5.82E+00
		678.62		0.47	-1.66E+00		3.63E+00
		688.67		0.86	2.34E-01		2.33E+00
		719.35		0.28	9.76E-01		6.35E+00
		778.90		12.96	-5.08E-02		1.38E-01
		810.45		0.32	1.16E+00		5.49E+00
		867.37		4.26	3.86E-02		4.53E-01
		919.33		0.43	-4.78E+00		4.30E+00
		964.08		14.65	-4.69E-02		1.80E-01
		1085.87		10.24	-1.87E-01		2.26E-01
		1089.74		1.73	3.23E-01		1.41E+00
		1112.07		13.69	-8.11E-02		1.83E-01
		1212.95		1.43	-9.11E-01		2.00E+00
		1249.94		0.19	-5.96E+00		1.30E+01
		1299.14		1.63	2.51E-01		1.57E+00
		1408.01		21.07	-5.44E-03		9.43E-02
		1457.64		0.50	-1.73E+00		1.97E+01
		1528.10		0.28	2.09E-01		5.25E+00
	Eu-154	123.07		40.40	1.68E-03	4.05E-02	4.05E-02
		247.93		6.89	-2.40E-01		2.15E-01
		591.76		4.95	-1.45E-01		3.39E-01
		692.42		1.78	1.56E-01		1.07E+00
		723.30		20.06	-1.80E-02		1.04E-01
		756.80		4.52	-1.71E-01		4.15E-01
		873.18		12.08	5.94E-02		1.60E-01
		996.29		10.48	1.52E-02		2.06E-01

Analysis Report for 27-Feb-19-10021

L1-12101A-FSGS-013SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	4.30E-02	4.05E-02	1.18E-01
		1274.43		34.80	9.15E-03		6.92E-02
		1596.48		1.80	-9.74E-01		8.13E-01
	Eu-155	45.30		1.31	9.13E-01	8.64E-02	5.75E+00
		60.01		1.22	-1.53E+00		6.52E+00
		86.55		30.70	2.28E-02		8.64E-02
		105.31		21.10	-3.08E-02		9.25E-02
+	Ra-226	186.21	*	3.64	6.02E-01	4.02E-01	4.02E-01
	Pa-231	27.36		10.30	9.16E-01	6.08E-01	6.08E-01
		283.69		1.70	-1.86E-01		9.06E-01
		300.07		2.47	1.67E-01		6.80E-01
		302.65		2.20	3.04E-01		7.30E-01
		330.06		1.40	4.02E-01		1.21E+00
+	U-235	143.76		10.96	5.49E-03	2.56E-02	1.46E-01
		163.33		5.08	1.67E-01		3.49E-01
		185.71	*	57.20	3.83E-02		2.56E-02
		202.11		1.08	7.66E-01		1.53E+00
		205.31		5.01	-4.40E-01		3.25E-01
	Am-241	59.54		35.90	-9.25E-03	2.29E-01	2.29E-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 27-Feb-19-10022

L1-12 101A-FSGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	:27-Feb-19-10022
Sample Description	:L1-12 101A-FSGS-014SS
Sample Type	:Soil
Unit	:
Sample Point	:
Sample Size	: 1.688E+03 grams
Facility	: Default
Sample Taken On	:2/25/2019 9:13:00AM
Acquisition Started	:2/27/2019 10:41:09AM
Procedure	: 130G_SOIL_1
Operator	:Administrator
Detector Name	:352
Geometry	130G_SOIL_1
Live Time	:1800.0 seconds
Real Time	:1800.7 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	:3.00
Peak Locate Range (in channels)	:120 - 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	:2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64314
Fill Height	:1687.85 gram
Certificate Name	:Eu155-Na22
Certificate Date	:1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 11:15:28AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500

JGraham

Analysis Report for 27-Feb-19 10:02:27
L1-12 101A-FSGS-014SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.05	306 -	316	309.50	7.42E+01	18.54	1.11E+02	0.92
	2	185.86	735 -	752	744.15	7.80E+01	24.05	1.52E+02	0.63
M	3	238.58	945 -	974	954.77	3.25E+02	52.54	1.22E+02	1.22
m	4	241.63	945 -	974	966.96	7.56E+01	15.68	1.42E+02	1.22
	5	295.22	1174 -	1189	1181.12	9.64E+01	19.09	8.86E+01	0.90
	6	338.17	1348 -	1359	1352.74	3.54E+01	14.03	6.36E+01	0.70
	7	351.74	1399 -	1414	1406.95	1.73E+02	19.26	6.59E+01	1.05
	8	583.16	2325 -	2340	2331.95	7.11E+01	15.17	5.29E+01	0.78
	9	609.06	2429 -	2446	2435.51	1.67E+02	16.50	3.15E+01	1.35
	10	661.48	2633 -	2653	2645.10	3.73E+02	22.32	3.53E+01	1.35
	11	910.81	3636 -	3650	3642.30	6.05E+01	11.69	2.65E+01	0.44
	12	968.96	3869 -	3881	3874.92	3.24E+01	8.75	1.66E+01	0.90
	13	1172.98	4680 -	4701	4691.31	1.37E+02	15.85	3.04E+01	2.09
	14	1331.96	5320 -	5336	5327.71	8.94E+01	12.88	2.46E+01	1.20
	15	1407.37	5623 -	5636	5629.64	8.27E+00	5.51	6.73E+00	0.31
	16	1460.27	5829 -	5854	5841.46	6.42E+02	26.53	1.52E+01	1.83

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1000sigma

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.95	1460.82	*	10.66	6.55E+00	3.93E-01

Analysis Report for 27-Feb-19 10:02:2

L112 101A-FSGS-014SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Co-60	0.97	1173.23	*	99.85	1.28E-01	1.57E-02
		1332.49	*	99.98	9.08E-02	1.36E-02
Cs-137	0.99	661.66	*	85.10	2.83E-01	2.40E-02
Tl-208	1.00	583.19	*	85.00	4.99E-02	1.10E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.51E-01	4.53E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	3.44E-01	9.30E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.24E-01	2.60E-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	3.65E-01	2.44E-01
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	3.53E-01	7.84E-02
		295.22	*	18.42	1.97E-01	4.21E-02
		351.93	*	35.60	2.07E-01	2.84E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	6.06E-01	1.66E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.98	186.21	*	3.64	6.45E-01	2.06E-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	1.30E-01	5.26E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.87E-01	3.70E-02
		964.77		4.99		
		968.97	*	15.80	1.70E-01	4.66E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.11E-02	1.31E-02

Analysis Report for 27-Feb-19 10:02:2

L1-12 101A-FSGS-014SS

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
U-235	0.99	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: 1.00 keV
Nuclide confidence index threshold = 0.30
Errors quoted at 1.00 sigma

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.953	6.55E+00	3.93E-01	
	Co-60	0.973	1.07E-01	1.03E-02	
	Cs-137	0.995	2.83E-01	2.40E-02	
	Tl-208	1.000	4.99E-02	1.10E-02	
X	Bi-211	0.931			
	Pb-212	1.000	2.51E-01	4.53E-02	
?	Pb212-XR	1.000	3.44E-01	9.30E-02	
	Bi-214	0.994	2.26E-01	2.59E-02	
	Pb-214	0.994	2.16E-01	2.25E-02	
?	Pb214-XR	1.000	6.06E-01	1.66E-01	
?	Ra-226	0.980	6.45E-01	2.06E-01	
	Ac-228	0.992	1.69E-01	2.54E-02	
?	U-235	0.998	4.11E-02	1.31E-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 1.00 sigma

Analysis Report for 27-Feb-19 10:02:27

L1-12 101A-FSGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 11:15:28 AM
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 1000 sigma

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.74E-02	3.80E-02	3.80E-02
	BE-7	477.60		10.44	7.71E-02	3.05E-01	3.05E-01
+	K-40	1460.82	*	10.66	6.55E+00	3.02E-01	3.02E-01
+	Co-60	1173.23	*	99.85	1.28E-01	3.31E-02	3.68E-02
		1332.49	*	99.98	9.08E-02		3.31E-02
	Nb-94	702.65		99.81	-1.24E-03	3.07E-02	3.07E-02
		871.09		99.89	3.73E-03		3.50E-02
	Ag-108m	79.13		6.60	4.23E-01	3.14E-02	9.65E-01
		433.94		90.50	3.24E-03		3.14E-02
		614.28		89.80	1.04E-02		5.27E-02
		722.94		90.80	5.19E-03		3.71E-02
	Sb-125	176.31		6.84	1.39E-01	8.78E-02	3.65E-01
		380.45		1.52	2.08E-01		1.77E+00
		427.87		29.60	-5.14E-02		8.78E-02
		463.36		10.49	-1.79E-01		2.89E-01
		600.60		17.65	-1.18E-01		1.71E-01
		606.71		4.98	2.27E+00		9.97E-01
		635.95		11.22	1.52E-01		2.71E-01
		671.44		1.79	-3.44E-02		1.59E+00

Analysis Report for 27-Feb-19 10:02:2

L112 101A-FSGS-014SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	-1.72E+00	5.41E-02	2.30E+00
		81.00		32.90	-1.53E-01		1.55E-01
		276.40		7.16	9.58E-02		3.61E-01
		302.85		18.34	2.48E-02		1.47E-01
		356.01		62.05	-5.81E-03		5.41E-02
		383.85		8.94	5.22E-03		3.06E-01
	Cs-134	475.36		1.48	1.05E+00	3.68E-02	2.14E+00
		563.25		8.34	1.51E-01		3.17E-01
		569.33		15.37	3.33E-02		1.79E-01
		604.72		97.62	-2.74E-03		4.78E-02
		795.86		85.46	5.45E-03		3.68E-02
		801.95		8.69	-2.35E-01		3.66E-01
		1038.61		0.99	1.94E-01		3.72E+00
		1167.97		1.79	-7.84E-01		3.81E+00
		1365.19		3.02	-3.61E-01		7.98E-01
+	Cs-137	661.66	*	85.10	2.83E-01	3.11E-02	3.11E-02
	Eu-152	121.78		28.67	4.79E-02	1.04E-01	1.06E-01
		244.70		7.61	-1.08E-01		3.82E-01
		295.94		0.45	5.86E+00		7.28E+00
		344.28		26.60	2.05E-03		1.04E-01
		367.79		0.86	-1.09E+00		3.18E+00
		411.12		2.24	6.17E-01		1.29E+00
		443.96		2.83	-7.63E-01		9.91E-01
		488.68		0.42	2.40E+00		6.89E+00
		563.99		0.49	3.25E-01		5.28E+00
		586.26		0.46	1.15E+01		8.56E+00
		678.62		0.47	3.15E+00		6.49E+00
		688.67		0.86	-2.52E+00		3.17E+00
		719.35		0.28	6.71E-01		1.09E+01
		778.90		12.96	-5.22E-02		2.53E-01
		810.45		0.32	-4.18E+00		9.95E+00
		867.37		4.26	-1.00E+00		7.94E-01
		919.33		0.43	-5.48E+00		7.90E+00
		964.08		14.65	-1.37E-01		3.00E-01
		1085.87		10.24	3.32E-02		3.70E-01
		1089.74		1.73	5.22E-01		2.32E+00
		1112.07		13.69	-9.95E-02		2.81E-01
		1212.95		1.43	2.98E+00		3.26E+00
		1249.94		0.19	-3.67E+00		2.19E+01
		1299.14		1.63	1.19E+00		2.04E+00
		1408.01		21.07	3.16E-02		1.57E-01
		1457.64		0.50	1.41E+02		2.75E+01
		1528.10		0.28	3.28E+00		9.04E+00
	Eu-154	123.07		40.40	5.13E-02	7.46E-02	7.46E-02
		247.93		6.89	-1.08E-01		3.61E-01
		591.76		4.95	-4.18E-01		5.66E-01
		692.42		1.78	-1.71E+00		1.64E+00
		723.30		20.06	-3.51E-02		1.65E-01
		756.80		4.52	-4.75E-01		6.98E-01
		873.18		12.08	3.55E-02		2.92E-01
		996.29		10.48	1.17E-01		3.71E-01

Analysis Report for 27-Feb-19 10:02:2

L1-12 101A-FSGS-014SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	-7.88E-02	7.46E-02	2.20E-01
		1274.43		34.80	-6.08E-02		9.42E-02
		1596.48		1.80	-1.12E+00		1.26E+00
	Eu-155	45.30		1.31	-2.02E+00	1.64E-01	1.44E+01
		60.01		1.22	-7.13E+00		1.46E+01
		86.55		30.70	-1.56E-03		1.64E-01
		105.31		21.10	-5.53E-02		1.64E-01
+	Ra-226	186.21	*	3.64	6.45E-01	6.52E-01	6.52E-01
	Pa-231	27.36		10.30	1.79E+00	1.16E+00	1.78E+00
		283.69		1.70	7.13E-01		1.48E+00
		300.07		2.47	4.77E-01		1.16E+00
		302.65		2.20	6.55E-01		1.24E+00
		330.06		1.40	1.41E+00		2.01E+00
+	U-235	143.76		10.96	-1.56E-01	4.15E-02	2.47E-01
		163.33		5.08	-3.30E-01		4.76E-01
		185.71	*	57.20	4.11E-02		4.15E-02
		202.11		1.08	-6.58E-01		2.47E+00
		205.31		5.01	-1.37E-01		5.35E-01
	Am-241	59.54		35.90	-2.20E-01	5.18E-01	5.18E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10023

L1-12101A-FSGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10023
Sample Description	: L1-12101A-FSGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.635E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:14:00AM
Acquisition Started	: 2/27/2019 11:29:59AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1800.5 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	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64318
Fill Height	: 1635.03 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 12:00:02PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500

JGraham

Analysis Report for 27-Feb-19-10023

L1-12101A-FSGS-015SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.23	305 -	315	309.46	6.76E+01	21.10	1.57E+02	0.83
M	2	238.70	947 -	975	954.39	2.97E+02	17.72	9.02E+01	1.16
m	3	241.97	947 -	975	967.42	6.74E+01	9.82	7.69E+01	1.17
	4	295.23	1173 -	1186	1180.22	9.94E+01	16.06	5.76E+01	0.80
	5	351.88	1401 -	1413	1406.51	1.63E+02	16.35	3.99E+01	1.33
	6	462.72	1845 -	1855	1849.42	1.45E+01	8.88	2.65E+01	0.30
	7	558.40	2227 -	2237	2231.78	3.18E+01	7.81	1.22E+01	0.82
	8	583.06	2322 -	2339	2330.36	8.73E+01	15.25	4.47E+01	0.79
	9	609.04	2425 -	2442	2434.21	1.29E+02	14.20	2.25E+01	1.41
	10	661.37	2635 -	2651	2643.36	1.92E+02	16.07	2.13E+01	1.30
	11	910.54	3632 -	3648	3639.61	8.55E+01	10.60	8.50E+00	1.31
	12	1460.00	5824 -	5849	5837.94	5.29E+02	23.58	6.50E+00	1.51

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.89	1460.82	*	10.66	5.82E+00	3.62E-01
Cs-137	0.98	661.66	*	85.10	1.55E-01	1.59E-02
Tl-208	0.99	583.19	*	85.00	6.47E-02	1.20E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.33E-01	2.34E-02

Analysis Report for 27-Feb-19-10023

L1-12101A-FSGS-015SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	2.36E-01	7.77E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.83E-01	2.31E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99	*	7.25	3.21E-01	5.33E-02
		295.22	*	18.42	2.10E-01	3.78E-02
		351.93	*	35.60	2.03E-01	2.60E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	4.16E-01	1.38E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.97	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	1.77E-01	1.09E-01
		794.95		4.25		
		911.20	*	25.80	2.82E-01	3.71E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

Analysis Report for 27-Feb-19-10023

L1-12101A-FSGS-015SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.898	5.82E+00	3.62E-01	
X	Sb-125	0.992			
	Cs-137	0.987	1.55E-01	1.59E-02	
	Tl-208	0.997	6.47E-02	1.20E-02	
X	Bi-211	0.901			
	Pb-212	0.999	2.33E-01	2.34E-02	
?	Pb212-XR	0.999	2.36E-01	7.77E-02	
	Bi-214	0.995	1.83E-01	2.31E-02	
	Pb-214	1.000	2.21E-01	1.99E-02	
?	Pb214-XR	0.999	4.16E-01	1.38E-01	
	Ac-228	0.978	2.72E-01	3.52E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 27-Feb-19-10023

L1-12101A-FSGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 12:00:02PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
7	558.40	1.76926E-02	24.52		

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	8.08E-02	4.08E-02	4.08E-02
	BE-7	477.60		10.44	1.15E-01	2.69E-01	2.69E-01
+	K-40	1460.82	*	10.66	5.82E+00	2.28E-01	2.28E-01
	Co-60	1173.23		99.85	2.92E-02	4.39E-02	4.67E-02
		1332.49		99.98	3.58E-02		4.39E-02
	Nb-94	702.65		99.81	-1.00E-02	2.71E-02	2.71E-02
		871.09		99.89	1.92E-02		2.90E-02
	Ag-108m	79.13		6.60	1.21E-01	2.75E-02	7.85E-01
		433.94		90.50	-1.94E-02		2.75E-02
		614.28		89.80	8.00E-03		3.80E-02
		722.94		90.80	1.91E-02		3.43E-02
	Sb-125	176.31		6.84	-1.99E-01	9.04E-02	2.97E-01
		380.45		1.52	3.28E-02		1.47E+00
		427.87		29.60	-3.58E-02		9.04E-02
		463.36	*	10.49	7.44E-02		1.55E-01
		600.60		17.65	-9.64E-02		1.39E-01
		606.71		4.98	1.45E+00		8.75E-01
		635.95		11.22	1.86E-01		2.48E-01

Analysis Report for 27-Feb-19-10023

L1-12101A-FSGS-015SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-5.02E-01	9.04E-02	1.45E+00
	Ba-133	79.61		2.65	4.00E-01	4.22E-02	1.91E+00
		81.00		32.90	-6.89E-02		1.20E-01
		276.40		7.16	2.62E-02		3.37E-01
		302.85		18.34	1.27E-02		1.26E-01
		356.01		62.05	-9.68E-03		4.22E-02
		383.85		8.94	-1.20E-01		2.39E-01
	Cs-134	475.36		1.48	1.69E+00	3.35E-02	1.98E+00
		563.25		8.34	-1.94E-01		2.89E-01
		569.33		15.37	-3.73E-02		1.50E-01
		604.72		97.62	-1.78E-02		3.99E-02
		795.86		85.46	1.23E-03		3.35E-02
		801.95		8.69	-2.93E-02		3.25E-01
		1038.61		0.99	2.69E+00		3.30E+00
		1167.97		1.79	-1.07E+00		2.65E+00
		1365.19		3.02	-3.84E-01		9.21E-01
+	Cs-137	661.66	*	85.10	1.55E-01	2.46E-02	2.46E-02
	Eu-152	121.78		28.67	-2.35E-02	7.71E-02	7.71E-02
		244.70		7.61	-5.02E-02		3.32E-01
		295.94		0.45	9.59E+00		6.56E+00
		344.28		26.60	3.80E-02		8.82E-02
		367.79		0.86	1.04E+00		2.81E+00
		411.12		2.24	6.86E-02		1.09E+00
		443.96		2.83	-3.62E-01		8.31E-01
		488.68		0.42	4.95E-01		6.02E+00
		563.99		0.49	-2.38E+00		4.62E+00
		586.26		0.46	-1.92E+00		8.92E+00
		678.62		0.47	1.67E+00		5.69E+00
		688.67		0.86	-1.22E+00		2.94E+00
		719.35		0.28	2.60E+00		9.67E+00
		778.90		12.96	2.17E-01		2.22E-01
		810.45		0.32	-6.66E+00		8.05E+00
		867.37		4.26	-5.01E-02		6.27E-01
		919.33		0.43	2.91E+00		6.43E+00
		964.08		14.65	1.89E-01		3.02E-01
		1085.87		10.24	-1.25E-02		3.28E-01
		1089.74		1.73	-7.27E-01		2.06E+00
		1112.07		13.69	-5.69E-01		2.73E-01
		1212.95		1.43	-1.42E+00		2.89E+00
		1249.94		0.19	-8.16E+00		1.99E+01
		1299.14		1.63	6.55E-01		2.10E+00
		1408.01		21.07	-3.21E-02		1.06E-01
		1457.64		0.50	1.23E+02		2.67E+01
		1528.10		0.28	-5.17E+00		6.71E+00
	Eu-154	123.07		40.40	-2.25E-02	5.36E-02	5.36E-02
		247.93		6.89	-2.97E-01		3.04E-01
		591.76		4.95	-1.42E-01		5.27E-01
		692.42		1.78	-7.09E-01		1.34E+00
		723.30		20.06	4.57E-02		1.54E-01
		756.80		4.52	1.28E-01		5.77E-01
		873.18		12.08	-1.71E-01		2.43E-01

Analysis Report for 27-Feb-19-10023

L1-12101A-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	8.97E-02	5.36E-02	3.18E-01
	1004.76	18.01	1.07E-01		1.86E-01
	1274.43	34.80	-7.64E-04		9.92E-02
	1596.48	1.80	-6.85E-01		1.41E+00
Eu-155	45.30	1.31	1.21E+00	1.20E-01	7.61E+00
	60.01	1.22	4.85E+00		9.04E+00
	86.55	30.70	1.87E-02		1.20E-01
	105.31	21.10	3.87E-03		1.32E-01
Ra-226	186.21	3.64	8.05E-01	6.58E-01	6.58E-01
Pa-231	27.36	10.30	9.66E-01	8.75E-01	8.75E-01
	283.69	1.70	5.19E-01		1.37E+00
	300.07	2.47	-3.98E-01		9.10E-01
	302.65	2.20	-3.07E-01		1.05E+00
	330.06	1.40	1.21E+00		1.68E+00
U-235	143.76	10.96	3.24E-02	4.16E-02	2.07E-01
	163.33	5.08	4.04E-02		4.47E-01
	185.71	57.20	4.04E-02		4.16E-02
	202.11	1.08	-4.70E-02		2.00E+00
	205.31	5.01	-1.27E-01		4.48E-01
Am-241	59.54	35.90	2.69E-02	3.18E-01	3.18E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10024

L1-12101A-FSGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10024
Sample Description	: L1-12101A-FSGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.558E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:15:00AM
Acquisition Started	: 2/27/2019 11:30:18AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 2700.0 seconds
Real Time	: 2701.0 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64319
Fill Height	: 1558.25 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 12:20:26PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 2/27/19 1500

JGraham

Analysis Report for 27-Feb-19-10024

L1-12101A-FSGS-016SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.81	297 -	316	300.55	8.00E+01	14.31	1.75E+02	0.98
m	2	76.95	297 -	316	309.12	1.34E+02	15.99	2.20E+02	0.98
	3	185.96	738 -	752	744.57	1.35E+02	27.60	2.17E+02	0.97
	4	209.42	829 -	844	838.30	5.53E+01	25.27	1.92E+02	1.03
M	5	238.54	947 -	974	954.63	4.87E+02	58.54	1.73E+02	1.15
m	6	241.77	947 -	974	967.52	1.22E+02	19.28	1.74E+02	1.16
M	7	295.10	1175 -	1207	1180.64	1.63E+02	15.36	1.16E+02	1.11
m	8	300.12	1175 -	1207	1200.69	3.97E+01	9.78	1.14E+02	1.12
	9	338.27	1348 -	1359	1353.13	9.59E+01	17.62	8.51E+01	1.04
	10	351.78	1399 -	1415	1407.10	3.58E+02	26.52	1.11E+02	1.21
	11	510.63	2030 -	2046	2041.99	8.28E+01	19.82	9.82E+01	0.41
	12	583.07	2323 -	2340	2331.62	1.56E+02	18.72	6.00E+01	1.26
	13	609.03	2425 -	2446	2435.40	2.99E+02	22.70	5.76E+01	1.44
	14	661.39	2634 -	2653	2644.72	1.64E+02	19.34	5.99E+01	1.14
	15	727.08	2900 -	2915	2907.41	4.77E+01	12.80	3.83E+01	0.45
	16	910.84	3634 -	3651	3642.40	1.34E+02	13.83	1.77E+01	1.75
	17	949.86	3793 -	3804	3798.51	1.76E+01	8.06	1.84E+01	0.33
	18	968.59	3865 -	3883	3873.44	8.89E+01	13.79	3.01E+01	0.72
	19	1119.80	4472 -	4486	4478.47	4.14E+01	12.81	4.26E+01	0.34
	20	1460.30	5826 -	5855	5841.59	1.18E+03	35.55	1.87E+01	2.07
	21	1763.81	7050 -	7066	7057.31	5.28E+01	9.21	1.02E+01	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

Analysis Report for 27-Feb-19-10024

L1-12101A-FSGS-016SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.97	511.00	*	100.00	3.15E-02	7.84E-03
K-40	0.95	1460.82	*	10.66	8.16E+00	4.32E-01
Cs-137	0.98	661.66	*	85.10	8.45E-02	1.12E-02
Tl-208	0.99	583.19	*	85.00	7.41E-02	9.94E-03
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	3.34E-01	9.16E-02
		785.37		1.10		
		1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.53E-01	3.67E-02
		300.09	*	3.30	3.09E-01	8.01E-02
Pb212-XR	0.99	74.82	*	10.28	4.62E-01	9.53E-02
		77.11	*	17.10	4.19E-01	6.59E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.97	609.32	*	45.49	2.73E-01	2.64E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	1.72E-01	5.36E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49	*	15.30	2.94E-01	5.26E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	3.82E-01	6.80E-02
		295.22	*	18.42	2.25E-01	2.78E-02
		351.93	*	35.60	2.90E-01	3.16E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	7.50E-01	1.65E-01
Ac-228	0.98	129.07		2.42		
		209.25	*	3.89	3.03E-01	1.41E-01
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.38E-01	4.79E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.82E-01	3.15E-02
		964.77		4.99		
		968.97	*	15.80	3.17E-01	5.11E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.77E-02	1.05E-02

Analysis Report for 27-Feb-19-10024

L1-12101A-FSGS-016SS

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
U-235	0.99	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	0.978	3.15E-02	7.84E-03	
	K-40	0.958	8.16E+00	4.32E-01	
	Cs-137	0.988	8.45E-02	1.12E-02	
	Tl-208	0.998	7.41E-02	9.94E-03	
X	Bi-211	0.923			
	Bi-212	0.993	3.34E-01	9.16E-02	
	Pb-212	0.999	2.63E-01	3.34E-02	
	Pb212-XR	0.998	4.33E-01	5.42E-02	
	Bi-214	0.979	2.60E-01	2.16E-02	
	Pb-214	0.996	2.64E-01	2.00E-02	
X	Pb214-XR	0.998			
?	Ra-226	0.990	7.50E-01	1.65E-01	
	Ac-228	0.989	2.79E-01	2.31E-02	
X	Pa-231	1.000			
?	U-235	0.993	4.77E-02	1.05E-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 27-Feb-19-10024

L1-12101A-FSGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 12:20:26PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
17	949.86	6.52263E-03	45.77	S-Esc	

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	3.15E-02	2.38E-02	2.38E-02
	BE-7	477.60		10.44	1.60E-01	2.44E-01	2.44E-01
+	K-40	1460.82	*	10.66	8.16E+00	2.42E-01	2.42E-01
	Co-60	1173.23		99.85	1.51E-02	3.47E-02	4.00E-02
		1332.49		99.98	4.27E-02		3.47E-02
	Nb-94	702.65		99.81	-3.13E-02	2.50E-02	2.50E-02
		871.09		99.89	1.95E-02		2.78E-02
	Ag-108m	79.13		6.60	-8.17E-02	2.32E-02	8.64E-01
		433.94		90.50	-5.83E-03		2.32E-02
		614.28		89.80	7.40E-03		4.39E-02
		722.94		90.80	-8.01E-03		3.07E-02
	Sb-125	176.31		6.84	5.08E-02	7.09E-02	2.95E-01
		380.45		1.52	-1.88E-01		1.40E+00
		427.87		29.60	1.23E-02		7.09E-02
		463.36		10.49	1.45E-01		2.34E-01
		600.60		17.65	9.44E-02		1.38E-01
		606.71		4.98	2.12E+00		8.44E-01
		635.95		11.22	-1.08E-04		2.28E-01

Analysis Report for 27-Feb-19-10024

L1-12101A-FSGS-016SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-5.85E-01	7.09E-02	1.35E+00
	Ba-133	79.61		2.65	-3.00E-02	4.66E-02	2.09E+00
		81.00		32.90	-5.60E-02		1.44E-01
		276.40		7.16	-1.13E-01		3.07E-01
		302.85		18.34	1.35E-04		1.19E-01
		356.01		62.05	-1.90E-02		4.66E-02
		383.85		8.94	-1.77E-02		2.38E-01
	Cs-134	475.36		1.48	1.29E+00	3.46E-02	1.66E+00
		563.25		8.34	2.43E-01		3.05E-01
		569.33		15.37	-3.08E-02		1.55E-01
		604.72		97.62	7.35E-03		4.11E-02
		795.86		85.46	3.00E-02		3.46E-02
		801.95		8.69	-2.18E-01		3.21E-01
		1038.61		0.99	2.14E-01		2.82E+00
		1167.97		1.79	1.11E+00		2.17E+00
		1365.19		3.02	2.13E-02		8.68E-01
+	Cs-137	661.66	*	85.10	8.45E-02	2.68E-02	2.68E-02
	Eu-152	121.78		28.67	3.68E-02	7.78E-02	8.34E-02
		244.70		7.61	-7.24E-02		3.22E-01
		295.94		0.45	-1.25E+00		5.96E+00
		344.28		26.60	-6.25E-02		7.78E-02
		367.79		0.86	1.68E+00		2.40E+00
		411.12		2.24	7.77E-01		1.01E+00
		443.96		2.83	3.78E-01		8.14E-01
		488.68		0.42	-3.76E+00		5.13E+00
		563.99		0.49	5.68E+00		5.25E+00
		586.26		0.46	-2.28E-01		7.28E+00
		678.62		0.47	8.88E-01		4.94E+00
		688.67		0.86	-1.34E+00		2.79E+00
		719.35		0.28	-6.97E+00		8.16E+00
		778.90		12.96	-2.76E-01		1.90E-01
		810.45		0.32	-1.28E+01		8.15E+00
		867.37		4.26	-4.07E-01		6.56E-01
		919.33		0.43	-2.03E+00		6.56E+00
		964.08		14.65	1.56E-01		2.77E-01
		1085.87		10.24	-7.33E-02		3.05E-01
		1089.74		1.73	5.58E-01		1.94E+00
		1112.07		13.69	1.12E-01		2.47E-01
		1212.95		1.43	-2.26E+00		2.42E+00
		1249.94		0.19	1.53E+01		1.95E+01
		1299.14		1.63	-1.01E+00		1.94E+00
		1408.01		21.07	1.61E-02		1.27E-01
		1457.64		0.50	1.70E+02		2.49E+01
		1528.10		0.28	1.29E+00		6.60E+00
	Eu-154	123.07		40.40	-1.20E-02	5.88E-02	5.88E-02
		247.93		6.89	5.37E-02		3.08E-01
		591.76		4.95	-4.94E-02		4.51E-01
		692.42		1.78	3.65E-01		1.45E+00
		723.30		20.06	-7.19E-02		1.40E-01
		756.80		4.52	7.77E-02		5.59E-01
		873.18		12.08	-3.15E-02		2.24E-01

Analysis Report for 27-Feb-19-10024

L1-12101A-FSGS-016SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	8.53E-02	5.88E-02	2.59E-01
		1004.76		18.01	2.40E-02		1.50E-01
		1274.43		34.80	1.64E-02		9.72E-02
		1596.48		1.80	-1.82E+00		1.07E+00
	Eu-155	45.30		1.31	5.84E+00	1.38E-01	1.23E+01
		60.01		1.22	-1.32E+01		1.23E+01
		86.55		30.70	8.61E-03		1.39E-01
		105.31		21.10	2.36E-02		1.38E-01
+	Ra-226	186.21	*	3.64	7.50E-01	4.89E-01	4.89E-01
	Pa-231	27.36		10.30	2.77E+00	5.63E-01	1.44E+00
		283.69		1.70	-1.51E+00		1.17E+00
		300.07	*	2.47	4.13E-01		5.63E-01
		302.65		2.20	1.50E-01		9.93E-01
		330.06		1.40	2.07E-01		1.56E+00
+	U-235	143.76		10.96	-1.77E-01	3.11E-02	2.01E-01
		163.33		5.08	-4.92E-02		4.25E-01
		185.71	*	57.20	4.77E-02		3.11E-02
		202.11		1.08	1.14E+00		2.03E+00
		205.31		5.01	-1.33E-01		4.23E-01
	Am-241	59.54		35.90	-3.98E-01	4.37E-01	4.37E-01

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

Apex-Gamma

Analysis Report for 27-Feb-19-10025
L1-12101A-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 27-Feb-19-10025
Sample Description	: L1-12101A-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.771E+03 grams
Facility	: Default
Sample Taken On	: 2/25/2019 9:16:00AM
Acquisition Started	: 2/27/2019 11:49:23AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 2700.0 seconds
Real Time	: 2703 3 seconds
Dead Time	: 0.12 %
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	: 2/27/2019
Efficiency Calibration Description	:
Sample Number	: 64320
Fill Height	: 177131 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 2/27/2019 12:48:56PM
Peak Analysis From Channel : 120
Peak Analysis To Channel : 4096

DATA VALIDATED 2/27/19 1500
JGraham

Analysis Report for 27-Feb-19-10025

L1-12101A-FSGS-017SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	185.97	368 -	376	372.26	1.90E+02	28.28	2.86E+02	1.42
M	2	238.61	472 -	488	477.41	5.15E+02	63.75	2.24E+02	1.12
m	3	241.78	472 -	488	483.72	1.21E+02	19.97	2.37E+02	1.12
	4	270.00	535 -	544	540.10	8.23E+01	23.04	1.99E+02	1.29
	5	295.19	585 -	595	590.44	2.10E+02	26.65	2.10E+02	1.15
	6	338.20	671 -	681	676.38	1.16E+02	22.21	1.58E+02	1.28
	7	351.93	699 -	708	703.80	3.63E+02	25.61	1.30E+02	1.35
	8	477.60	949 -	960	954.93	7.45E+01	18.26	1.04E+02	1.31
	9	510.49	1015 -	1026	1020.66	1.87E+02	19.99	8.29E+01	1.84
	10	583.10	1160 -	1171	1165.81	2.14E+02	18.47	5.07E+01	1.38
	11	609.18	1212 -	1223	1217.94	3.54E+02	22.62	6.31E+01	1.67
	12	661.53	1319 -	1328	1322.59	5.45E+01	14.23	6.45E+01	1.60
	13	860.26	1715 -	1725	1719.96	2.55E+01	11.10	3.95E+01	0.75
	14	911.01	1815 -	1827	1821.48	1.51E+02	16.18	4.22E+01	1.85
M	15	964.30	1923 -	1941	1928.06	2.55E+01	6.58	3.25E+01	1.30
m	16	968.83	1923 -	1941	1937.13	7.83E+01	10.73	5.33E+01	1.30
	17	1120.24	2235 -	2243	2240.02	8.12E+01	11.49	2.38E+01	1.02
	18	1460.60	2914 -	2927	2921.25	1.22E+03	36.03	2.80E+01	2.06
	19	1764.18	3522 -	3536	3529.21	6.80E+01	8.60	1.96E+00	2.19

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1000 sigma

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

Analysis Report for 27-Feb-19-10025

L1-12101A-FSGS-017SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.95	511.00	*	100.00	6.27E-02	7.94E-03
BE-7	1.00	477.60	*	10.44	2.29E-01	5.84E-02
K-40	0.99	1460.82	*	10.66	7.38E+00	3.87E-01
Cs-137	0.99	661.66	*	85.10	2.47E-02	6.61E-03
Tl-208	0.99	583.19	*	85.00	8.95E-02	9.40E-03
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.35E-01	3.48E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.84E-01	2.49E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	2.94E-01	4.32E-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	3.29E-01	4.36E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	3.36E-01	6.15E-02
		295.22	*	18.42	2.56E-01	3.84E-02
		351.93	*	35.60	2.59E-01	2.76E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	9.23E-01	1.56E-01
Ac-228	0.80	129.07		2.42		
		209.25		3.89		
		270.24	*	3.46	5.07E-01	1.48E-01
		328.00		2.95		
		338.32	*	11.27	2.53E-01	5.28E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.77E-01	3.20E-02
		964.77	*	4.99	2.51E-01	6.57E-02
		968.97	*	15.80	2.44E-01	3.52E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	5.87E-02	9.95E-03
		202.11		1.08		
		205.31		5.01		

Analysis Report for 27-Feb-19-10025

L1-12101A-FSGS-017SS

* = 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 1.000 sigma

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.959	6.27E-02	7.94E-03	
	BE-7	1.000	2.29E-01	5.84E-02	
	K-40	0.992	7.38E+00	3.87E-01	
	Cs-137	0.997	2.47E-02	6.61E-03	
	Tl-208	0.999	8.95E-02	9.40E-03	
X	Bi-211	0.889			
	Pb-212	1.000	2.35E-01	3.48E-02	
	Bi-214	0.996	2.95E-01	1.93E-02	
	Pb-214	0.999	2.67E-01	2.10E-02	
?	Ra-226	0.991	9.23E-01	1.56E-01	
	Ac-228	0.801	2.64E-01	2.03E-02	
?	U-235	0.992	5.87E-02	9.95E-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 1.000 sigma

Analysis Report for 27-Feb-19 10025
L1-12101A-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 2/27/2019 12:48:56PM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
13	860.26	9.43447E-03	43.56		

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet
Errors quoted at 1000 sigma

NUCLIDE MDA REPORT

Nuclide Library Used : C:\Canberra\Apex\Root\Default\Library\ION 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	6.27E-02	1.75E-02	1.75E-02
+	BE-7	477.60	*	10.44	2.29E-01	1.77E-01	1.77E-01
+	K-40	1460.82	*	10.66	7.38E+00	1.97E-01	1.97E-01
	Co-60	1173.23		99.85	9.88E-03	2.71E-02	3.20E-02
		1332.49		99.98	2.18E-02		2.71E-02
	Nb-94	702.65		99.81	4.42E-03	2.08E-02	2.08E-02
		871.09		99.89	-9.09E-03		2.17E-02
	Ag-108m	79.13		6.60	4.81E-01	2.06E-02	6.72E-01
		433.94		90.50	6.15E-03		2.06E-02
		614.28		89.80	-3.20E-02		3.08E-02
		722.94		90.80	-1.32E-02		2.49E-02
	Sb-125	176.31		6.84	-4.33E-02	5.87E-02	2.82E-01
		380.45		1.52	-2.62E-01		1.11E+00
		427.87		29.60	-1.51E-02		5.87E-02
		463.36		10.49	1.60E-01		1.90E-01
		600.60		17.65	3.11E-02		1.15E-01
		606.71		4.98	-6.86E-02		7.70E-01
		635.95		11.22	8.48E-02		1.80E-01

Analysis Report for 27-Feb-19-10025

L1-12101A-FSGS-017SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	2.89E-01	5.87E-02	1.20E+00
	Ba-133	79.61		2.65	6.29E-01	4.11E-02	1.57E+00
		81.00		32.90	-2.01E-01		1.06E-01
		276.40		7.16	1.67E-03		2.44E-01
		302.85		18.34	6.64E-02		1.03E-01
		356.01		62.05	-4.65E-02		4.11E-02
		383.85		8.94	3.67E-02		2.00E-01
	Cs-134	475.36		1.48	-6.32E-02	2.67E-02	1.44E+00
		563.25		8.34	-4.17E-02		2.40E-01
		569.33		15.37	-2.69E-03		1.30E-01
		604.72		97.62	-1.52E-03		3.39E-02
		795.86		85.46	-1.15E-03		2.67E-02
		801.95		8.69	-7.87E-02		2.22E-01
		1038.61		0.99	4.01E-01		2.56E+00
		1167.97		1.79	-9.97E-01		1.73E+00
		1365.19		3.02	3.14E-01		7.06E-01
+	Cs-137	661.66	*	85.10	2.47E-02	2.00E-02	2.00E-02
	Eu-152	121.78		28.67	-1.70E-03	6.60E-02	6.60E-02
		244.70		7.61	-4.68E-02		2.75E-01
		295.94		0.45	-9.32E-01		5.28E+00
		344.28		26.60	1.25E-02		6.75E-02
		367.79		0.86	-6.79E-01		2.03E+00
		411.12		2.24	-2.38E-01		7.92E-01
		443.96		2.83	-1.72E-02		6.37E-01
		488.68		0.42	6.03E-01		4.56E+00
		563.99		0.49	-1.68E+00		4.03E+00
		586.26		0.46	-4.52E+00		6.48E+00
		678.62		0.47	-3.94E-01		4.26E+00
		688.67		0.86	6.81E-01		2.32E+00
		719.35		0.28	-2.06E+00		7.34E+00
		778.90		12.96	-2.82E-02		1.63E-01
		810.45		0.32	9.79E-01		5.97E+00
		867.37		4.26	8.50E-02		4.96E-01
		919.33		0.43	-4.56E+00		4.86E+00
		964.08		14.65	-6.15E-03		2.03E-01
		1085.87		10.24	3.15E-01		2.88E-01
		1089.74		1.73	-9.38E-01		1.65E+00
		1112.07		13.69	-1.18E-01		1.87E-01
		1212.95		1.43	-2.30E-01		2.23E+00
		1249.94		0.19	-6.10E-01		1.69E+01
		1299.14		1.63	1.57E-01		1.69E+00
		1408.01		21.07	-8.89E-03		9.66E-02
		1457.64		0.50	-1.86E+00		2.23E+01
		1528.10		0.28	2.81E+00		6.23E+00
	Eu-154	123.07		40.40	-4.13E-03	4.65E-02	4.65E-02
		247.93		6.89	-2.29E-02		2.59E-01
		591.76		4.95	-1.70E-02		3.90E-01
		692.42		1.78	4.79E-02		1.13E+00
		723.30		20.06	3.10E-02		1.19E-01
		756.80		4.52	6.39E-03		4.53E-01
		873.18		12.08	-5.61E-02		1.81E-01

Analysis Report for 27-Feb-19-10025

L1-12101A-FSGS-017SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-1.01E-01	4.65E-02	2.15E-01
		1004.76		18.01	2.56E-02		1.38E-01
		1274.43		34.80	-2.96E-02		8.47E-02
		1596.48		1.80	7.46E-02		1.10E+00
	Eu-155	45.30		1.31	-1.26E+00	1.03E-01	6.41E+00
		60.01		1.22	-4.54E+00		7.04E+00
		86.55		30.70	1.85E-02		1.03E-01
		105.31		21.10	1.56E-02		1.05E-01
+	Ra-226	186.21	*	3.64	9.23E-01	4.21E-01	4.21E-01
	Pa-231	27.36		10.30	7.87E-01	6.77E-01	6.77E-01
		283.69		1.70	-1.56E-01		1.04E+00
		300.07		2.47	-1.07E-01		7.59E-01
		302.65		2.20	5.53E-01		8.56E-01
		330.06		1.40	-3.55E-01		1.31E+00
+	U-235	143.76		10.96	-7.66E-03	2.68E-02	1.63E-01
		163.33		5.08	4.12E-02		3.98E-01
		185.71	*	57.20	5.87E-02		2.68E-02
		202.11		1.08	4.81E-01		1.78E+00
		205.31		5.01	-2.39E-01		3.78E-01
	Am-241	59.54		35.90	-2.97E-02	2.53E-01	2.53E-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 15-Mar-19-10001

L1-12101A-FSGS-002SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 15-Mar-19-10001
Sample Description	: L1-12101A-FSGS-002SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.259E+03 grams
Facility	: Default
Sample Taken On	: 3/6/2019 9:20:00AM
Acquisition Started	: 3/15/2019 5:40:59AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1803.0 seconds
Dead Time	: 0.17 %
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	: 3/15/2019
Efficiency Calibration Description	:
Sample Number	: 64817
Fill Height	: 1259.03 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 3/15/2019 6:11:06AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 3/19/19 0600

J Brehm / [signature]

Analysis Report for 15-Mar-19-10001

L1-12101A-FSGS-002SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.18	305 -	313	309.45	4.11E+01	17.64	1.27E+02	0.49
2	238.57	948 -	962	954.36	2.27E+02	26.46	1.58E+02	1.08
3	295.30	1174 -	1187	1181.09	9.37E+01	17.44	7.63E+01	0.99
4	338.40	1349 -	1359	1353.36	4.32E+01	14.52	6.78E+01	0.52
5	351.91	1399 -	1416	1407.36	1.65E+02	21.87	9.54E+01	1.32
6	583.04	2325 -	2338	2331.38	7.44E+01	12.73	3.16E+01	0.56
7	609.16	2429 -	2443	2435.80	1.29E+02	14.21	2.48E+01	0.94
8	661.59	2637 -	2652	2645.45	1.46E+02	15.94	3.60E+01	1.01
9	910.93	3636 -	3651	3642.69	6.10E+01	11.57	2.40E+01	0.55
10	968.87	3868 -	3880	3874.45	3.04E+01	9.08	1.96E+01	0.41
11	1460.54	5829 -	5853	5842.00	5.83E+02	25.22	1.26E+01	1.66

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	7.78E+00	4.77E-01
Cs-137	0.99	661.66	*	85.10	1.41E-01	1.75E-02
Tl-208	0.99	583.19	*	85.00	6.58E-02	1.19E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.12E-01	3.01E-02
		300.09		3.30		

Analysis Report for 15-Mar-19-10001

L1-12101A-FSGS-002SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	2.57E-01	1.14E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.20E-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		
		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	2.35E-01	4.75E-02
		351.93	*	35.60	2.43E-01	3.77E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	4.54E-01	2.01E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.95E-01	6.76E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.42E-01	4.70E-02
		964.77		4.99		
		968.97	*	15.80	2.05E-01	6.20E-02
		1588.20		3.22		

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

Analysis Report for 15-Mar-19-10001

L1-12101A-FSGS-002SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.988	7.78E+00	4.77E-01	
	Cs-137	0.999	1.41E-01	1.75E-02	
	Tl-208	0.997	6.58E-02	1.19E-02	
X	Bi-211	0.894			
	Pb-212	0.999	2.12E-01	3.01E-02	
?	Pb212-XR	1.000	2.57E-01	1.14E-01	
	Bi-214	0.998	2.20E-01	2.76E-02	
	Pb-214	1.000	2.40E-01	2.95E-02	
?	Pb214-XR	1.000	4.54E-01	2.01E-01	
	Ac-228	0.996	2.21E-01	3.28E-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 15-Mar-19-10001

L1-12101A-FSGS-002SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 3/15/2019 6:11:06AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.20E-02	5.12E-02	5.12E-02
	BE-7	477.60		10.44	2.65E-01	3.57E-01	3.57E-01
+	K-40	1460.82	*	10.66	7.78E+00	3.66E-01	3.66E-01
	Co-60	1173.23		99.85	-2.54E-02	4.31E-02	5.00E-02
		1332.49		99.98	2.57E-02		4.31E-02
	Nb-94	702.65		99.81	-1.07E-02	3.43E-02	3.43E-02
		871.09		99.89	1.55E-02		3.44E-02
	Ag-108m	79.13		6.60	-5.57E-01	3.52E-02	1.34E+00
		433.94		90.50	6.74E-04		3.52E-02
		614.28		89.80	1.28E-03		4.83E-02
		722.94		90.80	1.14E-02		4.24E-02
	Sb-125	176.31		6.84	7.52E-02	1.10E-01	4.51E-01
		380.45		1.52	-7.40E-01		1.87E+00
		427.87		29.60	-2.34E-02		1.10E-01
		463.36		10.49	7.27E-02		3.16E-01
		600.60		17.65	-1.05E-01		1.98E-01
		606.71		4.98	1.83E+00		1.09E+00
		635.95		11.22	-6.45E-02		2.84E-01
		671.44		1.79	-7.57E-01		1.98E+00

Analysis Report for 15-Mar-19-10001

L1-12101A-FSGS-002SB

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	-1.28E+00	6.23E-02	3.25E+00
		81.00		32.90	-1.24E-01		2.21E-01
		276.40		7.16	1.16E-01		4.16E-01
		302.85		18.34	9.86E-03		1.74E-01
		356.01		62.05	2.54E-03		6.23E-02
		383.85		8.94	-6.69E-02		3.32E-01
	Cs-134	475.36		1.48	2.26E-01	4.46E-02	2.18E+00
		563.25		8.34	9.97E-02		3.96E-01
		569.33		15.37	-1.61E-01		2.21E-01
		604.72		97.62	-1.84E-02		5.31E-02
		795.86		85.46	1.02E-02		4.46E-02
		801.95		8.69	-4.12E-01		3.77E-01
		1038.61		0.99	2.50E+00		4.38E+00
		1167.97		1.79	9.68E-01		2.91E+00
		1365.19		3.02	-1.67E-03		1.25E+00
+	Cs-137	661.66	*	85.10	1.41E-01	3.68E-02	3.68E-02
	Eu-152	121.78		28.67	-9.62E-03	1.17E-01	1.19E-01
		244.70		7.61	2.05E-01		4.36E-01
		295.94		0.45	3.64E+00		8.10E+00
		344.28		26.60	-2.56E-02		1.17E-01
		367.79		0.86	9.36E-01		3.43E+00
		411.12		2.24	8.39E-01		1.50E+00
		443.96		2.83	8.04E-01		1.21E+00
		488.68		0.42	2.16E+00		7.03E+00
		563.99		0.49	-1.02E+00		6.77E+00
		586.26		0.46	-3.61E+00		1.02E+01
		678.62		0.47	-4.43E+00		6.69E+00
		688.67		0.86	-7.55E-01		3.65E+00
		719.35		0.28	-1.56E+01		1.13E+01
		778.90		12.96	-1.77E-03		2.63E-01
		810.45		0.32	-3.67E+00		1.12E+01
		867.37		4.26	1.47E-01		8.53E-01
		919.33		0.43	5.71E+00		9.34E+00
		964.08		14.65	-6.85E-02		3.70E-01
		1085.87		10.24	1.56E-01		4.11E-01
		1089.74		1.73	-2.63E+00		2.48E+00
		1112.07		13.69	2.79E-02		3.18E-01
		1212.95		1.43	-2.10E-01		4.09E+00
		1249.94		0.19	4.68E+00		2.58E+01
		1299.14		1.63	-9.82E-01		2.44E+00
		1408.01		21.07	-1.88E-01		1.70E-01
		1457.64		0.50	1.60E+02		3.41E+01
		1528.10		0.28	-5.23E-01		9.83E+00
	Eu-154	123.07		40.40	-1.48E-02	8.48E-02	8.48E-02
		247.93		6.89	1.46E-01		4.27E-01
		591.76		4.95	-4.93E-01		6.65E-01
		692.42		1.78	1.27E+00		1.88E+00
		723.30		20.06	1.37E-01		1.95E-01
		756.80		4.52	-4.19E-01		8.28E-01
		873.18		12.08	-2.71E-01		2.73E-01
		996.29		10.48	-1.64E-01		3.61E-01

Analysis Report for 15-Mar-19-10001

L1-12101A-FSGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	3.44E-02	8.48E-02	2.07E-01
	1274.43	34.80	-1.45E-01		1.36E-01
	1596.48	1.80	-2.34E-01		1.60E+00
Eu-155	45.30	1.31	1.40E+01	1.96E-01	2.38E+01
	60.01	1.22	-1.25E+01		2.21E+01
	86.55	30.70	7.89E-02		1.96E-01
	105.31	21.10	-1.28E-01		1.98E-01
Ra-226	186.21	3.64	5.81E-01	8.74E-01	8.74E-01
Pa-231	27.36	10.30	3.17E+00	1.22E+00	2.62E+00
	283.69	1.70	-3.53E-01		1.67E+00
	300.07	2.47	6.66E-01		1.22E+00
	302.65	2.20	-1.06E-01		1.44E+00
	330.06	1.40	1.38E-01		2.18E+00
U-235	143.76	10.96	1.34E-02	5.48E-02	3.09E-01
	163.33	5.08	-2.82E-02		5.74E-01
	185.71	57.20	7.48E-03		5.48E-02
	202.11	1.08	-1.74E+00		2.64E+00
	205.31	5.01	-3.62E-01		5.99E-01
Am-241	59.54	35.90	1.65E-01	8.11E-01	8.11E-01

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

Apex-Gamma

Analysis Report for 15-Mar-19-10002

L1-12101A-FSGS-008SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 15-Mar-19-10002
Sample Description	: L1-12101A-FSGS-008SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.622E+03 grams
Facility	: Default
Sample Taken On	: 3/6/2019 10:15:00AM
Acquisition Started	: 3/15/2019 5:41:06AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 1800.0 seconds
Real Time	: 1800.6 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 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	: 3/15/2019
Efficiency Calibration Description	:
Sample Number	: 64818
Fill Height	: 1622.10 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 3/15/2019 6:11:11AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 3/19/19 0600

J Brehm

Analysis Report for 15-Mar-19-10002

L1-12101A-FSGS-008SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	75.03	296 -	315	300.65	8.31E+01	13.14	1.58E+02	0.91
m	2	77.24	296 -	315	309.50	1.47E+02	14.91	1.61E+02	0.91
M	3	238.70	948 -	973	954.39	3.31E+02	19.15	9.85E+01	1.07
m	4	241.84	948 -	973	966.91	8.21E+01	11.45	1.17E+02	1.07
	5	295.28	1171 -	1189	1180.40	1.76E+02	20.06	6.67E+01	1.01
	6	338.19	1344 -	1359	1351.84	6.85E+01	15.89	6.05E+01	1.04
	7	351.90	1397 -	1414	1406.62	2.77E+02	21.10	5.17E+01	1.37
	8	510.76	2031 -	2046	2041.41	7.54E+01	14.82	4.76E+01	0.61
	9	583.11	2322 -	2337	2330.57	1.37E+02	15.06	2.99E+01	1.04
	10	609.09	2426 -	2442	2434.42	1.75E+02	17.18	3.84E+01	1.31
	11	794.14	3170 -	3179	3174.15	2.54E+01	6.69	8.57E+00	0.76
	12	910.52	3631 -	3647	3639.55	8.77E+01	11.97	1.73E+01	0.68
	13	968.20	3862 -	3880	3870.22	7.41E+01	11.28	1.59E+01	0.86
	14	1460.05	5824 -	5850	5838.14	9.25E+02	30.90	6.75E+00	1.76

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	4.88E-02	1.02E-02
K-40	0.90	1460.82	*	10.66	1.02E+01	5.59E-01
Tl-208	0.99	583.19	*	85.00	1.02E-01	1.27E-02

Analysis Report for 15-Mar-19-10002

L1-12101A-FSGS-008SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.60E-01	2.59E-02
		300.09		3.30		
Pb212-XR	0.99	74.82	*	10.28	5.26E-01	9.93E-02
		77.11	*	17.10	5.14E-01	7.42E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.50E-01	2.88E-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	3.91E-01	6.28E-02
		295.22	*	18.42	3.73E-01	5.18E-02
		351.93	*	35.60	3.45E-01	3.81E-02
		785.96		1.06		
Ac-228	0.95	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.61E-01	6.43E-02
		409.46		1.92		
		463.00		4.40		
		794.95	*	4.25	4.66E-01	1.25E-01
		911.20	*	25.80	2.90E-01	4.16E-02
		964.77		4.99		
		968.97	*	15.80	4.17E-01	6.62E-02
		1588.20		3.22		

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

Analysis Report for 15-Mar-19-10002

L1-12101A-FSGS-008SB

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.991	4.88E-02	1.02E-02	
	K-40	0.909	1.02E+01	5.59E-01	
	Tl-208	0.999	1.02E-01	1.27E-02	
X	Bi-211	0.895			
	Pb-212	0.999	2.60E-01	2.59E-02	
	Pb212-XR	0.996	5.18E-01	5.94E-02	
	Bi-214	0.997	2.50E-01	2.88E-02	
	Pb-214	0.999	3.62E-01	2.76E-02	
X	Pb214-XR	0.996			
	Ac-228	0.955	3.20E-01	3.00E-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 15-Mar-19-10002

L1-12101A-FSGS-008SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 3/15/2019 6:11:11AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	4.88E-02	2.82E-02	2.82E-02
	BE-7	477.60		10.44	1.17E-01	2.92E-01	2.92E-01
+	K-40	1460.82	*	10.66	1.02E+01	2.35E-01	2.35E-01
	Co-60	1173.23		99.85	-2.19E-02	3.78E-02	4.80E-02
		1332.49		99.98	-3.18E-03		3.78E-02
	Nb-94	702.65		99.81	-2.19E-02	3.17E-02	3.17E-02
		871.09		99.89	7.87E-03		3.29E-02
	Ag-108m	79.13		6.60	-1.60E-01	2.85E-02	8.68E-01
		433.94		90.50	-1.96E-02		2.85E-02
		614.28		89.80	-1.32E-02		4.25E-02
		722.94		90.80	3.33E-02		4.23E-02
	Sb-125	176.31		6.84	7.04E-02	9.37E-02	3.47E-01
		380.45		1.52	-9.45E-01		1.60E+00
		427.87		29.60	7.23E-02		9.37E-02
		463.36		10.49	-7.93E-02		2.60E-01
		600.60		17.65	-5.04E-02		1.80E-01
		606.71		4.98	2.21E+00		1.06E+00
		635.95		11.22	-1.77E-02		2.58E-01
		671.44		1.79	-1.99E+00		1.69E+00

Analysis Report for 15-Mar-19-10002

L1-12101A-FSGS-008SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-7.18E-01	5.00E-02	2.12E+00
	81.00	32.90	-1.44E-01		1.35E-01
	276.40	7.16	-2.60E-02		3.41E-01
	302.85	18.34	5.92E-02		1.38E-01
	356.01	62.05	4.56E-03		5.00E-02
	383.85	8.94	3.82E-02		2.71E-01
Cs-134	475.36	1.48	-1.41E+00	4.14E-02	1.81E+00
	563.25	8.34	-4.50E-01		3.37E-01
	569.33	15.37	-3.39E-02		1.81E-01
	604.72	97.62	8.19E-03		4.90E-02
	795.86	85.46	1.40E-02		4.14E-02
	801.95	8.69	4.01E-01		4.06E-01
	1038.61	0.99	1.65E+00		3.68E+00
	1167.97	1.79	-2.81E+00		2.59E+00
	1365.19	3.02	-3.86E-01		1.04E+00
Cs-137	661.66	85.10	4.21E-02	3.93E-02	3.93E-02
Eu-152	121.78	28.67	3.21E-02	8.97E-02	8.97E-02
	244.70	7.61	-2.62E-01		3.82E-01
	295.94	0.45	9.38E+00		7.35E+00
	344.28	26.60	2.48E-02		9.34E-02
	367.79	0.86	2.47E-01		2.73E+00
	411.12	2.24	-4.89E-01		1.16E+00
	443.96	2.83	1.36E-01		9.50E-01
	488.68	0.42	2.42E+00		6.46E+00
	563.99	0.49	-2.26E-01		5.59E+00
	586.26	0.46	-4.69E+00		9.73E+00
	678.62	0.47	2.21E+00		6.60E+00
	688.67	0.86	4.23E-01		3.27E+00
	719.35	0.28	-4.47E+00		1.19E+01
	778.90	12.96	2.93E-02		2.41E-01
	810.45	0.32	-1.97E+00		1.01E+01
	867.37	4.26	3.05E-01		8.17E-01
	919.33	0.43	-1.40E+00		8.76E+00
	964.08	14.65	1.69E-01		3.68E-01
	1085.87	10.24	1.96E-01		4.14E-01
	1089.74	1.73	-5.17E-01		2.35E+00
	1112.07	13.69	-1.70E-01		3.09E-01
	1212.95	1.43	1.59E+00		3.78E+00
	1249.94	0.19	-5.85E+00		2.61E+01
	1299.14	1.63	-1.13E+00		2.21E+00
	1408.01	21.07	8.19E-03		1.70E-01
	1457.64	0.50	2.16E+02		3.50E+01
	1528.10	0.28	-5.41E-01		8.43E+00
Eu-154	123.07	40.40	2.05E-02	6.30E-02	6.30E-02
	247.93	6.89	5.70E-02		3.56E-01
	591.76	4.95	1.96E-01		6.31E-01
	692.42	1.78	5.80E-01		1.74E+00
	723.30	20.06	1.54E-01		1.93E-01
	756.80	4.52	-7.14E-03		7.14E-01
	873.18	12.08	-4.95E-02		2.88E-01
	996.29	10.48	1.91E-01		3.50E-01

Analysis Report for 15-Mar-19-10002

L1-12101A-FSGS-008SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	8.50E-02	6.30E-02	2.23E-01
	1274.43	34.80	-2.97E-02		1.27E-01
	1596.48	1.80	5.28E-01		1.46E+00
Eu-155	45.30	1.31	-4.57E+00	1.40E-01	8.46E+00
	60.01	1.22	-7.40E+00		9.49E+00
	86.55	30.70	5.61E-02		1.40E-01
	105.31	21.10	-1.81E-02		1.46E-01
Ra-226	186.21	3.64	2.35E-01	7.23E-01	7.23E-01
Pa-231	27.36	10.30	1.07E+00	9.91E-01	9.91E-01
	283.69	1.70	-7.37E-01		1.31E+00
	300.07	2.47	-6.08E-02		1.03E+00
	302.65	2.20	1.01E+00		1.16E+00
	330.06	1.40	-6.50E-01		1.79E+00
U-235	143.76	10.96	7.67E-02	4.69E-02	2.37E-01
	163.33	5.08	-1.16E-02		4.59E-01
	185.71	57.20	4.74E-02		4.69E-02
	202.11	1.08	-9.11E-01		1.95E+00
	205.31	5.01	-2.73E-01		4.31E-01
Am-241	59.54	35.90	-5.20E-03	3.40E-01	3.40E-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

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-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:

Gerald Wood
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	**20-03012**
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
20-03012-01	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

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 002 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
An EnergySolutions Company

REC'D MAR 04 2020

20-03012

ZS-WM-131
Revision 0
Information Use

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:	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			Randolph Spencer	03/04/2020	0935

Comments

* per email 3/12/20 - ID should be L112106KFIGS017SBC
3/12/20

EBERLINE ANALYTICAL

EBERLINE ANALYTICAL CORPORATION
601 SCARBORO ROAD
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EBS-OR-45454

May 17, 2019

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

CASE NARRATIVE
Work Order # 19-04010-OR

SAMPLE RECEIPT

This work order contains nine soil samples received 04/02/2019. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-12102A-FSGS-006-SS-A	19-04010-04	L1-12101A-FSGS-011-SS-A	19-04010-09
L1-12101A-FSGS-014-SS-A	19-04010-05	L1-12103A-FSGS-009-SS-A	19-04010-10
L1-12101A-FSGS-012-SS-A	19-04010-06	L1-12103A-FSGS-015-SS-A	19-04010-11
L1-12101A-FSGS-002-SB-A	19-04010-07	L1-12203A FQGS-012-SS-A	19-04010-12
L1-12102A-FSGS-017-SS-A	19-04010-08		

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 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. 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 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

A representative aliquot of each sample was placed into an appropriately sized beaker. Stable elemental Nickel carrier was added to each sample prior to digestion. Samples were digested in concentrated Nitric acid. After digestion, sample pH 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. 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 Cobalt-60 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: 5/17/2019

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-04010
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
19-04010-01	LCS	KNOWN	04/02/19 00:00	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	2.13E+02	7.65E+00				pCi/g
19-04010-01	LCS	SPIKE	04/02/19 00:00	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	2.21E+02	8.54E+00	1.51E+01	7.47E+00		pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	5.84E+00	4.75E+00	4.76E+00	7.90E+00	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	1.30E+01	4.71E+00	4.76E+00	7.50E+00		pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	7.59E+00	4.53E+00	4.55E+00	7.45E+00		pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	5.27E+00	4.60E+00	4.61E+00	7.67E+00	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	4.68E+00	4.40E+00	4.41E+00	7.35E+00	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	7.08E+00	4.44E+00	4.46E+00	7.31E+00	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	7.24E+00	4.54E+00	4.56E+00	7.48E+00	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	4.21E+00	4.48E+00	4.48E+00	7.51E+00	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	3.88E+00	4.54E+00	4.54E+00	7.62E+00	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	4.58E+00	4.48E+00	4.48E+00	7.49E+00	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/23/2019	19-04010	Tritium	LANL ER-210 Modified	4.78E+00	4.49E+00	4.50E+00	7.50E+00	U	pCi/g
19-04010-01	LCS	KNOWN	04/02/19 00:00	4/2/2019	5/1/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	1.47E+03	4.41E+01				pCi/g
19-04010-01	LCS	SPIKE	04/02/19 00:00	4/2/2019	5/1/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	1.18E+03	1.19E+01	7.05E+01	3.43E+00		pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	5/1/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	-9.00E-02	1.97E+00	1.97E+00	3.39E+00	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	5/1/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	-1.23E+00	2.04E+00	2.04E+00	3.58E+00	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	5/2/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	-3.64E-01	1.98E+00	1.98E+00	3.44E+00	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	5/2/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	-6.60E-01	2.04E+00	2.04E+00	3.55E+00	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	5/2/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	-6.60E-01	2.05E+00	2.05E+00	3.56E+00	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	5/2/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	1.75E+00	2.06E+00	2.07E+00	3.47E+00	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	5/2/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	-1.69E+00	2.12E+00	2.13E+00	3.75E+00	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	5/2/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	-1.49E+00	1.87E+00	1.88E+00	3.31E+00	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	5/2/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	-4.81E-01	2.09E+00	2.09E+00	3.63E+00	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	5/2/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	-9.71E-02	2.12E+00	2.12E+00	3.66E+00	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	5/2/2019	19-04010	Nickel-63	ASTM 3500-Ni Modified	-1.32E+00	2.03E+00	2.03E+00	3.56E+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

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Patricia Giza	SDG:	19-04010
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-04010-01	LCS	KNOWN	04/02/19 00:00	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	5.10E+01	2.85E-01				pCi/g
19-04010-01	LCS	SPIKE	04/02/19 00:00	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	4.37E+01	2.44E+00	1.54E+01	9.87E-01		pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	3.68E-01	3.53E-01	3.76E-01	7.14E-01	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	2.27E-01	3.68E-01	3.76E-01	7.61E-01	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	2.73E-01	3.45E-01	3.58E-01	7.08E-01	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	1.59E-02	2.97E-01	2.97E-01	6.33E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	-1.05E-01	2.97E-01	2.99E-01	6.45E-01	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	-8.17E-02	3.10E-01	3.11E-01	6.73E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	3.58E-01	3.04E-01	3.28E-01	6.09E-01	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	3.09E-01	2.63E-01	2.84E-01	5.27E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	3.36E-01	2.74E-01	2.98E-01	5.44E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	5.39E-01	3.40E-01	3.88E-01	6.69E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/29/2019	19-04010	Strontium-90	ElChroM SRW01 Modified	1.31E-01	2.76E-01	2.80E-01	5.77E-01	U	pCi/g
19-04010-01	LCS	KNOWN	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
19-04010-01	LCS	KNOWN	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
19-04010-01	LCS	SPIKE	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Cobalt-60	EPA 901.1 Modified	1.45E+02	9.35E+00	1.20E+01	1.29E+00		pCi/g
19-04010-01	LCS	SPIKE	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Cesium-137	EPA 901.1 Modified	9.15E+01	1.00E+01	1.11E+01	1.91E+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

0019

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Patricia Giza	SDG:	19-04010
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Actinium-228	EPA 901.1 Modified	2.44E-02	8.00E-02	8.00E-02	1.38E-01	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Silver-108m	EPA 901.1 Modified	9.11E-03	2.10E-02	2.10E-02	2.40E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Americium-241	EPA 901.1 Modified	4.34E-02	3.89E-02	3.89E-02	6.05E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Barium-133	EPA 901.1 Modified	-7.17E-04	2.28E-02	2.28E-02	3.04E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Bismuth-214	EPA 901.1 Modified	3.87E-02	4.17E-02	4.18E-02	7.55E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Cobalt-60	EPA 901.1 Modified	1.03E-02	2.11E-02	2.11E-02	3.04E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Cesium-134	EPA 901.1 Modified	-2.06E-03	1.62E-02	1.62E-02	2.77E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Cesium-137	EPA 901.1 Modified	1.45E-03	8.65E-03	8.65E-03	3.69E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Europium-152	EPA 901.1 Modified	-1.40E-02	9.04E-02	9.04E-02	8.21E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Europium-154	EPA 901.1 Modified	1.76E-02	3.58E-02	3.58E-02	4.16E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Europium-155	EPA 901.1 Modified	-6.55E-03	3.78E-02	3.78E-02	4.91E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Holmium-166m	EPA 901.1 Modified	-6.37E-03	3.85E-02	3.85E-02	3.28E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Iodine-129	EPA 901.1 Modified	9.85E-02	1.13E+00	1.13E+00	9.82E-01	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Potassium-40	EPA 901.1 Modified	4.09E-02	1.97E-01	1.97E-01	3.29E-01	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Manganese-54	EPA 901.1 Modified	-4.51E-03	1.76E-02	1.76E-02	2.73E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Molybdenum-93	EPA 901.1 Modified	-5.09E-04	1.63E-02	1.63E-02	1.87E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Niobium-94	EPA 901.1 Modified	1.32E-02	1.74E-02	1.74E-02	3.42E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Lead-210	EPA 901.1 Modified	7.75E-01	5.18E-01	5.20E-01	9.56E-01	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Lead-212	EPA 901.1 Modified	1.64E-02	4.08E-02	4.08E-02	5.73E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Lead-214	EPA 901.1 Modified	5.66E-02	5.63E-02	5.63E-02	9.25E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Promethium-145	EPA 901.1 Modified	5.71E-02	1.79E-01	1.79E-01	2.88E-01	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Radium-226	EPA 901.1 Modified	3.87E-02	4.17E-02	4.18E-02	7.55E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Antimony-125	EPA 901.1 Modified	1.72E-02	4.25E-02	4.26E-02	7.76E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Thorium-234	EPA 901.1 Modified	6.84E-02	3.75E-01	3.75E-01	5.13E-01	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Thallium-208	EPA 901.1 Modified	2.00E-02	4.32E-02	4.33E-02	8.32E-02	U	pCi/g
19-04010-02	MBL	BLANK	04/02/19 00:00	4/2/2019	4/8/2019	19-04010	Uranium-235	EPA 901.1 Modified	1.66E-02	1.29E-01	1.29E-01	1.77E-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

0020

EBERLINE ANALYTICAL

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-04010
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
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Actinium-228	EPA 901.1 Modified	1.23E+00	3.99E-01	4.04E-01	7.16E-01		pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Silver-108m	EPA 901.1 Modified	1.51E-02	5.05E-02	5.05E-02	9.10E-02	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Americium-241	EPA 901.1 Modified	-3.44E-03	1.89E-01	1.89E-01	2.42E-01	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Barium-133	EPA 901.1 Modified	5.61E-03	6.43E-02	6.43E-02	1.27E-01	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Bismuth-214	EPA 901.1 Modified	1.65E+00	2.48E-01	2.62E-01	2.65E-01		pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Cobalt-60	EPA 901.1 Modified	6.34E-02	9.78E-02	9.78E-02	1.26E-01	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Cesium-134	EPA 901.1 Modified	3.74E-03	2.81E-02	2.81E-02	9.12E-02	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Cesium-137	EPA 901.1 Modified	-1.21E-01	8.62E-02	8.64E-02	1.07E-01	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Europium-152	EPA 901.1 Modified	-2.03E-01	2.70E-01	2.70E-01	2.86E-01	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Europium-154	EPA 901.1 Modified	5.75E-02	2.59E-01	2.59E-01	1.49E-01	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Europium-155	EPA 901.1 Modified	1.37E-01	9.59E-02	9.61E-02	2.60E-01	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Holmium-166m	EPA 901.1 Modified	7.74E-03	5.02E-02	5.02E-02	1.27E-01	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Iodine-129	EPA 901.1 Modified	3.30E+00	1.40E+01	1.40E+01	3.73E+00	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Potassium-40	EPA 901.1 Modified	3.60E+01	4.38E+00	4.75E+00	1.52E+00		pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Manganese-54	EPA 901.1 Modified	-9.04E-02	8.28E-02	8.29E-02	1.07E-01	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Molybdenum-93	EPA 901.1 Modified	-3.99E-03	5.11E-02	5.11E-02	7.84E-02	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Niobium-94	EPA 901.1 Modified	-1.73E-02	7.01E-02	7.01E-02	9.75E-02	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Lead-210	EPA 901.1 Modified	2.91E+00	2.81E+00	2.82E+00	4.62E+00	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Lead-212	EPA 901.1 Modified	1.35E+00	2.16E-01	2.27E-01	3.00E-01		pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Lead-214	EPA 901.1 Modified	1.77E+00	2.44E-01	2.60E-01	3.15E-01		pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Promethium-145	EPA 901.1 Modified	2.69E-01	6.70E-01	6.70E-01	1.02E+00	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Radium-226	EPA 901.1 Modified	1.65E+00	2.48E-01	2.62E-01	2.65E-01		pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Antimony-125	EPA 901.1 Modified	3.37E-02	1.56E-01	1.56E-01	2.65E-01	U	pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Thorium-234	EPA 901.1 Modified	4.31E+00	2.35E+00	2.36E+00	3.80E+00		pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Thallium-208	EPA 901.1 Modified	7.99E-01	1.60E-01	1.65E-01	1.36E-01		pCi/g
19-04010-03	DUP	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Uranium-235	EPA 901.1 Modified	-1.51E-01	5.08E-01	5.09E-01	6.43E-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:	Work Order Details:	
Patricia Giza	SDG:	19-04010
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Actinium-228	EPA 901.1 Modified	1.25E+00	3.27E-01	3.33E-01	5.82E-01		pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Silver-108m	EPA 901.1 Modified	1.78E-02	5.04E-02	5.04E-02	8.59E-02	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Americium-241	EPA 901.1 Modified	2.48E-02	1.94E-01	1.94E-01	2.50E-01	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Barium-133	EPA 901.1 Modified	-3.01E-01	1.44E-01	1.45E-01	1.28E-01	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Bismuth-214	EPA 901.1 Modified	1.60E+00	2.43E-01	2.57E-01	3.03E-01		pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Cobalt-60	EPA 901.1 Modified	1.76E-03	9.62E-02	9.62E-02	9.95E-02	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Cesium-134	EPA 901.1 Modified	2.81E-02	3.65E-02	3.65E-02	9.12E-02	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Cesium-137	EPA 901.1 Modified	-3.24E-02	8.58E-02	8.58E-02	1.19E-01	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Europium-152	EPA 901.1 Modified	4.03E-03	2.49E-01	2.49E-01	3.02E-01	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Europium-154	EPA 901.1 Modified	-9.08E-02	2.55E-01	2.55E-01	1.57E-01	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Europium-155	EPA 901.1 Modified	3.89E-01	2.04E-01	2.05E-01	2.58E-01	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Holmium-166m	EPA 901.1 Modified	4.43E-02	1.17E-01	1.17E-01	1.30E-01	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Iodine-129	EPA 901.1 Modified	4.36E+00	1.82E+01	1.82E+01	3.95E+00	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Potassium-40	EPA 901.1 Modified	3.26E+01	4.10E+00	4.43E+00	1.89E+00		pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Manganese-54	EPA 901.1 Modified	-5.32E-03	5.31E-02	5.31E-02	1.24E-01	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Molybdenum-93	EPA 901.1 Modified	-1.63E-02	6.45E-02	6.46E-02	9.49E-02	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Niobium-94	EPA 901.1 Modified	-4.66E-02	6.56E-02	6.56E-02	8.95E-02	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Lead-210	EPA 901.1 Modified	3.45E+00	2.15E+00	2.16E+00	3.52E+00	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Lead-212	EPA 901.1 Modified	1.27E+00	2.10E-01	2.20E-01	3.41E-01		pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Lead-214	EPA 901.1 Modified	1.73E+00	2.16E-01	2.33E-01	4.32E-01		pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Promethium-145	EPA 901.1 Modified	2.83E-01	4.94E-01	4.94E-01	9.56E-01	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Radium-226	EPA 901.1 Modified	1.60E+00	2.43E-01	2.57E-01	3.03E-01		pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Antimony-125	EPA 901.1 Modified	-3.41E-02	1.54E-01	1.54E-01	2.53E-01	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Thorium-234	EPA 901.1 Modified	3.80E+00	2.35E+00	2.36E+00	3.84E+00	U	pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Thallium-208	EPA 901.1 Modified	8.14E-01	1.69E-01	1.74E-01	1.36E-01		pCi/g
19-04010-04	DO	L1-12102A-FSGS-006-SS-A	02/07/19 12:30	4/2/2019	4/8/2019	19-04010	Uranium-235	EPA 901.1 Modified	3.12E-01	4.83E-01	4.83E-01	6.55E-01	U	pCi/g

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

0022

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-04010
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
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Actinium-228	EPA 901.1 Modified	2.55E-01	1.78E-01	1.78E-01	3.84E-01	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Silver-108m	EPA 901.1 Modified	3.64E-03	1.61E-02	1.61E-02	6.48E-02	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Americium-241	EPA 901.1 Modified	-2.25E-02	7.46E-02	7.47E-02	1.07E-01	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Barium-133	EPA 901.1 Modified	-1.02E-02	2.54E-02	2.54E-02	1.07E-01	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Bismuth-214	EPA 901.1 Modified	3.60E-01	1.33E-01	1.34E-01	2.10E-01		pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Cobalt-60	EPA 901.1 Modified	2.31E-01	7.18E-02	7.28E-02	1.57E-01		pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Cesium-134	EPA 901.1 Modified	-4.36E-03	1.78E-02	1.78E-02	8.76E-02	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Cesium-137	EPA 901.1 Modified	3.22E-01	7.71E-02	7.88E-02	8.71E-02		pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Europium-152	EPA 901.1 Modified	6.92E-02	1.10E-01	1.10E-01	1.55E-01	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Europium-154	EPA 901.1 Modified	-1.03E-01	1.98E-01	1.98E-01	8.31E-02	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Europium-155	EPA 901.1 Modified	5.44E-02	7.41E-02	7.42E-02	1.12E-01	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Holmium-166m	EPA 901.1 Modified	5.61E-02	7.79E-02	7.79E-02	6.34E-02	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Iodine-129	EPA 901.1 Modified	-8.77E-02	1.84E-01	1.84E-01	2.60E-01	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Potassium-40	EPA 901.1 Modified	1.45E+01	2.84E+00	2.94E+00	8.25E-01		pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Manganese-54	EPA 901.1 Modified	1.29E-02	5.29E-02	5.29E-02	8.91E-02	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Molybdenum-93	EPA 901.1 Modified	-1.39E-03	4.30E-02	4.30E-02	6.94E-02	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Niobium-94	EPA 901.1 Modified	-1.39E-02	5.43E-02	5.43E-02	7.56E-02	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Lead-210	EPA 901.1 Modified	6.05E-01	6.80E-01	6.80E-01	1.13E+00	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Lead-212	EPA 901.1 Modified	3.43E-01	1.41E-01	1.42E-01	2.20E-01		pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Lead-214	EPA 901.1 Modified	2.84E-01	1.26E-01	1.26E-01	2.27E-01		pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Promethium-145	EPA 901.1 Modified	1.15E-01	1.20E-01	1.20E-01	1.83E-01	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Radium-226	EPA 901.1 Modified	3.60E-01	1.33E-01	1.34E-01	2.10E-01		pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Antimony-125	EPA 901.1 Modified	-9.79E-02	1.59E-01	1.59E-01	2.03E-01	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Thorium-234	EPA 901.1 Modified	1.11E+00	9.78E-01	9.79E-01	1.62E+00	U	pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Thallium-208	EPA 901.1 Modified	4.40E-01	1.87E-01	1.88E-01	2.75E-01		pCi/g
19-04010-05	TRG	L1-12101A-FSGS-014-SS-A	02/25/19 09:13	4/2/2019	4/8/2019	19-04010	Uranium-235	EPA 901.1 Modified	-5.01E-03	2.29E-01	2.29E-01	3.37E-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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601 SCARBORO ROAD OAK RIDGE, TN 37830 865/481-0683 FAX 865/483-4621

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Patricia Giza	SDG:	19-04010
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Actinium-228	EPA 901.1 Modified	6.73E-01	2.66E-01	2.69E-01	4.16E-01		pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Silver-108m	EPA 901.1 Modified	6.19E-02	7.50E-02	7.51E-02	9.35E-02	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Americium-241	EPA 901.1 Modified	-2.38E-02	1.01E-01	1.01E-01	1.46E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Barium-133	EPA 901.1 Modified	-1.23E-03	4.81E-02	4.81E-02	1.64E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Bismuth-214	EPA 901.1 Modified	4.36E-01	1.79E-01	1.80E-01	3.33E-01		pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Cobalt-60	EPA 901.1 Modified	1.68E-01	6.73E-02	6.78E-02	1.01E-01		pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Cesium-134	EPA 901.1 Modified	0.00E+00	5.20E-02	5.20E-02	1.30E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Cesium-137	EPA 901.1 Modified	2.23E-01	1.24E-01	1.25E-01	1.93E-01		pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Europium-152	EPA 901.1 Modified	-7.74E-03	2.35E-01	2.35E-01	2.30E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Europium-154	EPA 901.1 Modified	-2.44E-02	2.22E-01	2.22E-01	1.17E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Europium-155	EPA 901.1 Modified	1.10E-01	1.02E-01	1.03E-01	1.70E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Holmium-166m	EPA 901.1 Modified	8.69E-02	1.35E-01	1.35E-01	8.68E-02	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Iodine-129	EPA 901.1 Modified	-6.75E-04	7.35E-02	7.35E-02	1.09E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Potassium-40	EPA 901.1 Modified	1.05E+01	2.03E+00	2.10E+00	1.73E+00		pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Manganese-54	EPA 901.1 Modified	-2.36E-02	7.52E-02	7.52E-02	1.17E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Molybdenum-93	EPA 901.1 Modified	-3.06E-02	7.93E-02	7.94E-02	1.00E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Niobium-94	EPA 901.1 Modified	-1.53E-03	7.01E-02	7.01E-02	1.13E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Lead-210	EPA 901.1 Modified	9.94E-01	8.62E-01	8.63E-01	1.42E+00	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Lead-212	EPA 901.1 Modified	2.56E-01	1.38E-01	1.39E-01	2.21E-01		pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Lead-214	EPA 901.1 Modified	3.71E-01	1.44E-01	1.45E-01	2.54E-01		pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Promethium-145	EPA 901.1 Modified	-1.38E-02	9.21E-02	9.21E-02	1.35E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Radium-226	EPA 901.1 Modified	4.36E-01	1.79E-01	1.80E-01	3.33E-01		pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Antimony-125	EPA 901.1 Modified	1.90E-01	1.88E-01	1.89E-01	3.01E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Thorium-234	EPA 901.1 Modified	3.54E-01	9.62E-01	9.62E-01	1.44E+00	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Thallium-208	EPA 901.1 Modified	3.02E-01	1.48E-01	1.49E-01	4.23E-01	U	pCi/g
19-04010-06	TRG	L1-12101A-FSGS-012-SS-A	02/25/19 09:11	4/2/2019	4/8/2019	19-04010	Uranium-235	EPA 901.1 Modified	2.36E-01	3.09E-01	3.09E-01	4.82E-01	U	pCi/g

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

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Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Patricia Giza	SDG:	19-04010
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Actinium-228	EPA 901.1 Modified	5.83E-01	2.36E-01	2.37E-01	5.03E-01		pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Silver-108m	EPA 901.1 Modified	-3.37E-02	6.35E-02	6.35E-02	8.36E-02	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Americium-241	EPA 901.1 Modified	-2.50E-02	9.60E-02	9.60E-02	1.35E-01	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Barium-133	EPA 901.1 Modified	1.10E-02	4.40E-02	4.40E-02	1.24E-01	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Bismuth-214	EPA 901.1 Modified	4.88E-01	1.94E-01	1.95E-01	3.45E-01		pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Cobalt-60	EPA 901.1 Modified	8.83E-03	9.52E-02	9.52E-02	1.50E-01	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Cesium-134	EPA 901.1 Modified	5.69E-03	1.88E-02	1.88E-02	1.16E-01	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Cesium-137	EPA 901.1 Modified	2.72E-01	8.33E-02	8.44E-02	1.04E-01		pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Europium-152	EPA 901.1 Modified	-2.43E-01	2.32E-01	2.32E-01	1.87E-01	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Europium-154	EPA 901.1 Modified	-1.81E-02	2.31E-01	2.31E-01	9.60E-02	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Europium-155	EPA 901.1 Modified	8.29E-02	9.61E-02	9.62E-02	1.44E-01	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Holmium-166m	EPA 901.1 Modified	-6.40E-03	7.60E-02	7.60E-02	8.24E-02	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Iodine-129	EPA 901.1 Modified	7.16E-02	2.41E-01	2.41E-01	3.58E-01	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Potassium-40	EPA 901.1 Modified	1.78E+01	3.57E+00	3.68E+00	1.42E+00		pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Manganese-54	EPA 901.1 Modified	9.16E-03	7.07E-02	7.07E-02	1.15E-01	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Molybdenum-93	EPA 901.1 Modified	-1.13E-02	5.23E-02	5.23E-02	8.27E-02	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Niobium-94	EPA 901.1 Modified	4.33E-03	5.28E-02	5.28E-02	8.10E-02	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Lead-210	EPA 901.1 Modified	8.74E-01	9.55E-01	9.56E-01	1.45E+00	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Lead-212	EPA 901.1 Modified	4.94E-01	1.66E-01	1.68E-01	2.49E-01		pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Lead-214	EPA 901.1 Modified	4.62E-01	1.16E-01	1.19E-01	1.95E-01		pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Promethium-145	EPA 901.1 Modified	4.95E-03	1.53E-01	1.53E-01	2.26E-01	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Radium-226	EPA 901.1 Modified	4.88E-01	1.94E-01	1.95E-01	3.45E-01		pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Antimony-125	EPA 901.1 Modified	4.45E-02	1.98E-01	1.98E-01	2.82E-01	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Thorium-234	EPA 901.1 Modified	1.47E+00	1.33E+00	1.33E+00	2.21E+00	U	pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Thallium-208	EPA 901.1 Modified	4.22E-01	2.18E-01	2.19E-01	3.37E-01		pCi/g
19-04010-07	TRG	L1-12101A-FSGS-002-SB-A	03/06/19 09:20	4/2/2019	4/9/2019	19-04010	Uranium-235	EPA 901.1 Modified	7.19E-02	2.79E-01	2.79E-01	4.21E-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:	Work Order Details:	
Patricia Giza	SDG:	19-04010
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Actinium-228	EPA 901.1 Modified	2.90E-01	3.08E-01	3.08E-01	5.49E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Silver-108m	EPA 901.1 Modified	-3.51E-02	8.41E-02	8.41E-02	8.73E-02	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Americium-241	EPA 901.1 Modified	8.61E-02	1.02E-01	1.02E-01	1.55E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Barium-133	EPA 901.1 Modified	1.22E-02	4.39E-02	4.39E-02	1.73E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Bismuth-214	EPA 901.1 Modified	5.20E-01	1.81E-01	1.83E-01	1.18E-01		pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Cobalt-60	EPA 901.1 Modified	1.34E-01	9.42E-02	9.44E-02	1.50E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Cesium-134	EPA 901.1 Modified	-1.25E-03	3.83E-02	3.83E-02	1.34E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Cesium-137	EPA 901.1 Modified	2.32E-01	7.98E-02	8.07E-02	9.66E-02		pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Europium-152	EPA 901.1 Modified	2.54E-02	2.24E-01	2.24E-01	2.37E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Europium-154	EPA 901.1 Modified	-1.60E-01	2.69E-01	2.69E-01	1.25E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Europium-155	EPA 901.1 Modified	1.72E-01	1.09E-01	1.10E-01	1.90E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Holmium-166m	EPA 901.1 Modified	-9.78E-02	1.66E-01	1.66E-01	8.57E-02	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Iodine-129	EPA 901.1 Modified	3.35E-03	7.71E-02	7.71E-02	1.14E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Potassium-40	EPA 901.1 Modified	1.44E+01	2.32E+00	2.43E+00	1.41E+00		pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Manganese-54	EPA 901.1 Modified	6.85E-02	8.39E-02	8.40E-02	1.50E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Molybdenum-93	EPA 901.1 Modified	-1.71E-02	7.77E-02	7.77E-02	8.58E-02	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Niobium-94	EPA 901.1 Modified	1.92E-02	6.91E-02	6.91E-02	1.06E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Lead-210	EPA 901.1 Modified	1.09E+00	9.24E-01	9.26E-01	1.53E+00	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Lead-212	EPA 901.1 Modified	6.13E-01	1.64E-01	1.67E-01	2.45E-01		pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Lead-214	EPA 901.1 Modified	5.12E-01	1.42E-01	1.44E-01	2.57E-01		pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Promethium-145	EPA 901.1 Modified	-5.94E-02	9.75E-02	9.75E-02	1.38E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Radium-226	EPA 901.1 Modified	5.20E-01	1.81E-01	1.83E-01	1.18E-01		pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Antimony-125	EPA 901.1 Modified	7.50E-02	2.09E-01	2.09E-01	3.01E-01	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Thorium-234	EPA 901.1 Modified	-2.28E-01	1.04E+00	1.04E+00	1.49E+00	U	pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Thallium-208	EPA 901.1 Modified	4.73E-01	1.69E-01	1.71E-01	3.12E-01		pCi/g
19-04010-08	TRG	L1-12102A-FSGS-017-SS-A	02/07/19 12:41	4/2/2019	4/9/2019	19-04010	Uranium-235	EPA 901.1 Modified	-3.02E-02	3.56E-01	3.56E-01	5.19E-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:
Patricia Giza
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:
SDG: 19-04010
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
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Actinium-228	EPA 901.1 Modified	3.11E-01	1.96E-01	1.96E-01	3.76E-01	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Silver-108m	EPA 901.1 Modified	1.69E-02	5.17E-02	5.17E-02	7.18E-02	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Americium-241	EPA 901.1 Modified	-9.92E-02	8.06E-02	8.08E-02	1.08E-01	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Barium-133	EPA 901.1 Modified	1.82E-02	2.37E-02	2.38E-02	1.11E-01	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Bismuth-214	EPA 901.1 Modified	4.11E-01	1.54E-01	1.56E-01	2.44E-01		pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Cobalt-60	EPA 901.1 Modified	1.84E-01	6.17E-02	6.25E-02	1.07E-01		pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Cesium-134	EPA 901.1 Modified	8.39E-04	2.76E-02	2.76E-02	9.80E-02	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Cesium-137	EPA 901.1 Modified	1.54E-01	8.17E-02	8.20E-02	1.26E-01		pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Europium-152	EPA 901.1 Modified	-7.31E-02	7.81E-02	7.82E-02	1.67E-01	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Europium-154	EPA 901.1 Modified	-1.54E-01	1.87E-01	1.87E-01	8.61E-02	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Europium-155	EPA 901.1 Modified	7.41E-02	7.77E-02	7.78E-02	1.18E-01	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Holmium-166m	EPA 901.1 Modified	6.47E-02	8.30E-02	8.31E-02	6.43E-02	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Iodine-129	EPA 901.1 Modified	-1.30E-01	1.92E-01	1.92E-01	2.65E-01	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Potassium-40	EPA 901.1 Modified	1.46E+01	2.88E+00	2.97E+00	8.10E-01		pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Manganese-54	EPA 901.1 Modified	5.75E-03	4.83E-02	4.83E-02	8.91E-02	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Molybdenum-93	EPA 901.1 Modified	-2.45E-02	4.80E-02	4.80E-02	7.24E-02	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Niobium-94	EPA 901.1 Modified	-1.50E-02	3.83E-02	3.83E-02	7.62E-02	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Lead-210	EPA 901.1 Modified	1.10E+00	1.18E+00	1.18E+00	1.98E+00	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Lead-212	EPA 901.1 Modified	4.12E-01	1.32E-01	1.34E-01	1.96E-01		pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Lead-214	EPA 901.1 Modified	4.16E-01	1.53E-01	1.54E-01	2.91E-01		pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Promethium-145	EPA 901.1 Modified	5.42E-02	1.25E-01	1.25E-01	1.88E-01	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Radium-226	EPA 901.1 Modified	4.11E-01	1.54E-01	1.56E-01	2.44E-01		pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Antimony-125	EPA 901.1 Modified	1.71E-02	1.56E-01	1.56E-01	2.21E-01	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Thorium-234	EPA 901.1 Modified	7.36E-01	7.07E-01	7.08E-01	1.08E+00	U	pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Thallium-208	EPA 901.1 Modified	3.90E-01	2.15E-01	2.16E-01	3.44E-01		pCi/g
19-04010-09	TRG	L1-12101A-FSGS-011-SS-A	02/25/19 09:10	4/2/2019	4/9/2019	19-04010	Uranium-235	EPA 901.1 Modified	6.41E-02	2.34E-01	2.34E-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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Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-04010
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
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Actinium-228	EPA 901.1 Modified	7.71E-01	3.28E-01	3.30E-01	8.10E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Silver-108m	EPA 901.1 Modified	1.64E-02	8.27E-02	8.27E-02	1.07E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Americium-241	EPA 901.1 Modified	-2.01E-02	1.20E-01	1.20E-01	1.72E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Barium-133	EPA 901.1 Modified	-1.22E-02	6.45E-02	6.45E-02	1.94E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Bismuth-214	EPA 901.1 Modified	5.38E-01	2.10E-01	2.12E-01	3.18E-01		pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Cobalt-60	EPA 901.1 Modified	5.16E-02	1.04E-01	1.04E-01	1.36E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Cesium-134	EPA 901.1 Modified	1.73E-02	4.13E-02	4.13E-02	1.41E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Cesium-137	EPA 901.1 Modified	1.71E-01	1.10E-01	1.11E-01	1.72E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Europium-152	EPA 901.1 Modified	5.05E-02	1.03E-01	1.03E-01	2.52E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Europium-154	EPA 901.1 Modified	-8.15E-02	2.37E-01	2.37E-01	1.29E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Europium-155	EPA 901.1 Modified	3.33E-01	1.50E-01	1.51E-01	2.55E-01		pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Holmium-166m	EPA 901.1 Modified	3.44E-02	1.32E-01	1.32E-01	1.00E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Iodine-129	EPA 901.1 Modified	-3.79E-02	8.54E-02	8.54E-02	1.23E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Potassium-40	EPA 901.1 Modified	1.67E+01	2.67E+00	2.81E+00	1.76E+00		pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Manganese-54	EPA 901.1 Modified	-7.69E-03	9.09E-02	9.09E-02	1.46E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Molybdenum-93	EPA 901.1 Modified	3.38E-03	5.93E-02	5.93E-02	9.55E-02	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Niobium-94	EPA 901.1 Modified	3.79E-02	6.98E-02	6.98E-02	1.22E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Lead-210	EPA 901.1 Modified	1.63E-01	9.50E-01	9.50E-01	1.40E+00	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Lead-212	EPA 901.1 Modified	5.63E-01	1.25E-01	1.29E-01	2.29E-01		pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Lead-214	EPA 901.1 Modified	7.61E-01	1.83E-01	1.87E-01	2.68E-01		pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Promethium-145	EPA 901.1 Modified	3.12E-03	1.03E-01	1.03E-01	1.52E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Radium-226	EPA 901.1 Modified	5.38E-01	2.10E-01	2.12E-01	3.18E-01		pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Antimony-125	EPA 901.1 Modified	-5.73E-02	2.42E-01	2.42E-01	3.28E-01	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Thorium-234	EPA 901.1 Modified	1.13E+00	1.28E+00	1.28E+00	2.14E+00	U	pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Thallium-208	EPA 901.1 Modified	6.33E-01	2.07E-01	2.10E-01	3.79E-01		pCi/g
19-04010-10	TRG	L1-12103A-FSGS-009-SS-A	02/07/19 09:08	4/2/2019	4/9/2019	19-04010	Uranium-235	EPA 901.1 Modified	-3.80E-02	3.79E-01	3.79E-01	5.54E-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

0028

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 19-04010
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
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Actinium-228	EPA 901.1 Modified	3.16E-01	2.46E-01	2.47E-01	5.91E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Silver-108m	EPA 901.1 Modified	1.08E-02	3.50E-02	3.50E-02	7.86E-02	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Americium-241	EPA 901.1 Modified	-1.98E-02	8.74E-02	8.74E-02	1.26E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Barium-133	EPA 901.1 Modified	-6.65E-02	1.16E-01	1.16E-01	1.23E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Bismuth-214	EPA 901.1 Modified	3.63E-01	1.33E-01	1.35E-01	3.17E-01		pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Cobalt-60	EPA 901.1 Modified	8.39E-02	7.82E-02	7.83E-02	1.49E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Cesium-134	EPA 901.1 Modified	-7.63E-02	9.23E-02	9.24E-02	1.15E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Cesium-137	EPA 901.1 Modified	1.50E-01	9.47E-02	9.50E-02	1.50E-01		pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Europium-152	EPA 901.1 Modified	-2.27E-01	2.06E-01	2.06E-01	1.80E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Europium-154	EPA 901.1 Modified	-7.07E-02	2.16E-01	2.16E-01	9.32E-02	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Europium-155	EPA 901.1 Modified	3.06E-02	9.26E-02	9.26E-02	1.38E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Holmium-166m	EPA 901.1 Modified	-6.56E-03	9.80E-02	9.80E-02	7.63E-02	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Iodine-129	EPA 901.1 Modified	1.80E-01	2.04E-01	2.04E-01	3.31E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Potassium-40	EPA 901.1 Modified	1.71E+01	3.40E+00	3.51E+00	1.07E+00		pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Manganese-54	EPA 901.1 Modified	-2.60E-02	7.02E-02	7.03E-02	1.08E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Molybdenum-93	EPA 901.1 Modified	2.87E-03	5.15E-02	5.15E-02	8.25E-02	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Niobium-94	EPA 901.1 Modified	-3.11E-03	5.26E-02	5.26E-02	8.43E-02	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Lead-210	EPA 901.1 Modified	5.70E-01	9.29E-01	9.30E-01	1.40E+00	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Lead-212	EPA 901.1 Modified	5.63E-01	1.67E-01	1.70E-01	2.45E-01		pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Lead-214	EPA 901.1 Modified	3.70E-01	1.51E-01	1.52E-01	2.86E-01		pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Promethium-145	EPA 901.1 Modified	6.74E-02	1.32E-01	1.32E-01	2.21E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Radium-226	EPA 901.1 Modified	3.63E-01	1.33E-01	1.35E-01	3.17E-01		pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Antimony-125	EPA 901.1 Modified	6.70E-02	1.71E-01	1.71E-01	2.53E-01	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Thorium-234	EPA 901.1 Modified	6.52E-01	7.86E-01	7.87E-01	1.20E+00	U	pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Thallium-208	EPA 901.1 Modified	4.90E-01	1.75E-01	1.77E-01	2.39E-01		pCi/g
19-04010-11	TRG	L1-12103A-FSGS-015-SS-A	02/07/19 09:14	4/2/2019	4/9/2019	19-04010	Uranium-235	EPA 901.1 Modified	3.04E-01	2.60E-01	2.61E-01	4.14E-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:	Work Order Details:	
Patricia Giza	SDG:	19-04010
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Actinium-228	EPA 901.1 Modified	8.34E-01	3.22E-01	3.25E-01	7.17E-01		pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Silver-108m	EPA 901.1 Modified	8.91E-03	1.01E-01	1.01E-01	1.02E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Americium-241	EPA 901.1 Modified	2.17E-02	5.00E-02	5.00E-02	1.95E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Barium-133	EPA 901.1 Modified	-2.55E-02	7.02E-02	7.02E-02	2.31E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Bismuth-214	EPA 901.1 Modified	8.80E-01	2.08E-01	2.12E-01	4.55E-01		pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Cobalt-60	EPA 901.1 Modified	2.26E-01	9.25E-02	9.32E-02	1.63E-01		pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Cesium-134	EPA 901.1 Modified	-3.57E-03	4.20E-02	4.20E-02	1.72E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Cesium-137	EPA 901.1 Modified	4.12E-01	1.16E-01	1.18E-01	2.94E-01		pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Europium-152	EPA 901.1 Modified	-8.96E-02	1.36E-01	1.36E-01	2.82E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Europium-154	EPA 901.1 Modified	8.57E-02	2.29E-01	2.29E-01	1.47E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Europium-155	EPA 901.1 Modified	1.46E-01	1.30E-01	1.30E-01	2.54E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Holmium-166m	EPA 901.1 Modified	-8.79E-02	2.02E-01	2.02E-01	1.14E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Iodine-129	EPA 901.1 Modified	2.34E-02	9.89E-02	9.89E-02	1.47E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Potassium-40	EPA 901.1 Modified	1.81E+01	3.00E+00	3.14E+00	2.34E+00		pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Manganese-54	EPA 901.1 Modified	1.74E-03	1.10E-01	1.10E-01	1.77E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Molybdenum-93	EPA 901.1 Modified	3.15E-02	8.95E-02	8.95E-02	1.11E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Niobium-94	EPA 901.1 Modified	2.71E-03	9.63E-02	9.63E-02	1.40E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Lead-210	EPA 901.1 Modified	2.02E-01	1.12E+00	1.12E+00	1.65E+00	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Lead-212	EPA 901.1 Modified	6.75E-01	1.62E-01	1.66E-01	3.09E-01		pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Lead-214	EPA 901.1 Modified	1.01E+00	2.29E-01	2.34E-01	4.02E-01		pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Promethium-145	EPA 901.1 Modified	-2.30E-02	1.24E-01	1.24E-01	1.80E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Radium-226	EPA 901.1 Modified	8.80E-01	2.08E-01	2.12E-01	4.55E-01		pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Antimony-125	EPA 901.1 Modified	-5.90E-02	2.71E-01	2.71E-01	3.62E-01	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Thorium-234	EPA 901.1 Modified	1.10E+00	1.33E+00	1.33E+00	2.22E+00	U	pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Thallium-208	EPA 901.1 Modified	6.25E-01	2.49E-01	2.51E-01	4.75E-01		pCi/g
19-04010-12	TRG	L1-12203A FQGS-012-SS-A	01/11/19 12:28	4/2/2019	4/9/2019	19-04010	Uranium-235	EPA 901.1 Modified	-1.10E-01	4.35E-01	4.35E-01	6.29E-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

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

ZION SOLUTIONS LLC
An EnergySolutions Company

REC'D APR 02 2019

ZS-WM-131
Revision 0
Information Use

3-25-19

19-04010

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	L1-12102A-FSGS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	2/7/2019	1230	5 ROC HTD	NA	594.19g
5	L1-12101A-FSGS-014-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	2/25/2019	0913	5 ROC HTD	NA	825.26g
6	L1-12101A-FSGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	2/25/2019	0911	5 ROC HTD	NA	750.94g
7	L1-12101A-FSGS-002-SB-A	NA	NA	SOIL	500	ml	MARINELLI	1	3/6/2019	0920	5 ROC HTD	NA	645.05g
8	L1-12102A-FSGS-017-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	2/7/2019	1241	5 ROC HTD	NA	766.94g
9	L1-12101A-FSGS-011-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	2/25/2019	0910	5 ROC HTD	NA	841.00g
10	L1-12103A-FSGS-009-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	2/7/2019	0908	5 ROC HTD	NA	726.90g
11	L1-12103A-FSGS-015-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	2/7/2019	0914	5 ROC HTD	NA	660.53g
12	L1-12203A-FQGS-012-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	1/11/2019	1228	5 ROC HTD	NA	671.79g

Laboratory:	Date Submitted To Lab:	Ship Container No.:	Cooler Temperature:	Airbill Number:
EBERLINE LABS		NA	N/A	Fed Ex Express Saver 8115 9539 7265

Relinquished by:	Date (mm/dd/yyyy): 3/28/19	Time: 1020	Received by: Richard F. Rickert	Date: (mm/dd/yyyy): 03/28/2019	
Relinquished by: Richard F. Rickert	Date (mm/dd/yyyy): 03/28/2019	Time: 1600	Received by: Fed Ex Express Saver	Date: (mm/dd/yyyy): 03/28/2019	
Relinquished by: Fedex	Date (mm/dd/yyyy):	Time:	Received by: Randolph Spencer	Date: (mm/dd/yyyy): 04/02/2019	
Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	

Comments: PO # 67718 30 Day Turn Around

9000