ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

VCC CONSTRUCTION AREA

SURVEY UNIT 10212B

REVISION 1

PREPARED BY / DATE: Robert Yetter III — Robert F. Yetter III, Apr 29 2020 9:46 AM, cosign

Final Status Survey Specialist

REVIEWED BY / DATE: Robert Yetter — Robert F. Yetter, Apr 29 2020 1:55 PM, cosign

Director, Radiological Site Closure

APPROVED BY / DATE: Sarah Roberts — Sarah Roberts, Apr 29 2020 6:39 PM, cosign

Vice President, Radiological Programs

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LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
AMCG	Average Member of the Critical Group
BcDCGL	Base Case DCGL
BcSOF	Base Case Sum of Fractions
C/LT	Characterization/License Termination
cpm	Counts per minute
DQO	Data Quality Objective
DCGL	Derived Concentration Guideline Level
FSS	Final Status Survey
GPS	Global Positioning System
HTD	Hard-to-Detect
HSA	Historical Site Assessment
IC	Insignificant Contributor
ISFSI	Independent Spent Fuel Storage Installation
LBGR	Lower Bound of the Gray Region
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
NAD	North American Datum
NaI	Sodium Iodide
OpDCGL	Operational Derived Concentration Guideline Level
OpSOF	Operational Sum of Fractions
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
VCC	Vertical Concrete Cask
VSP	Visual Sample Plan
ZNPS	Zion Nuclear Power Station
ZSRP	Zion Station Restoration Project

1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for Survey Unit 10212B, "VCC Construction 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 (L3-10212B-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 three. 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) random surface soil samples were acquired from the survey unit. In addition, surface scanning was performed on approximately 11% of the total surface area in the survey unit. Two (2) small areas of elevated activity were detected during the scans (see Section 9 for further discussion). The analytical results for all soil samples (random and investigation) taken in survey unit 10212B indicate that the Sum of Fractions (SOF) for each sample, when compared to the Operational Derived Concentration Guideline Levels (OpDCGL), was less than 0.5. For the random samples, the maximum Operational SOF (OpSOF) was 0.097 with a mean OpSOF of 0.039. The mean Base Case SOF (BcSOF), when the analytical results were compared to the Base Case DCGLs (BcDCGL), was 0.010, which results in a dose assigned to the survey unit of 0.250 mrem/year Total Effective Dose Equivalent (TEDE). Therefore, the null hypothesis is rejected and survey unit 10212B is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 10212B, "VCC Construction Area," is a Class 3 open land survey unit and is 16,154 m^2 in size. It is bounded on the west by survey unit 10214E, the east by survey unit 10222, the north by a non-impacted area and the south by survey units 10212A, 10213A and 10214E.

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

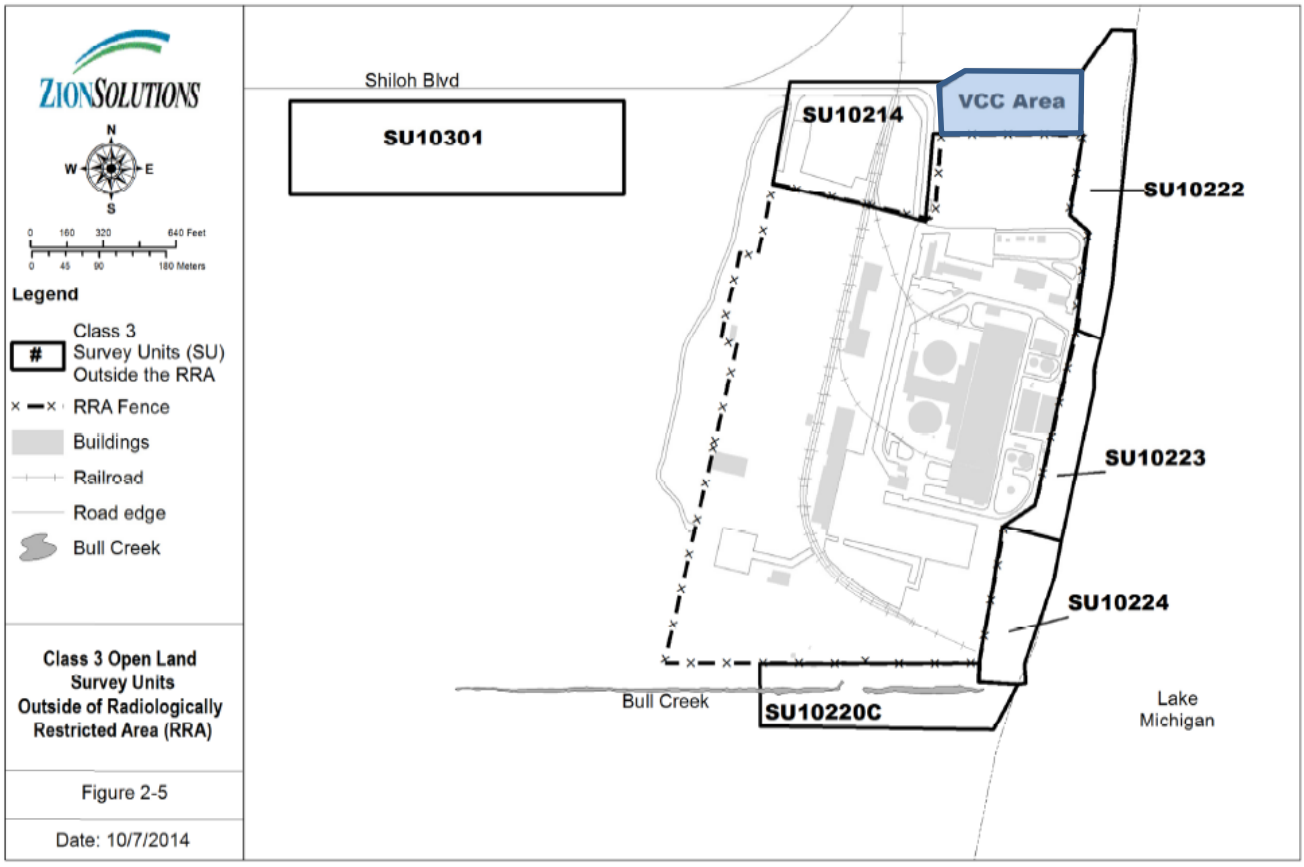
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 10212B was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 5).

The area encompassing this survey unit is made up of the northern halves of survey units 10212 and 10213 as identified in Figure 4 of the *"Zion Station Historical Site Assessment"* (HSA) (Reference 6). The HSA classified these survey units as non-impacted. The LTP subsequently described this area as the "VCC Area" and designated it a Class 3 open land survey unit as represented in Figure 2-5 of the LTP which is replicated below as Figure 1.

Figure 1 - Class 3 Open Land Survey Units Outside of "Radiologically Restricted Area" from Figure 2-5 of the LTP



The HSA states that this area contained the Power House and includes a reference to a Corporate Visitor Center. It also mentions that in 1997, 264 improperly controlled items were found outside of the Radiologically Protected Area having measurable fixed and/or removable contamination from 1,000 to 25,000 dpm/100 cm^2. A significant number (about 19%) were found in proximity to the Corporate Visitor Center.

During decommissioning this area was used for the assembly of the Vertical Concrete Casks (VCC) in support of the transfer of spent fuel to the Independent Spent Fuel Storage Installation (ISFSI). The area was also used for storage of miscellaneous equipment.

Surface soil samples were collected in this area under a Radiological Assessment (RA) survey performed in March of 2019. Thirteen (13) of the twenty (20) samples collected had positively detected concentrations greater than Minimum Detectable Concentration (MDC) for Cs-137 with the highest observed activity of 0.079 pCi/g.

An FSS readiness survey was performed in December of 2019 in survey unit 10212B under a RA. Approximately 25% of the survey unit was scanned with no elevated areas detected. Six (6) surface soil samples were obtained in an area of higher background on the western border of the survey unit with a visible clay composition. All six (6) samples were less than the MDC for the Radionuclides of Concern (ROC).

A Radiological Engineer (RE) and a Characterization/License Termination (C/LT) Supervisor performed a visual inspection and walk-down of the survey unit on December 2, 2019, prior to performing FSS. The purpose of the walk-down was to assess the physical condition of the survey unit, evaluate access points and travel paths and identify potentially hazardous conditions. A final classification assessment was performed in accordance with ZS-LT-300-001-002, as part of the survey design for FSS. The assessment confirmed that survey unit 10212B was correctly classified as Class 3.

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 10212B 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 Minimum Detectable Concentration (MDC). Therefore, the direct determination of radionuclide mixture fractions for initial suite radionuclides in soil is not technically feasible due to the MDC biasing issues discussed above. Based on a generalized assumption that the contaminated water that caused concrete contamination would be similar to the source of soil contamination, the ROC and radionuclide mixture derived for the Auxiliary Building concrete was considered to be reasonably representative of soils for FSS planning and implementation.*"

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

Table 1 - Dose Significant Radionuclides and Mixture

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

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

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

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

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

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

Table 2 - Base Case DCGLs for Surface Soils (BcDCGLss)

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

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

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

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

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

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

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

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

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

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

Instrument DQOs included a verification of the ability of the survey instrument to detect the radiation(s) of interest at the required scan MDC, which for Class 3 open land survey units, is less than or 50% of the applicable OpDCGL. Survey instrument response checks were required prior to issuance and after the instrument had been used. Control and accountability of survey instruments was required to ensure the quality and prevent the loss of data.

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

In accordance with the LTP, for laboratory analysis, MDCs less than 10% of the OpDCGL were preferable while MDCs up to 50% of the OpDCGL were acceptable. The maximum acceptable MDC for measurements obtained using field instruments was less than or 50% of the applicable OpDCGL.

5. SURVEY DESIGN

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

The DQO process determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 would be the ROC in survey unit 10212B. During FSS, concentrations for Hard-to-Detect (HTD) ROC Ni-63 and

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

Table 6 - Surrogate Ratios

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

For the FSS of survey unit 10212B, the surrogate OpDCGLs for Co-60 and Cs-137 were computed based on the maximum ratios from Table 6. The equation for calculating a surrogate DCGL is as follows:

Equation 1

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

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

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

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

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

Equation 2

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

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

Equation 3

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

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

The surrogate OpDCGL for Co-60 while inferring Ni-63 is 0.898 pCi/g, the surrogate OpDCGL for Cs-137 while inferring Sr-90 is 3.622 pCi/g and the OpDCGL for Cs-134 is 1.733 pCi/g. Using the normalized mixture for gamma-emitting ROC from Table 1, the surrogate adjusted gamma DCGL is then calculated as follows:

Equation 4

$$Surrogate_{DCGL\,(gamma)} = \frac{1}{\left[\left(\frac{0.012}{0.898_{(Co-60)}}\right) + \left(\frac{0.0001}{1.733_{Cs-134}}\right) + \left(\frac{0.988}{3.622_{(Cs-137)}}\right)\right]} = 3.494\ pCi/g$$

The surrogate adjusted gamma DCGL that was used in this survey unit is 3.494 pCi/g.

For this Class 3 open land survey unit, the "Investigation Levels" for area scanning and soil sample measurement results are those levels specified in LTP Chapter 5, Table 5-25 and are reproduced below in Table 7.

Table 7 - Investigation Levels

Classification	Scan Investigation Levels	Direct Investigation Levels
Class 3	>Operational DCGL or >MDC_{scan} if MDC_{scan} is greater than Operational DCGL	> 0.5 Operational DCGL

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

- background count rate of 3,000 counts per minute (cpm)
- scan speed of 0.25 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 2.05 pCi/g, which is less than the surrogate adjusted gamma DCGL calculated above. However, as a conservative measure, the scan investigation level was

set at the MDC_{scan} of the 2350-1/44-10. The collimator was used during the scan surveys to lower the background count rate.

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

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

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

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

The calculated MDC_{scan}, 2.05 pCi/g, is less than the surrogate adjusted gamma DCGL calculated above, therefore, no adjustment to the sample number was required.

The implementation of quality control (QC) measures as referenced by LTP, Section 5.9 and Zion*Solutions* procedure ZS-LT-01, "*Quality Assurance Project Plan (for Characterization and FSS)*" (QAPP) (Reference 12) includes the collection of a soil sample for "split sample" analysis on 5% of the soil samples taken in a survey unit with the locations selected at random. One (1) surface soil sample (L3-10212B-FQGS-002-SS) was selected randomly for split sample analysis for the FSS of this survey unit.

ZS-LT-01 also requires that replicate surveys be performed on 5% of all scan locations chosen at random. This requirement was being met by performing QC replicate scans on 5% of the total area scanned in Class 3 open land areas. A replicate measurement is an independent direct measurement performed by a qualified technician, other than the one who obtained the original measurement, with a separate but similar instrument. Area 6 was chosen at random for QC replicate scans. This area represents approximately 6% of the total area scanned is

this survey unit (100 m^2 of 1,730 m^2 total area scanned).

The locations of the seventeen (17) random samples are listed in Table 8. A map of the random sample locations is included in Attachment 1.

Table 8 - Random Sample Measurement Locations

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L3-10212B-FRGS-001-SS	642186.28	343758.80
L3-10212B-FRGS-002-SS	642139.04	343709.77
L3-10212B-FRGS-003-SS	642167.38	343807.83
L3-10212B-FRGS-004-SS	642195.73	343685.25
L3-10212B-FRGS-005-SS	642148.49	343783.31
L3-10212B-FRGS-006-SS	642176.83	343734.28
L3-10212B-FRGS-007-SS	642205.18	343832.34
L3-10212B-FRGS-008-SS	642132.74	343654.61
L3-10212B-FRGS-009-SS	642161.08	343752.67
L3-10212B-FRGS-010-SS	642189.43	343703.64
L3-10212B-FRGS-011-SS	642142.19	343801.70
L3-10212B-FRGS-012-SS	642170.53	343679.13
L3-10212B-FRGS-013-SS	642198.88	343777.19
L3-10212B-FRGS-014-SS	642151.63	343728.16
L3-10212B-FRGS-015-SS	642179.98	343826.22
L3-10212B-FRGS-016-SS	642135.89	343764.93
L3-10212B-FRGS-017-SS	642164.23	343715.90

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. This threshold was not encountered during the FSS of survey unit 10212B.

Three (3) soil samples, L3-10212B-FRGS-002-SS, L3-10212B-FRGS-011-SS and L3-10212B-FIGS-001-SS, were selected to meet the requirement that 10% of the samples collected during FSS of open land survey units be analyzed for HTD ROC. Each sample was sent off-site (Eberline Analytical) for analysis of the HTD ROC as specified in LTP, Section 5.1. Eberline analytical reports are provided in Attachment 8.

Table 9 provides a synopsis of the survey design for survey unit 10212B.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	16,154 m^2	GPS measurements of area
Number of Surface Soil Samples	17 (Random)	• σ = 0.30 • UBGR = SOF of 1 • LBGR = SOF of 0.5 • Type I error = 0.05 • Type II error = 0.05 • Δ/σ = 1.67 (MARSSIM Table 5.5)
Grid Spacing	N/A	(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	0.5 Operational DCGL	(LTP, Table 5-25)
Scan Survey Area Coverage	10% Replicate scans of area 6	(LTP, Table 5-24)
QC	One (1) surface soil sample selected randomly for split sample analysis	(LTP, Section 5.9)

6. SURVEY IMPLEMENTATION

Survey instructions for this FSS were incorporated into and performed in accordance with FSS sample plan L3-10212B-F, which was developed in accordance with ZS-LT-300-001-001. The FSS unit was inspected and controlled in accordance with Zion*Solutions* procedure ZS-LT-300-001-003, "*Isolation and Control for Final Status Survey*" (Reference 13).

For survey unit 10212B, 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, if during the performance of FSS, the analysis of a surface soil sample, or the results of a surface gamma scan indicated the potential presence of residual radioactivity at a concentration of 75% of the subsurface OpDCGL, then a biased subsurface soil sample(s) would have been taken to the appropriate depth within the area of concern as part of the investigation. This threshold was encountered during the FSS of survey unit 10212B while performing gamma scans in area 9. Two (2) small areas of elevated activity were identified (see Section 9 for further discussion). Surface and subsurface investigation soil samples were taken at these locations (L3-10212B-FIGS-001-SS through L3-10212B-FIGS-004-SS, L3-10212B-FIGS-001-SB and L3-10212B-FIGS-002-SB).

FSS field activities were conducted under FSS sample plan L3-10212B-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 December 6, 2019, and concluding on December 11, 2019. The QC replicate scan survey was performed on October 6, 2019.

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

Gamma scans were performed on approximately 11% (1,730 m^2) of the surface area of the survey unit (16,154 m^2) 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 0.25 meters per second. Two (2) areas of elevated activity were detected on the scans (see Section 9 for further discussion).

Daily, prior to and following use, each detector was subjected to an Operational Response Check in accordance with Zion*Solutions* procedure ZS-RP-108-004-011, *"Operation of the Ludlum Model 2350-1 Data Logger"* (Reference 14). The daily Operational Response Check compared the background response and the response to 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/ES0118	10/07/2020(1)
Ludlum 2350-1/Ludlum 44-10	304718/PR363311	09/19/2020(1)
Ludlum 2350-1/Ludlum 44-10	293136/PR316938	06/18/2020(1)
Ludlum 2350-1/Ludlum 44-10	304712/PR372143	09/09/2020(1)
Ludlum 2350-1/Ludlum 44-10	304726/PR363452	08/28/2020(1)
Ludlum 2350-1/Ludlum 44-10	266656/PR311750	07/24/2020(1)
Ludlum 2350-1/Ludlum 44-10	304708/PR321892	09/04/2020(1)
Ludlum 2350-1/Ludlum 44-10	304718/PR363311	09/19/2020(2)

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

In accordance with the survey design, seventeen (17) surface soil samples were collected at the designated random sample points. In addition, four (4) surface samples and two (2) subsurface samples were collected as part of the investigation of two (2) areas of elevated activity identified during the surface scans.

Three (3) samples (L3-10212B-FRGS-002-SS, L3-10212B-FRGS-011-SS and L3-10212B-FIGS-001-SS) were selected for HTD radionuclide analysis.

7. SURVEY RESULTS

Approximately 11% (1,730 m^2) of the surface area of the survey unit (16,154 m^2) was scanned for elevated radiation levels. Twenty-one (21) scan areas, 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. Two (2) elevated measurement locations were identified by surface scan in area 9 (see Section 9 for further discussion). 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
Area 1	1369	1628	None	None
Area 2	1869	2125	None	None
Area 3	1601	1628	None	None
Area 4	1662	1748	None	None
Area 5	2410	2487	None	None
Area 6	1306	1572	None	None
Area 7	2693	2895	None	None
Area 8	1876	2125	None	None
Area 9	1845	1661	7	L3-10212B-FIGS-001-SS thru 004-SS, L3-10212B-FIGS-001-SB and 002-SB
Area 10	1369	1544	None	None
Area 11	2738	2929	None	None
Area 12	2084	2093	None	None
Area 13	1333	1560	None	None
Area 14	2204	2206	None	None
Area 15	1441	1660	None	None
Area 16	2392	2442	None	None
Area 17	1507	1572	None	None
Area 18	2481	2552	None	None
Area 19	2606	2766	None	None
Area 20	1573	1661	None	None
Area 21	1318	1573	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) random surface soil samples taken for non-parametric statistical testing, the four (4) biased surface soil samples (investigation) and the two (2) subsurface soil samples (investigation) were analyzed using the on-site gamma spectroscopy system. Summaries of the sample analysis results are provided in Tables 12, 13 and 14, respectively. The basic statistics for the random sample population are summarized in Table 21. For the random samples, the gamma spectroscopy results revealed no samples with activity levels above MDC for Cs-137, Co-60 or Cs-134. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6. The mean of the gamma spectroscopic analysis results for the sample population indicated that Cs-137 was present at levels lower than the concentrations of Cs-137 expected to be found in off-site soil in the vicinity of the ZNPS as presented in Zion*Solutions* TSD 13-004, "*Examination of Cs-137 Global Fallout In Soils At Zion Station*" (Reference 15). The complete gamma spectroscopy reports are presented in Attachment 7.

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

MEASUREMENT ID	Co-60[1] (pCi/g)	Cs-134[1] (pCi/g)	Cs-137[1] (pCi/g)	Ni-63[2] (pCi/g)	Sr-90[2] (pCi/g)
L3-10212B-FRGS-001-SS	1.09E-02	1.27E-02	4.28E-03	1.97E+00	8.56E-06
L3-10212B-FRGS-002-SS	4.09E-02	3.67E-02	5.25E-02	7.38E+00	1.05E-04
L3-10212B-FRGS-003-SS	7.82E-03	0.00E+00	3.25E-02	1.41E+00	6.50E-05
L3-10212B-FRGS-004-SS	2.04E-02	0.00E+00	7.84E-03	3.68E+00	1.57E-05
L3-10212B-FRGS-005-SS	1.18E-02	2.24E-02	1.37E-02	2.13E+00	2.74E-05
L3-10212B-FRGS-006-SS	6.38E-03	3.37E-02	0.00E+00	1.15E+00	0.00E+00
L3-10212B-FRGS-007-SS	4.88E-02	1.21E-02	2.56E-02	8.81E+00	5.12E-05
L3-10212B-FRGS-008-SS	0.00E+00	3.60E-03	4.71E-02	0.00E+00	9.42E-05
L3-10212B-FRGS-009-SS	8.95E-03	0.00E+00	1.65E-02	1.62E+00	3.30E-05
L3-10212B-FRGS-010-SS	2.50E-02	8.48E-03	0.00E+00	4.51E+00	0.00E+00
L3-10212B-FRGS-011-SS	6.92E-02	1.27E-02	4.64E-02	1.25E+01	9.28E-05
L3-10212B-FRGS-012-SS	1.08E-02	9.18E-03	3.14E-02	1.95E+00	6.28E-05
L3-10212B-FRGS-013-SS	2.11E-02	1.20E-02	3.24E-02	3.81E+00	6.48E-05
L3-10212B-FRGS-014-SS	0.00E+00	1.29E-02	1.71E-02	0.00E+00	3.42E-05
L3-10212B-FRGS-015-SS	4.73E-02	0.00E+00	2.98E-02	8.54E+00	5.96E-05
L3-10212B-FRGS-016-SS	2.00E-02	3.08E-02	2.90E-02	3.61E+00	5.80E-05
L3-10212B-FRGS-017-SS	2.26E-02	3.23E-02	1.34E-02	4.08E+00	2.68E-05

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

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

MEASUREMENT ID	Co-60[1] (pCi/g)	Cs-134[1] (pCi/g)	Cs-137[1] (pCi/g)	Ni-63[2] (pCi/g)	Sr-90[2] (pCi/g)
L3-10212B-FIGS-001-SS	2.57E-02	2.70E-02	**5.45E-02**	4.64E+00	1.09E-04
L3-10212B-FIGS-002-SS	2.95E-02	0.00E+00	0.00E+00	5.32E+00	0.00E+00
L3-10212B-FIGS-003-SS	1.94E-02	0.00E+00	2.04E-02	3.50E+00	4.08E-05
L3-10212B-FIGS-004-SS	0.00E+00	1.83E-02	4.42E-03	0.00E+00	8.84E-06

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

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

MEASUREMENT ID	Co-60[1] (pCi/g)	Cs-134[1] (pCi/g)	Cs-137[1] (pCi/g)	Ni-63[2] (pCi/g)	Sr-90[2] (pCi/g)
L3-10212B-FIGS-001-SB	2.40E-02	0.00E+00	2.05E-02	4.33E+00	4.10E-05
L3-10212B-FIGS-002-SB	1.50E-02	6.56E-03	5.73E-02	2.71E+00	1.15E-04

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

The off-site laboratory, Eberline Analytical, processed the three (3) samples selected for HTD ROC analysis as specified in the survey design. Samples L3-10212B-FRGS-002-SS-A, L3-10212B-FRGS-011-SS-A and L3-10212B-FIGS-001-SS-A were selected. Only HTD radionuclides included as ROC (Ni-63 and Sr-90 for soils) were included in the analysis. All analyses met the required MDC. Only Cs-137 was positively detected in one (1) of the samples at a concentration greater than MDC. Consequently, comparison of existing ratios versus the maximum ratios from Table 6 was not required. The off-site analysis results are provided in Table 15.

Table 15 - Off-Site Analysis Results

Sample # L3-10212B-FRGS-002-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	1.08E-02	6.24E-02	9.39E-02	No
Cs-134	9.45E-03	3.32E-02	8.63E-02	No
Cs-137	8.51E-02	6.33E-02	1.00E-01	No
Ni-63	-1.67E+00	1.95E+00	3.44E+00	No
Sr-90	3.15E-01	2.96E-01	5.97E-01	No

Sample # L3-10212B-FQGS-011-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	2.93E-02	8.19E-02	1.22E-01	No
Cs-134	1.37E-02	2.76E-02	9.58E-02	No
Cs-137	-2.21E-02	7.78E-02	1.13E-01	No
Ni-63	-2.33E+00	1.98E+00	3.52E+00	No
Sr-90	3.29E-01	3.46E-01	7.03E-01	No

Sample # L3-10212B-FIGS-001-SS-A

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	9.33E-02	6.49E-02	1.31E-01	No
Cs-134	-1.35E-02	2.13E-02	6.85E-02	No
Cs-137	1.27E-01	6.85E-02	1.05E-01	Yes
Ni-63	-9.64E-01	2.17E+00	3.78E+00	No
Sr-90	2.16E-01	3.41E-01	7.05E-01	No

The implementation of survey specific QC measures included the collection of one (1) random sample (L3-10212B-FQGS-002-SS) and one (1) biased sample (L3-10212B-QIGS-001-SS) for "split sample" analysis. The on-site laboratory analyzed the designated QC samples using the on-site gamma spectroscopy system. Gamma spectroscopy results are summarized in Table 16. The concentrations for Ni-63 and Sr-90 were inferred based on the maximum ratios as specified in Table 6.

Table 16 - Summary of Gamma Spectroscopy Results for QC Soil Samples

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L3-10212B-FQGS-002-SS	3.51E-02	0.00E+00	3.23E-02	6.33E+00	6.46E-05
L3-10212B-QIGS-001-SS	0.00E+00	1.78E-02	2.90E-02	0.00E+00	5.80E-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 5

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

Where: C_n = concentration of radionuclide n

$DCGL_n$ = DCGL of radionuclide n.

The results of the unity rule calculations for the ROC in the random sample population when compared against the OpDCGLs for surface soils for survey unit 10212B are presented in Table 17. The results of the unity rule calculations for the ROC for the biased surface samples are presented in Table 18, the results for the subsurface samples are presented in Table 19, and the results for the QC samples are presented in Table 20.

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L3-10212B-FRGS-001-SS	9.99E-03	7.33E-03	1.18E-03	2.15E-03	2.77E-06	0.021
L3-10212B-FRGS-002-SS	3.75E-02	2.12E-02	1.45E-02	8.07E-03	3.39E-05	0.081
L3-10212B-FRGS-003-SS	7.17E-03	0.00E+00	8.95E-03	1.54E-03	2.10E-05	0.018
L3-10212B-FRGS-004-SS	1.87E-02	0.00E+00	2.16E-03	4.03E-03	5.07E-06	0.025
L3-10212B-FRGS-005-SS	1.08E-02	1.29E-02	3.77E-03	2.33E-03	8.85E-06	0.030
L3-10212B-FRGS-006-SS	5.85E-03	1.94E-02	0.00E+00	1.26E-03	0.00E+00	0.027
L3-10212B-FRGS-007-SS	4.47E-02	6.98E-03	7.05E-03	9.63E-03	1.65E-05	0.068
L3-10212B-FRGS-008-SS	0.00E+00	2.08E-03	1.30E-02	0.00E+00	3.04E-05	0.015
L3-10212B-FRGS-009-SS	8.20E-03	0.00E+00	4.55E-03	1.77E-03	1.07E-05	0.015
L3-10212B-FRGS-010-SS	2.29E-02	4.89E-03	0.00E+00	4.93E-03	0.00E+00	0.033
L3-10212B-FRGS-011-SS	6.34E-02	7.33E-03	1.28E-02	1.37E-02	3.00E-05	0.097
L3-10212B-FRGS-012-SS	9.90E-03	5.30E-03	8.65E-03	2.13E-03	2.03E-05	0.026
L3-10212B-FRGS-013-SS	1.93E-02	6.92E-03	8.93E-03	4.16E-03	2.09E-05	0.039
L3-10212B-FRGS-014-SS	0.00E+00	7.44E-03	4.71E-03	0.00E+00	1.11E-05	0.012
L3-10212B-FRGS-015-SS	4.34E-02	0.00E+00	8.21E-03	9.33E-03	1.93E-05	0.061
L3-10212B-FRGS-016-SS	1.83E-02	1.78E-02	7.99E-03	3.95E-03	1.87E-05	0.048
L3-10212B-FRGS-017-SS	2.07E-02	1.86E-02	3.69E-03	4.46E-03	8.66E-06	0.048

Random Measurements

Number of Random Measurements =	17
# of Random Measurements with OpSOF $\geq$ 0.5 =	0
# of Random Measurements with OpSOF > 0.1 (HTD Assessment) =	0
Max Individual Random Measurement OpSOF =	0.097
Mean Random Measurement OpSOF =	0.039

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L3-10212B-FIGS-001-SS	2.36E-02	1.56E-02	1.50E-02	5.07E-03	3.52E-05	0.059
L3-10212B-FIGS-002-SS	2.70E-02	0.00E+00	0.00E+00	5.82E-03	0.00E+00	0.033
L3-10212B-FIGS-003-SS	1.78E-02	0.00E+00	5.62E-03	3.83E-03	1.32E-05	0.027
L3-10212B-FIGS-004-SS	0.00E+00	1.06E-02	1.22E-03	0.00E+00	2.86E-06	0.012

Table 19 - Sum of Fractions for Individual Subsurface Soil Samples when compared to the OpDCGLs

MEASUREMENT ID	Fraction of the OpDCGLs for Subsurface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L3-10212B-FIGS-001-SB	2.72E-02	0.00E+00	1.03E-02	2.22E-02	9.65E-05	0.060
L3-10212B-FIGS-002-SB	1.70E-02	5.77E-03	2.89E-02	1.39E-02	2.70E-04	0.066

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L3-10212B-FQGS-002-SS	3.22E-02	0.00E+00	8.90E-03	6.93E-03	2.09E-05	0.048
L3-10212B-QIGS-001-SS	0.00E+00	1.03E-02	7.99E-03	0.00E+00	1.87E-05	0.018

Table 21 - Basic Statistical Properties of Random 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	2.19E-02	2.00E-02	6.92E-02	0.00E+00	0.019	4.26	5.14E-03	1.28E-01
Cs-134	1.41E-02	1.21E-02	3.67E-02	0.00E+00	0.013	6.77	2.08E-03	5.20E-02
Cs-137	2.35E-02	2.56E-02	5.25E-02	0.00E+00	0.016	14.18	1.66E-03	4.14E-02
Ni-63	3.95E+00	3.61E+00	1.25E+01	0.00E+00	3.464	3572.1	1.11E-03	2.76E-02
Sr-90	4.70E-05	5.12E-05	1.05E-04	0.00E+00	0.000	12.09	3.89E-06	9.72E-05

The mean BcSOF for survey unit 10212B is 0.010 which equates to a dose of 0.250 mrem/year TEDE.

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

8. QUALITY CONTROL

The on-site laboratory processed two (2) split samples, L3-10212B-FQGS-002-SS and L3-10212B-QIGS-001-SS, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in ZS-LT-01. The standard samples and QC samples did not both have positive results for gamma-emitting ROC; therefore, K-40 was used in the QC comparison. There was acceptable agreement between field split results. Refer to Attachment 5 for data and QC analysis results.

QC Replicate scans were performed in area 6 of the survey unit. This area represents approximately 6% of the total area scanned in this survey unit (100 m^2 of 1,730 m^2 total area scanned). The results were evaluated using acceptance criteria specified in the ZS-LT-01. The QC replicate scans were in agreement with the original scans. No elevated measurement

locations were identified in either the original survey or the replicate survey in this area. Complete QC replicate scan results are provided in Attachment 2.

9. INVESTIGATIONS AND RESULTS

An investigation was performed following scan alarms in area 9 on December 6, 2019. Two (2) areas were identified; a 1-meter by 1-meter area with a maximum count rate of 1,845 cpm and a 1-meter by 8-meter area with a maximum count rate of 1,802 cpm (a map of the areas is included in Attachment 1). One (1) surface soil sample was taken in the smaller area (L3-10212B-FIGS-002-SS) and three (3) surface samples were taken in the larger area (L3-10212B-FIGS-001-SS, L3-10212B-FIGS-003-SS and L3-10212B-FIGS-004-SS). A subsurface soil sample was also obtained in each area: L3-10212B-FIGS-001-SB and L3-10212B-FIGS-002-SB. Gamma spectroscopy results revealed only one (1) sample with an activity level above MDC for Cs-137: L3-10212B-FIGS-001-SS. None of the samples had activity levels above MDC for Co-60 or Cs-134. Since the OpSOF for the investigation samples were all less than 0.5, with an OpSOF of 0.059 for sample L3-10212B-FIGS-001-SS, no further action was necessary. The investigation is documented in an Attachment 13 (from ZS- LT-300-001-004), "Final Status Survey Investigation." The gamma spectroscopy results are summarized in Table 13 for the surface samples and Table 14 for the subsurface samples. The OpSOF are summarized in Table 18 for the surface samples and Table 19 for the subsurface samples.

10. REMEDIATION AND RESULTS

No remediation was performed in Class 3 open land survey unit 10212B. In accordance with LTP Chapter 5, Section 5.6.4.6.1, if contamination is present in a Class 3 open land survey unit in excess 50% of the OpDCGL, then all or part of the survey unit will be reclassified as Class 1 or Class 2 and the survey strategy for that survey unit will be redesigned for Class 1 or Class 2. This threshold was not encountered during the FSS of survey unit 10212B.

11. CHANGES FROM THE SURVEY PLAN

The FSS plan initially designated nineteen (19) scan areas. However, due to some areas in the survey unit being inaccessible for scan due to standing water, two (2) additional scan areas were added. This enabled the FSS plan's requirement of scanning 10% of the survey unit to be met. A map showing the additional scan areas is included in Attachment 1.

12. DATA QUALITY ASSESSMENT

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

The analytical results of all samples were less than an OpSOF of 0.5 when compared to the OpDCGLs.

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

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

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

13. ANOMALIES

Approximately 70 m^2 of surface area was inaccessible for scanning due to standing water. However, two (2) more areas were added to meet the FSS plan's requirement of scanning 10% of the survey unit. The inaccessibility is documented on the applicable field logs.

The standing water also precluded scanning a 1-meter radius around the following random sample location as prescribed in ZS-LT-300-001-001: sample point #11. This did not adversely affect the quality of the data collected during the FSS of this survey unit and was deemed acceptable.

14. CONCLUSION

Survey unit 10212B has met the DQOs of the FSS plan. The ALARA criteria for soils as specified in Chapter 4 of the LTP were achieved.

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

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

The mean BcSOF, when the analytical results were compared to the BcDCGLs, was 0.010, which results in a dose contribution from soil in survey unit 10212B of 0.250 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 10212B is acceptable for unrestricted release.

15. REFERENCES

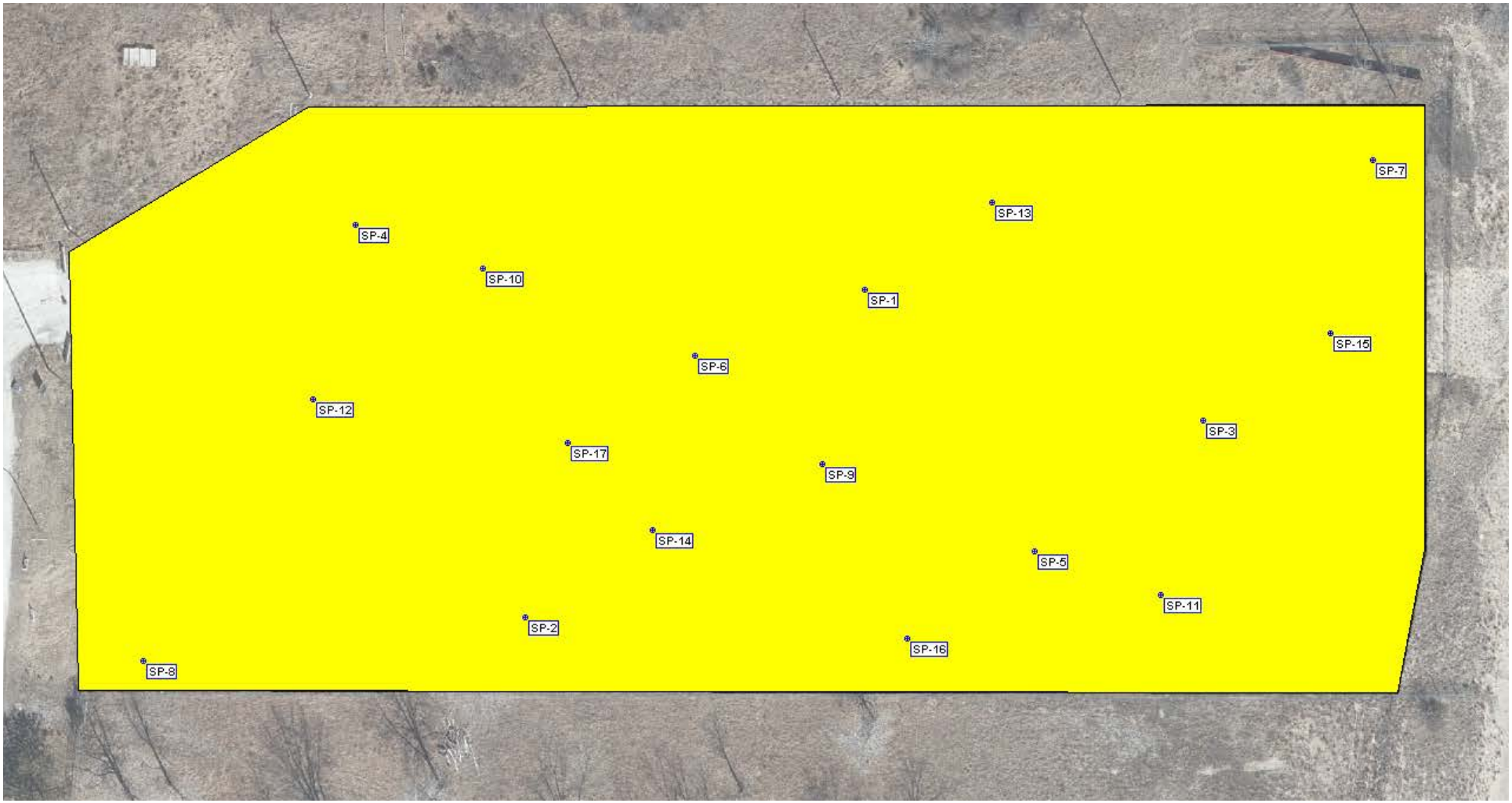
1. Zion*Solutions* procedure ZS-LT-300-001-005, "Final Status Survey Data Reporting"
2. Zion Station Restoration Project License Termination Plan
3. Zion*Solutions* procedure ZS-LT-300-001-001, "Final Status Survey Package Development"
4. NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation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

16. ATTACHMENTS

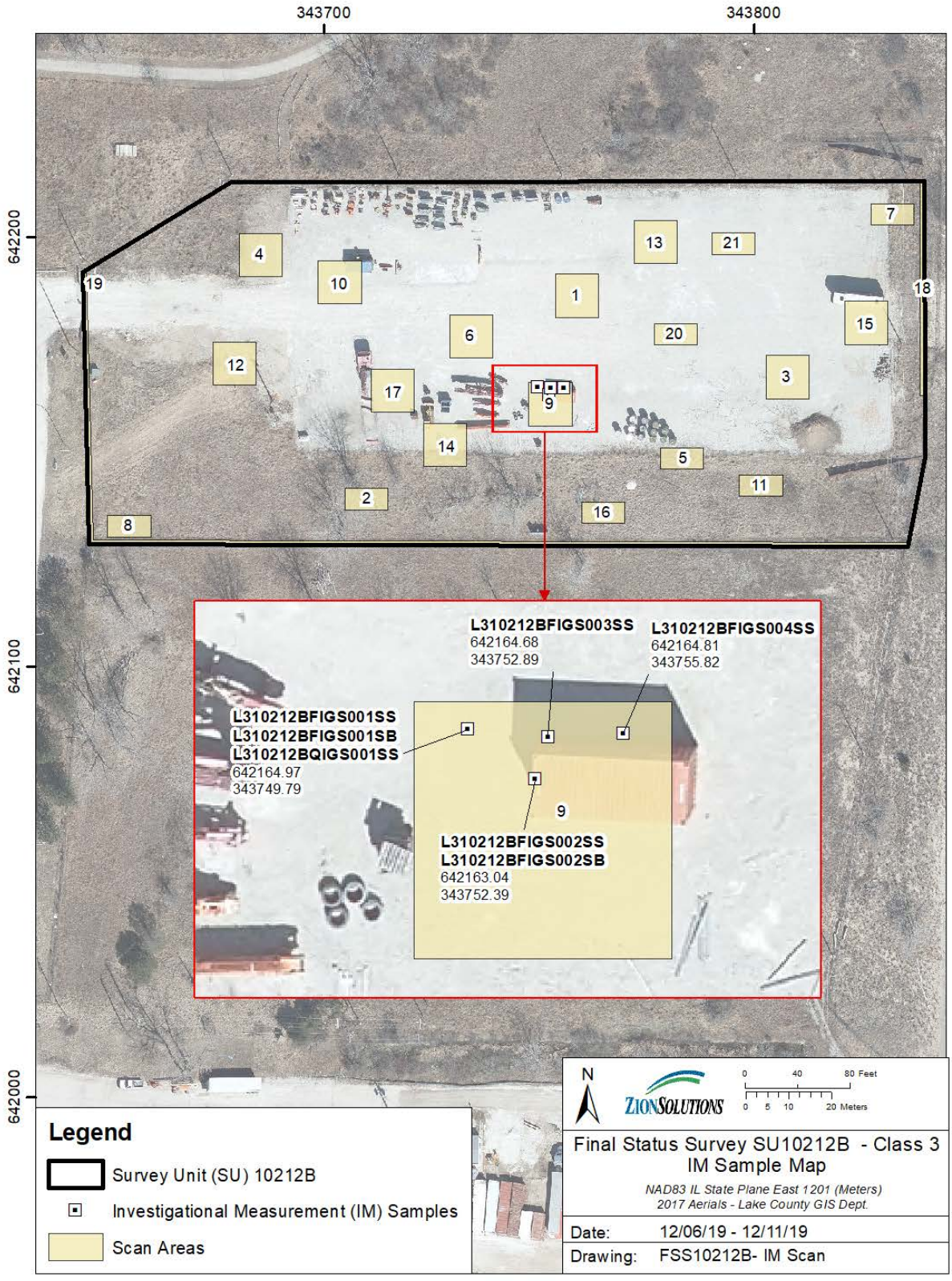
1. Attachment 1 - Figures and Maps
2. Attachment 2 - Scan Data
3. Attachment 3 - Consultation Triggers for Residential and Commercial/Industrial Soil Contamination
4. Attachment 4 - Sign Test
5. Attachment 5 - QC Sample Assessment
6. Attachment 6 - Graphical Presentations
7. Attachment 7 - Sample Analytical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

ATTACHMENT 1
FIGURES AND MAPS

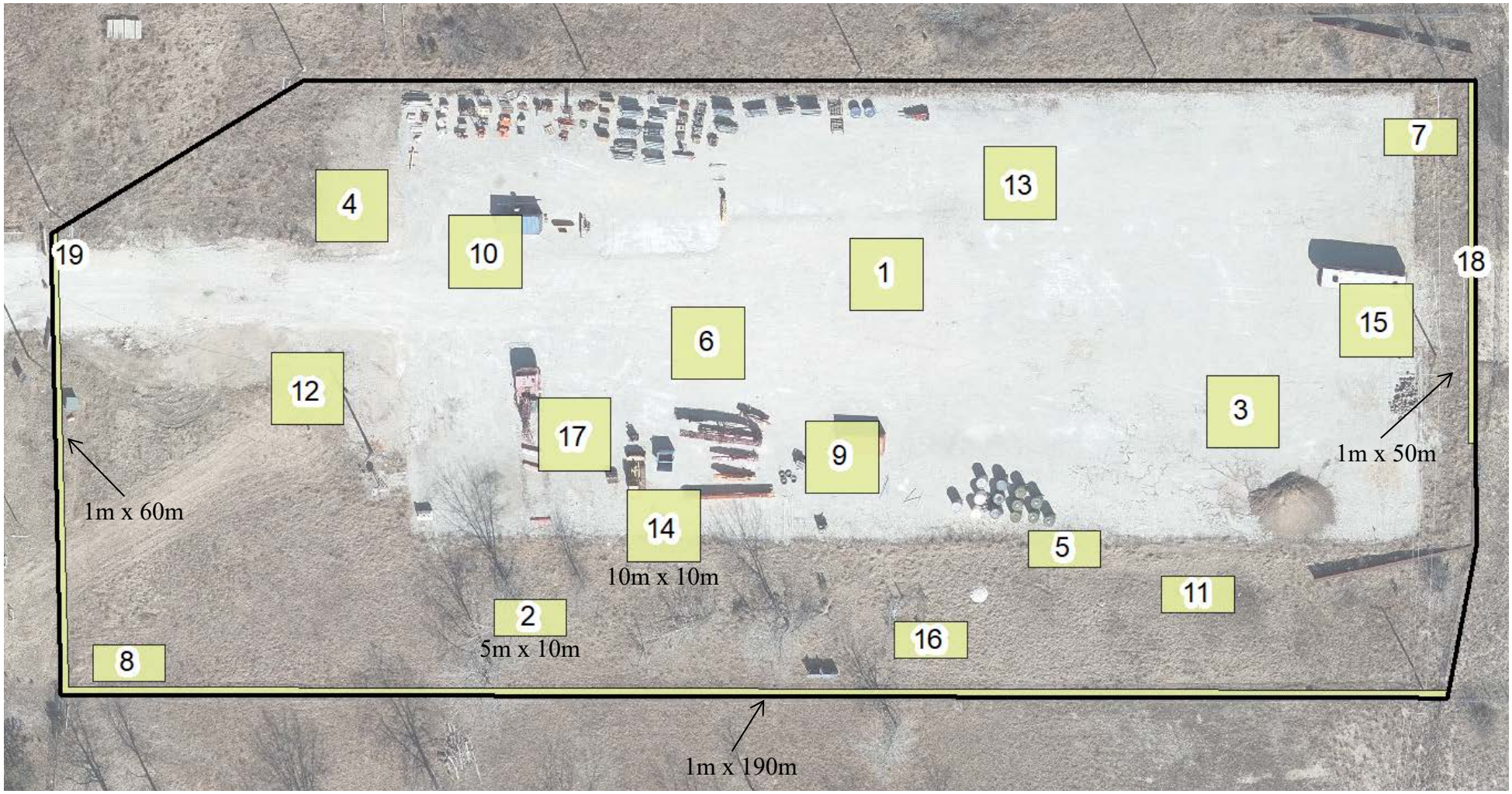
Survey Unit 10212B Final Status Survey Boundaries and Random Sample Points



Survey Unit 10212B Investigation Sample Points



Survey Unit 10212B Final Status Survey Scan Areas



Survey Unit 10212B Final Status Survey Scan Areas with Added Areas 20 and 21

ATTACHMENT 2
SCAN DATA

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
ORIGINAL SCANS									
44-10	ES0118	216173	10212B	GS006	12/6/2019 8:55	1206	1202	1572	No
44-10	ES0118	216173	10212B	GS006	12/6/2019 9:00	1225	1202	1572	No
44-10	ES0118	216173	10212B	GS006	12/6/2019 9:04	1231	1202	1572	No
44-10	ES0118	216173	10212B	GS006	12/6/2019 9:08	1219	1202	1572	No
44-10	ES0118	216173	10212B	GS006	12/6/2019 9:18	1298	1202	1572	No
44-10	ES0118	216173	10212B	GS006	12/6/2019 9:23	1235	1202	1572	No
44-10	ES0118	216173	10212B	GS006	12/6/2019 9:27	1283	1202	1572	No
44-10	ES0118	216173	10212B	GS006	12/6/2019 9:31	1293	1202	1572	No
44-10	ES0118	216173	10212B	GS006	12/6/2019 9:35	1305	1202	1572	No
44-10	ES0118	216173	10212B	GS006	12/6/2019 9:39	1306	1202	1572	No
44-10	ES0118	216173	10212B	GS017	12/6/2019 9:44	1331	1202	1572	No
44-10	ES0118	216173	10212B	GS017	12/6/2019 9:48	1360	1202	1572	No
44-10	ES0118	216173	10212B	GS017	12/6/2019 9:52	1299	1202	1572	No
44-10	ES0118	216173	10212B	GS017	12/6/2019 9:56	1271	1202	1572	No
44-10	ES0118	216173	10212B	GS017	12/6/2019 10:00	1315	1202	1572	No
44-10	ES0118	216173	10212B	GS017	12/6/2019 10:04	1319	1202	1572	No
44-10	ES0118	216173	10212B	GS017	12/6/2019 10:08	1455	1202	1572	No
44-10	ES0118	216173	10212B	GS017	12/6/2019 10:12	1507	1202	1572	No
44-10	ES0118	216173	10212B	GS017	12/6/2019 10:16	1252	1202	1572	No
44-10	ES0118	216173	10212B	GS017	12/6/2019 10:20	1238	1202	1572	No
44-10	ES0118	216173	10212B	GS014	12/6/2019 10:24	1277	1202	1572	No
44-10	ES0118	216173	10212B	GS014	12/6/2019 10:28	1226	1202	1572	No
44-10	ES0118	216173	10212B	GS014	12/6/2019 10:32	1272	1202	1572	No
44-10	ES0118	216173	10212B	GS014	12/6/2019 10:36	1221	1202	1572	No
44-10	ES0118	216173	10212B	GS014	12/6/2019 10:40	1253	1202	1572	No
44-10	ES0118	216173	10212B	GS014	12/6/2019 13:19	1769	1757	2206	No
44-10	ES0118	216173	10212B	GS014	12/6/2019 13:24	1881	1757	2206	No
44-10	ES0118	216173	10212B	GS014	12/6/2019 13:28	1988	1757	2206	No
44-10	ES0118	216173	10212B	GS014	12/6/2019 13:33	2204	1757	2206	No
44-10	ES0118	216173	10212B	GS014	12/6/2019 13:38	2175	1757	2206	No
44-10	PR316938	293136	10212B	GS009	12/6/2019 9:58	1304	1279	1661	No
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:03	1279	1279	1661	No
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:07	1285	1279	1661	No
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:12	1305	1279	1661	No
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:32	1358	1279	1661	No
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:36	1367	1279	1661	No
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:40	1556	1279	1661	No
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:46	1845	1279	1661	Yes
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:51	1606	1279	1661	No
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:54	1770	1279	1661	Yes
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:55	1759	1279	1661	Yes
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:56	1695	1279	1661	Yes
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:57	1802	1279	1661	Yes
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:57	1759	1279	1661	Yes
44-10	PR316938	293136	10212B	GS009	12/6/2019 10:59	1684	1279	1661	Yes

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR316938	293136	10212B	GS020	12/6/2019 13:16	1521	1279	1661	No
44-10	PR316938	293136	10212B	GS020	12/6/2019 13:24	1500	1279	1661	No
44-10	PR316938	293136	10212B	GS020	12/6/2019 13:28	1573	1279	1661	No
44-10	PR316938	293136	10212B	GS020	12/6/2019 13:32	1445	1279	1661	No
44-10	PR316938	293136	10212B	GS020	12/6/2019 13:36	1423	1279	1661	No
44-10	PR316938	293136	10212B	GS020	12/6/2019 13:45	1352	1279	1661	No
44-10	PR372143	304712	10212B	GS013	12/6/2019 9:28	1317	1191	1560	No
44-10	PR372143	304712	10212B	GS013	12/6/2019 9:32	1301	1191	1560	No
44-10	PR372143	304712	10212B	GS013	12/6/2019 9:36	1333	1191	1560	No
44-10	PR372143	304712	10212B	GS013	12/6/2019 9:40	1290	1191	1560	No
44-10	PR372143	304712	10212B	GS013	12/6/2019 9:44	1287	1191	1560	No
44-10	PR372143	304712	10212B	GS013	12/6/2019 9:48	1320	1191	1560	No
44-10	PR372143	304712	10212B	GS013	12/6/2019 9:52	1281	1191	1560	No
44-10	PR372143	304712	10212B	GS013	12/6/2019 9:56	1276	1191	1560	No
44-10	PR372143	304712	10212B	GS013	12/6/2019 10:00	1265	1191	1560	No
44-10	PR372143	304712	10212B	GS013	12/6/2019 10:04	1303	1191	1560	No
44-10	PR372143	304712	10212B	GS021	12/6/2019 10:18	1318	1202	1573	No
44-10	PR372143	304712	10212B	GS021	12/6/2019 10:22	1315	1202	1573	No
44-10	PR372143	304712	10212B	GS021	12/6/2019 10:26	1290	1202	1573	No
44-10	PR372143	304712	10212B	GS021	12/6/2019 10:30	1252	1202	1573	No
44-10	PR372143	304712	10212B	GS021	12/6/2019 10:34	1273	1202	1573	No
44-10	PR372143	304712	10212B	GS015	12/6/2019 13:17	1394	1278	1660	No
44-10	PR372143	304712	10212B	GS015	12/6/2019 13:21	1396	1278	1660	No
44-10	PR372143	304712	10212B	GS015	12/6/2019 13:25	1340	1278	1660	No
44-10	PR372143	304712	10212B	GS015	12/6/2019 13:29	1410	1278	1660	No
44-10	PR372143	304712	10212B	GS015	12/6/2019 13:33	1343	1278	1660	No
44-10	PR372143	304712	10212B	GS015	12/6/2019 13:37	1433	1278	1660	No
44-10	PR372143	304712	10212B	GS015	12/6/2019 13:41	1414	1278	1660	No
44-10	PR372143	304712	10212B	GS015	12/6/2019 13:45	1428	1278	1660	No
44-10	PR372143	304712	10212B	GS015	12/6/2019 13:49	1441	1278	1660	No
44-10	PR372143	304712	10212B	GS015	12/6/2019 13:53	1434	1278	1660	No
44-10	PR363452	304726	10212B	GS010	12/6/2019 8:49	1331	1177	1544	No
44-10	PR363452	304726	10212B	GS010	12/6/2019 8:53	1305	1177	1544	No
44-10	PR363452	304726	10212B	GS010	12/6/2019 8:58	1302	1177	1544	No
44-10	PR363452	304726	10212B	GS010	12/6/2019 9:02	1297	1177	1544	No
44-10	PR363452	304726	10212B	GS010	12/6/2019 9:06	1343	1177	1544	No
44-10	PR363452	304726	10212B	GS010	12/6/2019 9:10	1369	1177	1544	No
44-10	PR363452	304726	10212B	GS010	12/6/2019 9:15	1333	1177	1544	No
44-10	PR363452	304726	10212B	GS010	12/6/2019 9:19	1307	1177	1544	No
44-10	PR363452	304726	10212B	GS010	12/6/2019 9:23	1334	1177	1544	No
44-10	PR363452	304726	10212B	GS010	12/6/2019 9:28	1332	1177	1544	No
44-10	PR363452	304726	10212B	GS004	12/6/2019 9:37	1433	1177	1544	No
44-10	PR363452	304726	10212B	GS004	12/6/2019 9:42	1505	1177	1544	No
44-10	PR363452	304726	10212B	GS004	12/6/2019 9:46	1283	1177	1544	No
44-10	PR363452	304726	10212B	GS004	12/6/2019 9:51	1407	1177	1544	No
44-10	PR363452	304726	10212B	GS004	12/6/2019 9:56	1455	1177	1544	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR363452	304726	10212B	GS004	12/6/2019 10:01	1046	1177	1544	No
44-10	PR363452	304726	10212B	GS004	12/6/2019 10:07	1385	1177	1544	No
44-10	PR363452	304726	10212B	GS004	12/6/2019 10:13	1499	1177	1544	No
44-10	PR363452	304726	10212B	GS004	12/6/2019 10:18	1412	1177	1544	No
44-10	PR363452	304726	10212B	GS012	12/6/2019 13:07	1672	1658	2093	No
44-10	PR363452	304726	10212B	GS012	12/6/2019 13:14	1744	1658	2093	No
44-10	PR363452	304726	10212B	GS012	12/6/2019 13:23	1763	1658	2093	No
44-10	PR363452	304726	10212B	GS012	12/6/2019 13:28	2029	1658	2093	No
44-10	PR363452	304726	10212B	GS012	12/6/2019 13:38	1952	1658	2093	No
44-10	PR363452	304726	10212B	GS012	12/6/2019 13:43	2076	1658	2093	No
44-10	PR363452	304726	10212B	GS012	12/6/2019 13:48	2022	1658	2093	No
44-10	PR363452	304726	10212B	GS012	12/6/2019 13:54	1941	1658	2093	No
44-10	PR363452	304726	10212B	GS012	12/6/2019 14:00	1941	1658	2093	No
44-10	PR363452	304726	10212B	GS012	12/6/2019 14:05	2084	1658	2093	No
44-10	PR321892	304708	10212B	GS008	12/6/2019 8:46	1796	1686	2125	No
44-10	PR321892	304708	10212B	GS008	12/6/2019 8:50	1757	1686	2125	No
44-10	PR321892	304708	10212B	GS008	12/6/2019 8:54	1844	1686	2125	No
44-10	PR321892	304708	10212B	GS008	12/6/2019 8:58	1784	1686	2125	No
44-10	PR321892	304708	10212B	GS008	12/6/2019 9:02	1876	1686	2125	No
44-10	PR321892	304708	10212B	GS002	12/6/2019 9:07	1759	1686	2125	No
44-10	PR321892	304708	10212B	GS002	12/6/2019 9:11	1855	1686	2125	No
44-10	PR321892	304708	10212B	GS002	12/6/2019 9:15	1811	1686	2125	No
44-10	PR321892	304708	10212B	GS002	12/6/2019 9:19	1806	1686	2125	No
44-10	PR321892	304708	10212B	GS002	12/6/2019 9:23	1869	1686	2125	No
44-10	PR321892	304708	10212B	GS003	12/6/2019 10:21	1331	1250	1628	No
44-10	PR321892	304708	10212B	GS003	12/6/2019 10:26	1293	1250	1628	No
44-10	PR321892	304708	10212B	GS003	12/6/2019 10:30	1304	1250	1628	No
44-10	PR321892	304708	10212B	GS003	12/6/2019 10:34	1583	1250	1628	No
44-10	PR321892	304708	10212B	GS003	12/6/2019 10:41	1569	1250	1628	No
44-10	PR321892	304708	10212B	GS003	12/6/2019 13:07	1575	1250	1628	No
44-10	PR321892	304708	10212B	GS003	12/6/2019 13:15	1509	1250	1628	No
44-10	PR321892	304708	10212B	GS003	12/6/2019 13:20	1601	1250	1628	No
44-10	PR321892	304708	10212B	GS003	12/6/2019 13:24	1558	1250	1628	No
44-10	PR321892	304708	10212B	GS003	12/6/2019 13:29	1481	1250	1628	No
44-10	PR321892	304708	10212B	GS001	12/6/2019 13:50	1300	1250	1628	No
44-10	PR321892	304708	10212B	GS001	12/6/2019 13:54	1268	1250	1628	No
44-10	PR321892	304708	10212B	GS001	12/6/2019 13:58	1279	1250	1628	No
44-10	PR321892	304708	10212B	GS001	12/6/2019 14:02	1369	1250	1628	No
44-10	PR321892	304708	10212B	GS001	12/6/2019 14:06	1288	1250	1628	No
44-10	PR321892	304708	10212B	GS001	12/6/2019 14:10	1305	1250	1628	No
44-10	PR321892	304708	10212B	GS001	12/6/2019 14:14	1303	1250	1628	No
44-10	PR321892	304708	10212B	GS001	12/6/2019 14:18	1328	1250	1628	No
44-10	PR321892	304708	10212B	GS001	12/6/2019 14:22	1310	1250	1628	No
44-10	PR321892	304708	10212B	GS001	12/6/2019 14:26	1338	1250	1628	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 8:24	1740	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 8:28	1793	1709	2151	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	10212B	GS019	12/6/2019 8:32	1870	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 8:36	1922	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 8:40	1938	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 8:44	1938	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 8:48	1808	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 8:52	2039	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 8:56	1851	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 9:00	1970	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 9:04	2020	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 9:08	1937	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 9:12	1898	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 9:18	1772	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 9:22	1970	1709	2151	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 9:28	1788	1709	2151	No
44-10	PR363311	304718	10212B	GS018	12/6/2019 10:14	2398	2066	2552	No
44-10	PR363311	304718	10212B	GS018	12/6/2019 10:18	2410	2066	2552	No
44-10	PR363311	304718	10212B	GS018	12/6/2019 10:22	2481	2066	2552	No
44-10	PR363311	304718	10212B	GS018	12/6/2019 10:26	2352	2066	2552	No
44-10	PR363311	304718	10212B	GS018	12/6/2019 10:30	2448	2066	2552	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 13:04	2280	2066	2552	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 13:08	2429	2066	2552	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 13:54	2263	2258	2766	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 13:58	2541	2258	2766	No
44-10	PR363311	304718	10212B	GS019	12/6/2019 14:05	2606	2258	2766	No
44-10	PR311750	266656	10212B	GS005	12/6/2019 9:01	1922	2008	2487	No
44-10	PR311750	266656	10212B	GS005	12/6/2019 9:06	2117	2008	2487	No
44-10	PR311750	266656	10212B	GS005	12/6/2019 9:10	2181	2008	2487	No
44-10	PR311750	266656	10212B	GS005	12/6/2019 9:14	2235	2008	2487	No
44-10	PR311750	266656	10212B	GS005	12/6/2019 9:18	2410	2008	2487	No
44-10	PR311750	266656	10212B	GS007	12/6/2019 10:20	2540	2375	2895	No
44-10	PR311750	266656	10212B	GS007	12/6/2019 10:24	2431	2375	2895	No
44-10	PR311750	266656	10212B	GS007	12/6/2019 10:28	2630	2375	2895	No
44-10	PR311750	266656	10212B	GS007	12/6/2019 10:33	2520	2375	2895	No
44-10	PR311750	266656	10212B	GS007	12/6/2019 10:37	2693	2375	2895	No
44-10	PR311750	266656	10212B	GS011	12/6/2019 13:21	2669	2405	2929	No
44-10	PR311750	266656	10212B	GS011	12/6/2019 13:25	2558	2405	2929	No
44-10	PR311750	266656	10212B	GS011	12/6/2019 13:29	2580	2405	2929	No
44-10	PR311750	266656	10212B	GS011	12/6/2019 13:33	2581	2405	2929	No
44-10	PR311750	266656	10212B	GS011	12/6/2019 13:37	2738	2405	2929	No
44-10	PR311750	266656	10212B	GS016	12/6/2019 13:54	2151	1968	2442	No
44-10	PR311750	266656	10212B	GS016	12/6/2019 13:58	2080	1968	2442	No
44-10	PR311750	266656	10212B	GS016	12/6/2019 14:02	2297	1968	2442	No
44-10	PR311750	266656	10212B	GS016	12/6/2019 14:06	2392	1968	2442	No
44-10	PR311750	266656	10212B	GS016	12/6/2019 14:10	2226	1968	2442	No
44-10	PR363452	304726	10212B	GS004	12/9/2019 10:01	1662	1354	1748	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
QC REPLICATE SCANS									
44-10	PR363311	304718	10212B	GS006	12/6/2019 14:24	1443	1150	1513	No
44-10	PR363311	304718	10212B	GS006	12/6/2019 14:28	1345	1150	1513	No
44-10	PR363311	304718	10212B	GS006	12/6/2019 14:32	1308	1150	1513	No
44-10	PR363311	304718	10212B	GS006	12/6/2019 14:36	1323	1150	1513	No
44-10	PR363311	304718	10212B	GS006	12/6/2019 14:40	1287	1150	1513	No
44-10	PR363311	304718	10212B	GS006	12/6/2019 14:44	1305	1150	1513	No
44-10	PR363311	304718	10212B	GS006	12/6/2019 14:48	1261	1150	1513	No
44-10	PR363311	304718	10212B	GS006	12/6/2019 14:52	1174	1150	1513	No
44-10	PR363311	304718	10212B	GS006	12/6/2019 14:56	1234	1150	1513	No
44-10	PR363311	304718	10212B	GS006	12/6/2019 15:00	1170	1150	1513	No

ATTACHMENT 3

CONSULTATION TRIGGERS FOR RESIDENTIAL AND COMMERCIAL/INDUSTRIAL SOIL CONTAMINATION

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

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

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

ATTACHMENT 4
SIGN TEST

ZION SOLUTIONS LLC
An EnergySolutions Company

Attachment 12
Sign Statistical Test

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

Survey Area: No. 10200 **Description:** Radiological Restricted Area Grounds
Survey Unit: No. 10212B **Description:** VCC Construction Area
Classification: 3 **Type I (α) Error:** 0.05 **Number of Samples:** 17

#	Fraction of the Release Criterion						Weighted Sum (W_s)	1-W_s	Sign
	Radionuclides of Concern					Activity or SOF (as applicable)			
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90				
1	9.99E-03	7.33E-03	1.18E-03	2.15E-03	2.77E-06	SOF	0.021	0.979	+
2	3.75E-02	2.12E-02	1.45E-02	8.07E-03	3.39E-05	SOF	0.081	0.919	+
3	7.17E-03	0.00E+00	8.95E-03	1.54E-03	2.10E-05	SOF	0.018	0.982	+
4	1.87E-02	0.00E+00	2.16E-03	4.03E-03	5.07E-06	SOF	0.025	0.975	+
5	1.08E-02	1.29E-02	3.77E-03	2.33E-03	8.85E-06	SOF	0.030	0.970	+
6	5.85E-03	1.94E-02	0.00E+00	1.26E-03	0.00E+00	SOF	0.027	0.973	+
7	4.47E-02	6.98E-03	7.05E-03	9.63E-03	1.65E-05	SOF	0.068	0.932	+
8	0.00E+00	2.08E-03	1.30E-02	0.00E+00	3.04E-05	SOF	0.015	0.985	+
9	8.20E-03	0.00E+00	4.55E-03	1.77E-03	1.07E-05	SOF	0.015	0.985	+
10	2.29E-02	4.89E-03	0.00E+00	4.93E-03	0.00E+00	SOF	0.033	0.967	+
11	6.34E-02	7.33E-03	1.28E-02	1.37E-02	3.00E-05	SOF	0.097	0.903	+
12	9.90E-03	5.30E-03	8.65E-03	2.13E-03	2.03E-05	SOF	0.026	0.974	+
13	1.93E-02	6.92E-03	8.93E-03	4.16E-03	2.09E-05	SOF	0.039	0.961	+
14	0.00E+00	7.44E-03	4.71E-03	0.00E+00	1.11E-05	SOF	0.012	0.988	+
15	4.34E-02	0.00E+00	8.21E-03	9.33E-03	1.93E-05	SOF	0.061	0.939	+
16	1.83E-02	1.78E-02	7.99E-03	3.95E-03	1.87E-05	SOF	0.048	0.952	+
17	2.07E-02	1.86E-02	3.69E-03	4.46E-03	8.66E-06	SOF	0.048	0.952	+

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

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

Prepared By (RE): R.J. Mandic / [signature] 1-26-20
(Print Name) (Signature) (Date)

Peer Reviewed By (RE): G. Wood / [signature] 01-27-20
(Print Name) (Signature) (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #:	10200	Survey Unit #:	10212B	Survey Unit Name:	VCC Construction Area
Sample Plan#:		L3-10212B-F			

Sample Description: Comparison of split samples collected from systematic surface soil sample location #2 and investigation sample location #1 and analyzed using gamma spectroscopy by on-site HPGe system. The standard/comparison samples were L3-10212B-FSGS-002-SS/ L3-10212B-FQGS-002-SS and L3-10212B-FIGS-001-SS/ L3-10212B-QIGS-001-SS.

	STANDARD				COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
Systematic Sample #2								
K-40	6.49E+00	5.53E-01	11.74	0.6 - 1.66	6.97E+00	5.41E-01	0.93	Y
Investigation Sample #1								
K-40	4.10E+00	3.63E-01	11.29	0.6 - 1.66	3.78E+00	3.51E-01	1.08	Y

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

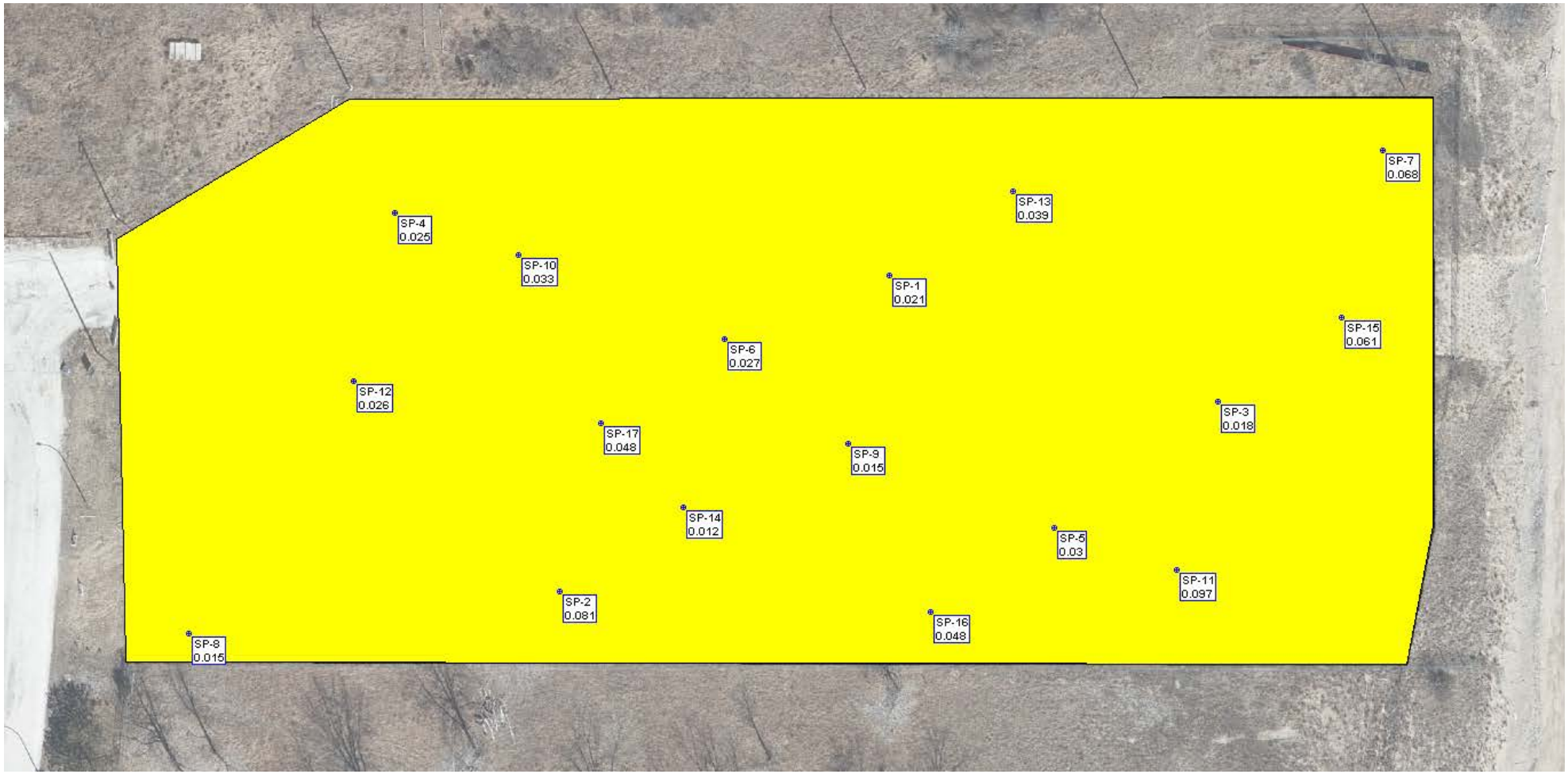
Table 4-1 from the QAPP is reproduced below to show acceptance criteria used to assess split samples.

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

Performed by:	Date:	Reveiwed by:	Date:
R.J. Mandic / [signature]	1-26-20	G. Wood / [signature]	01-27-20

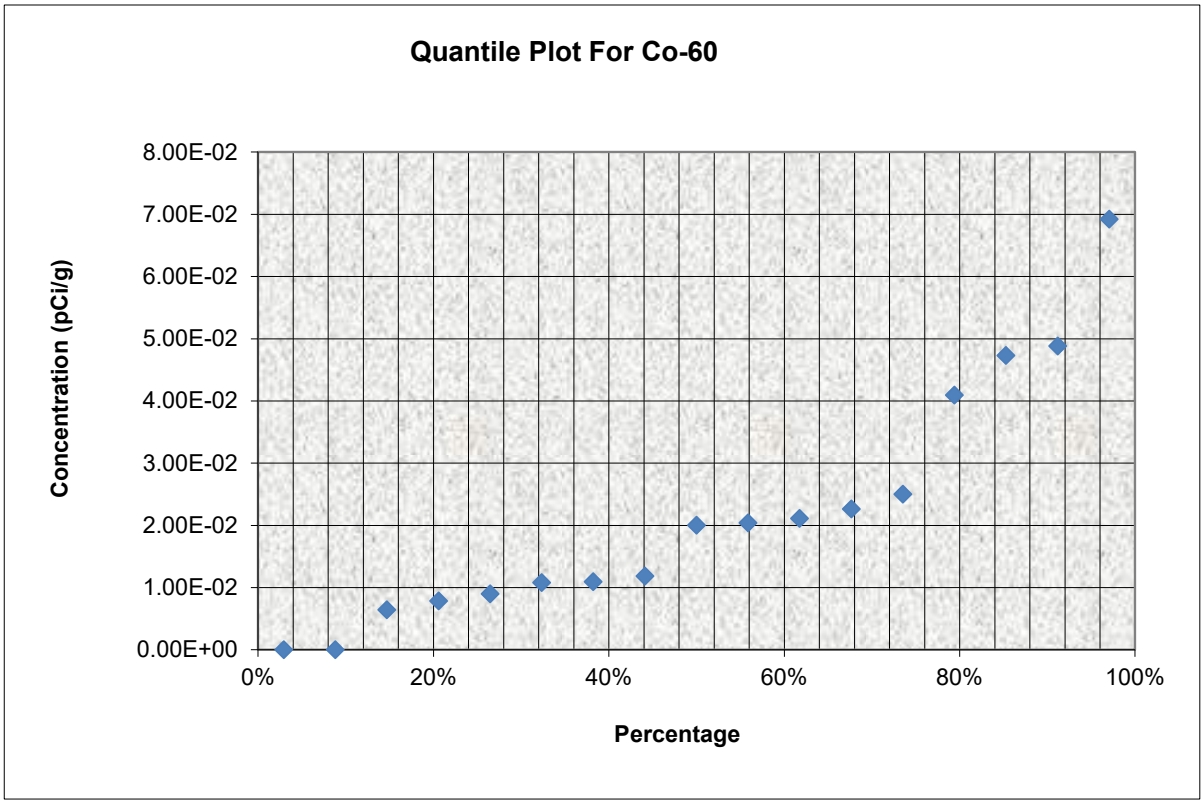
ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot



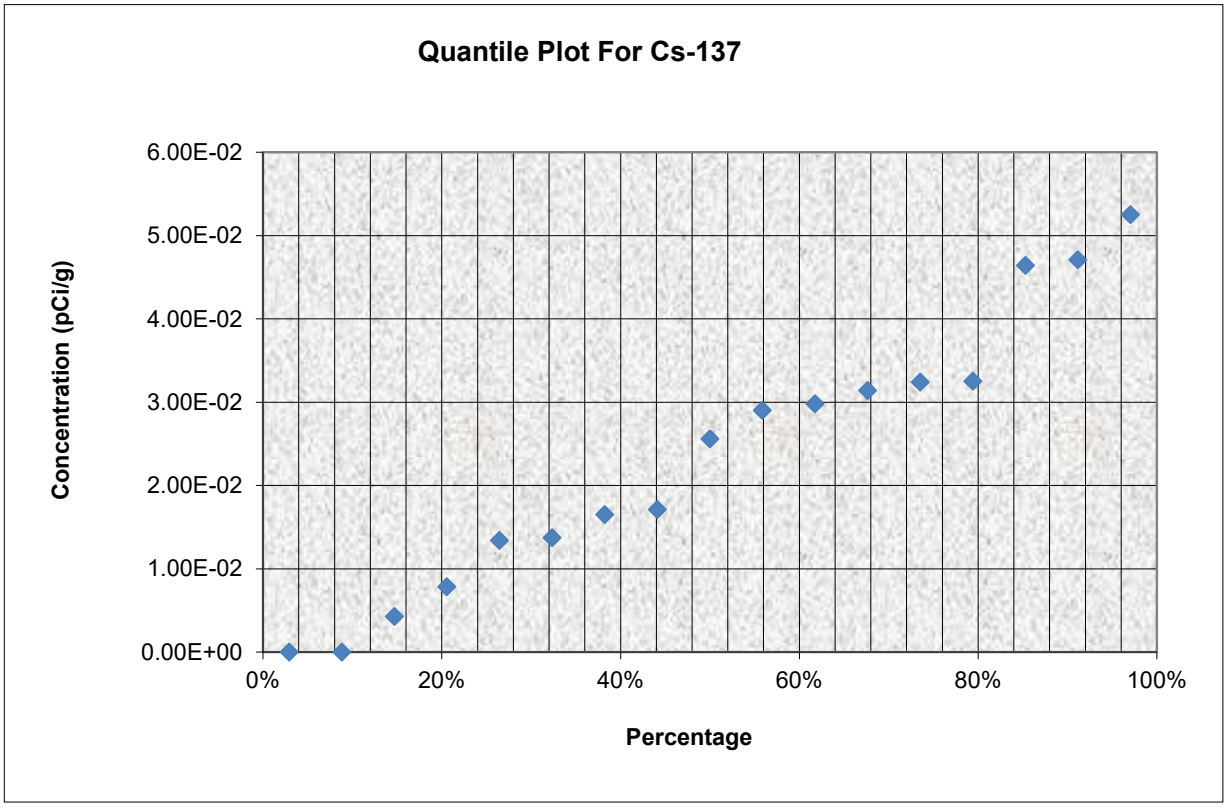
QUANTILE PLOT FOR Co-60

Survey Unit: 10212B
Survey Unit Name: VCC Construction Area
Mean: 2.19E-02 pCi/g



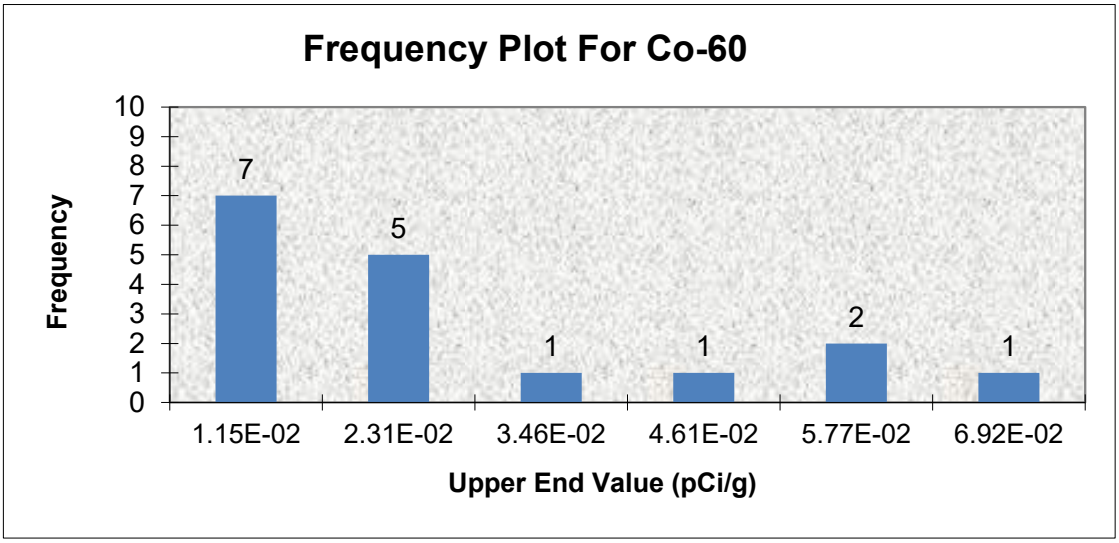
QUANTILE PLOT FOR Cs-137

Survey Unit: 10212B
Survey Unit Name: VCC Construction Area
Mean: 2.35E-02 pCi/g



HISTOGRAM FOR Co-60

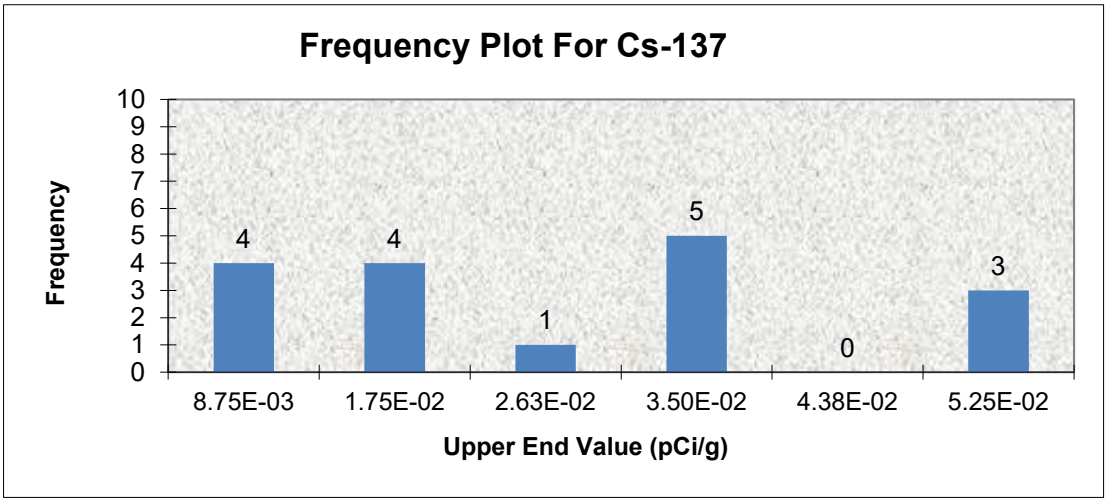
Survey Unit: 10212B
Survey Unit Name: VCC Construction Area
Mean: 2.19E-02 pCi/g
Median: 2.00E-02 pCi/g
ST DEV: 0.019
Skew: 1.156



Upper Value	Observation Frequency	Observation %
1.15E-02	7	41%
2.31E-02	5	29%
3.46E-02	1	6%
4.61E-02	1	6%
5.77E-02	2	12%
6.92E-02	1	6%
TOTAL	17	100%

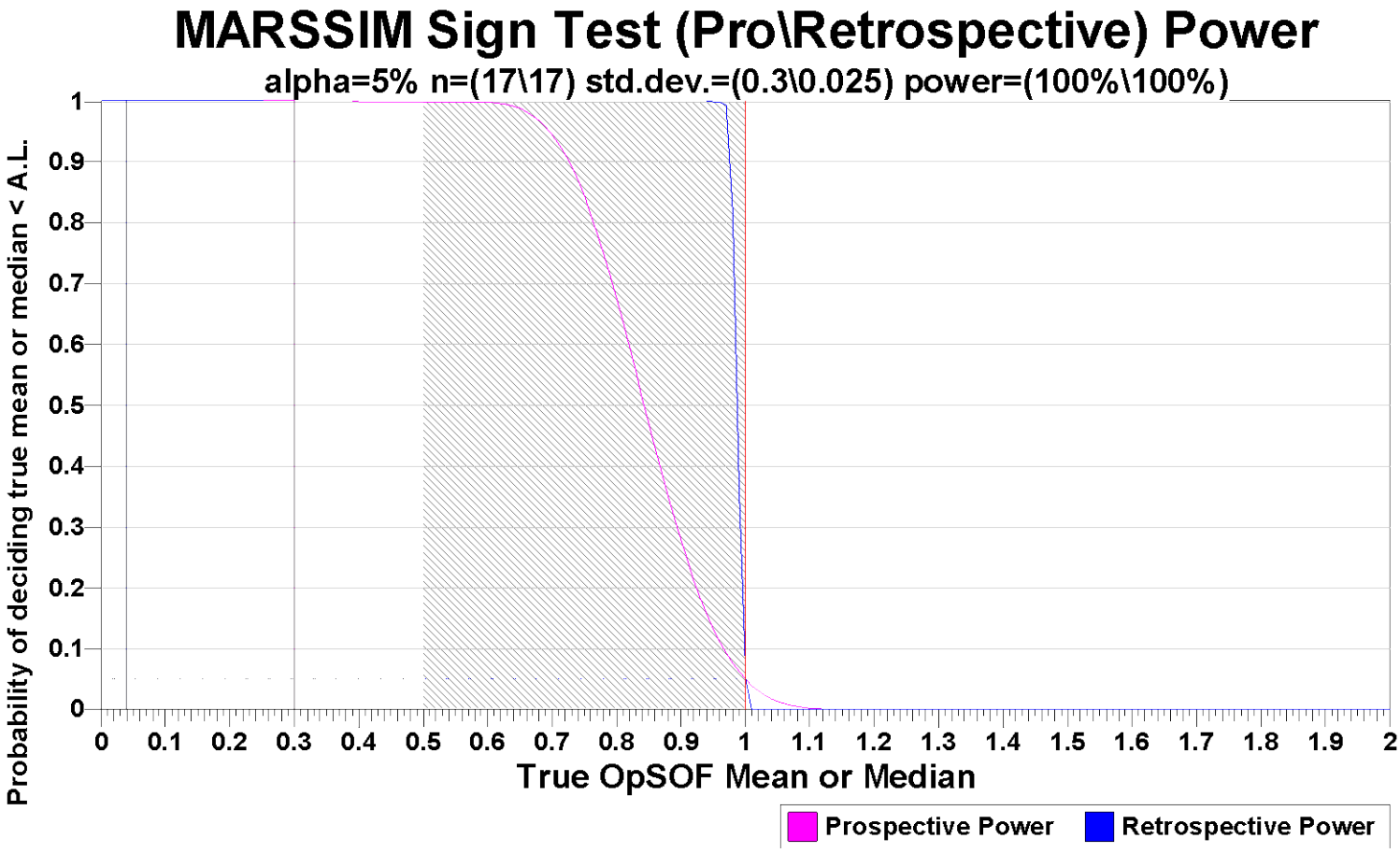
HISTOGRAM FOR Cs-137

Survey Unit: 10212B
Survey Unit Name: VCC Construction Area
Mean: 2.35E-02 pCi/g
Median: 2.56E-02 pCi/g
ST DEV: 0.016
Skew: 0.205



Upper Value	Observation Frequency	Observation %
8.75E-03	4	24%
1.75E-02	4	24%
2.63E-02	1	6%
3.50E-02	5	29%
4.38E-02	0	0%
5.25E-02	3	18%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Unit 10212B



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 10-Dec-19-10001

L3-10212B-FRGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10001
Sample Description	: L3-10212B-FRGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.463E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:00:00AM
Acquisition Started	: 12/10/2019 8:10:58AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81927
Fill Height	: 1462.59 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 8:26:01AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10001

L3-10212B-FRGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.78	473 -	482	477.75	6.21E+01	16.42	8.89E+01	1.35
2	295.43	586 -	594	590.92	3.85E+01	10.38	3.25E+01	0.95
3	351.96	698 -	708	703.86	6.05E+01	13.14	4.65E+01	0.83
4	609.20	1212 -	1223	1217.97	7.45E+01	9.66	7.50E+00	1.15
5	1460.68	2915 -	2928	2921.41	1.31E+02	12.07	5.37E+00	2.33

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	2.49E+00	2.54E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	8.78E-02	2.43E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.87E-01	2.67E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		

Analysis Report for 10-Dec-19-10001

L3-10212B-FRGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.45E-01	4.09E-02
		351.93	*	35.60	1.34E-01	3.10E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	2.49E+00	2.54E-01	
X	Bi-211	0.881			
	Pb-212	0.997	8.78E-02	2.43E-02	
	Bi-214	0.999	1.87E-01	2.67E-02	
	Pb-214	0.998	1.38E-01	2.47E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10001

L3-10212B-FRGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 8:26:01AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	2.77E-02	4.42E-02	4.42E-02
	BE-7	477.60		10.44	8.87E-02	2.74E-01	2.74E-01
+	K-40	1460.82	*	10.66	2.49E+00	3.05E-01	3.05E-01
	Mn-54	834.85		99.98	1.42E-02	3.26E-02	3.26E-02
	Co-60	1173.23		99.85	-4.37E-03	3.53E-02	3.53E-02
		1332.49		99.98	1.09E-02		3.70E-02
	Nb-94	702.65		99.81	-1.29E-02	3.18E-02	3.25E-02
		871.09		99.89	-2.25E-04		3.18E-02
	Ag-108m	79.13		6.60	5.85E-01	2.79E-02	9.89E-01
		433.94		90.50	1.01E-02		2.79E-02
		614.28		89.80	-2.17E-02		4.52E-02
		722.94		90.80	-4.21E-04		3.42E-02
	Sb-125	176.31		6.84	1.70E-01	9.76E-02	4.38E-01
		380.45		1.52	3.57E-01		1.90E+00
		427.87		29.60	5.15E-02		9.76E-02
		463.36		10.49	1.50E-02		2.48E-01
		600.60		17.65	3.53E-02		1.62E-01
		606.71		4.98	-1.34E-01		1.10E+00
		635.95		11.22	1.24E-01		2.76E-01

Analysis Report for 10-Dec-19-10001

L3-10212B-FRGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.10E+00	9.76E-02	1.46E+00
Ba-133	79.61	2.65	1.00E+00	6.32E-02	2.35E+00
	81.00	32.90	-1.75E-01		1.50E-01
	276.40	7.16	-1.61E-01		3.25E-01
	302.85	18.34	-3.09E-02		1.42E-01
	356.01	62.05	-1.16E-02		6.32E-02
	383.85	8.94	-2.31E-02		3.21E-01
Cs-134	475.36	1.48	1.33E-01	4.03E-02	1.88E+00
	563.25	8.34	-3.19E-02		3.30E-01
	569.33	15.37	-7.31E-02		1.61E-01
	604.72	97.62	-5.01E-03		4.87E-02
	795.86	85.46	1.27E-02		4.03E-02
	801.95	8.69	-1.65E-01		3.06E-01
	1038.61	0.99	1.84E+00		3.40E+00
	1167.97	1.79	-7.79E-01		2.09E+00
	1365.19	3.02	-3.77E-01		9.97E-01
Cs-137	661.66	85.10	4.28E-03	3.52E-02	3.52E-02
Eu-152	121.78	28.67	5.54E-02	1.02E-01	1.02E-01
	244.70	7.61	1.42E-02		4.06E-01
	295.94	0.45	3.41E+00		7.37E+00
	344.28	26.60	-1.27E-01		1.05E-01
	367.79	0.86	7.12E-01		3.23E+00
	411.12	2.24	-3.25E-01		1.16E+00
	443.96	2.83	-2.36E-01		8.44E-01
	488.68	0.42	8.20E-01		6.73E+00
	563.99	0.49	-8.57E-01		5.60E+00
	586.26	0.46	6.48E+00		9.05E+00
	678.62	0.47	8.14E-01		6.31E+00
	688.67	0.86	8.33E-02		3.42E+00
	719.35	0.28	9.98E-01		1.03E+01
	778.90	12.96	-1.81E-02		2.62E-01
	810.45	0.32	6.21E+00		1.13E+01
	867.37	4.26	-7.06E-02		8.38E-01
	919.33	0.43	2.91E+00		8.11E+00
	964.08	14.65	-3.13E-02		2.67E-01
	1085.87	10.24	-1.25E-01		3.28E-01
	1089.74	1.73	2.24E-01		2.01E+00
	1112.07	13.69	-2.29E-01		2.22E-01
	1212.95	1.43	-7.00E-02		3.36E+00
	1249.94	0.19	6.59E+00		1.74E+01
	1299.14	1.63	-1.09E+00		1.68E+00
	1408.01	21.07	1.88E-02		1.28E-01
	1457.64	0.50	-3.06E+00		2.40E+01
	1528.10	0.28	-1.86E-01		1.09E+01
Eu-154	123.07	40.40	1.73E-02	7.03E-02	7.03E-02
	247.93	6.89	3.52E-02		3.88E-01
	591.76	4.95	-1.49E-01		5.96E-01
	692.42	1.78	0.00E+00		1.66E+00
	723.30	20.06	3.15E-02		1.61E-01
	756.80	4.52	-1.45E-01		6.05E-01
	873.18	12.08	-1.31E-02		2.56E-01

Analysis Report for 10-Dec-19-10001

L3-10212B-FRGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.73E-02	7.03E-02	3.03E-01
	1004.76	18.01	9.63E-02		2.23E-01
	1274.43	34.80	1.19E-02		1.03E-01
	1596.48	1.80	-2.42E-01		1.88E+00
Eu-155	45.30	1.31	-3.69E+00	1.34E-01	7.77E+00
	60.01	1.22	-1.82E+00		9.84E+00
	86.55	30.70	-6.06E-02		1.34E-01
	105.31	21.10	-6.97E-02		1.39E-01
Ra-226	186.21	3.64	2.77E-01	8.12E-01	8.12E-01
Pa-231	27.36	10.30	5.54E-01	9.76E-01	9.76E-01
	283.69	1.70	1.08E-02		1.51E+00
	300.07	2.47	-3.40E-01		1.09E+00
	302.65	2.20	-2.58E-01		1.18E+00
	330.06	1.40	-4.54E-01		1.98E+00
U-235	143.76	10.96	1.27E-02	5.20E-02	2.42E-01
	163.33	5.08	-1.38E-01		5.81E-01
	185.71	57.20	1.31E-02		5.20E-02
	202.11	1.08	-5.59E-01		2.40E+00
	205.31	5.01	-3.11E-01		5.11E-01
Am-241	59.54	35.90	-8.44E-02	3.44E-01	3.44E-01

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

Apex-Gamma

Analysis Report for 10-Dec-19-10002

L3-10212B-FRGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10002
Sample Description	: L3-10212B-FRGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.021E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:02:00AM
Acquisition Started	: 12/10/2019 8:11:36AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.2 seconds
Dead Time	: 0.13 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81928
Fill Height	: 1020.72 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 8:26:40AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10002

L3-10212B-FRGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	76.87	306 -	314	308.21	2.78E+01	9.96	3.22E+01	0.60
2	238.70	946 -	961	954.89	7.21E+01	16.22	6.29E+01	0.93
3	351.91	1400 -	1412	1407.39	6.51E+01	11.67	2.69E+01	0.67
4	582.90	2326 -	2337	2330.80	3.00E+01	6.91	7.03E+00	0.67
5	609.19	2428 -	2441	2435.94	5.39E+01	9.33	1.21E+01	0.56
6	910.97	3637 -	3647	3642.84	2.16E+01	5.88	5.40E+00	0.37
7	969.07	3870 -	3881	3875.25	1.60E+01	5.58	6.00E+00	0.67
8	1460.57	5833 -	5852	5842.11	2.20E+02	16.14	1.19E+01	1.44

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.49E+00	5.53E-01
Tl-208	0.98	583.19	*	85.00	5.79E-02	1.38E-02
Bi-211	0.89	351.07	*	13.02	5.70E-01	1.12E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.46E-01	3.49E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.73E-01	1.39E-01
		87.35		3.97		

Analysis Report for 10-Dec-19-10002

L3-10212B-FRGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.01E-01	3.68E-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		
		351.93	*	35.60	2.09E-01	4.10E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	6.58E-01	2.47E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.88E-01	5.19E-02
		964.77		4.99		
		968.97	*	15.80	2.38E-01	8.35E-02
		1588.20		3.22		

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

Analysis Report for 10-Dec-19-10002

L3-10212B-FRGS-002SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.990	6.49E+00	5.53E-01	
	Tl-208	0.987	5.79E-02	1.38E-02	
?	Bi-211	0.892	5.70E-01	1.12E-01	
	Pb-212	0.999	1.46E-01	3.49E-02	
?	Pb212-XR	0.995	3.73E-01	1.39E-01	
	Bi-214	0.999	2.01E-01	3.68E-02	
?	Pb-214	1.000	2.09E-01	4.10E-02	
?	Pb214-XR	0.995	6.58E-01	2.47E-01	
	Ac-228	0.997	2.02E-01	4.41E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10002

L3-10212B-FRGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 8:26:40AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.38E-02	5.97E-02	5.97E-02
	BE-7	477.60		10.44	2.76E-02	3.91E-01	3.91E-01
+	K-40	1460.82	*	10.66	6.49E+00	7.20E-01	7.20E-01
	Mn-54	834.85		99.98	3.33E-02	5.78E-02	5.78E-02
	Co-60	1173.23		99.85	-3.14E-02	6.09E-02	7.07E-02
		1332.49		99.98	4.09E-02		6.09E-02
	Nb-94	702.65		99.81	4.22E-03	4.93E-02	5.71E-02
		871.09		99.89	-4.05E-02		4.93E-02
	Ag-108m	79.13		6.60	1.38E-01	4.59E-02	1.71E+00
		433.94		90.50	-1.92E-02		4.59E-02
		614.28		89.80	-1.14E-01		6.44E-02
		722.94		90.80	1.37E-02		5.85E-02
	Sb-125	176.31		6.84	7.03E-02	1.59E-01	6.06E-01
		380.45		1.52	-6.19E-01		2.83E+00
		427.87		29.60	1.06E-01		1.59E-01
		463.36		10.49	1.96E-01		4.94E-01
		600.60		17.65	-1.88E-02		2.60E-01
		606.71		4.98	1.49E+00		1.61E+00
		635.95		11.22	5.32E-02		3.62E-01

Analysis Report for 10-Dec-19-10002

L3-10212B-FRGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.21E+00	1.59E-01	2.57E+00
Ba-133	79.61	2.65	4.37E-01	8.88E-02	3.91E+00
	81.00	32.90	-4.14E-02		2.69E-01
	276.40	7.16	-8.80E-02		6.00E-01
	302.85	18.34	-9.72E-03		2.41E-01
	356.01	62.05	-4.44E-02		8.88E-02
	383.85	8.94	2.86E-02		5.10E-01
Cs-134	475.36	1.48	-9.12E-01	6.65E-02	2.80E+00
	563.25	8.34	2.07E-01		6.24E-01
	569.33	15.37	-8.76E-03		2.92E-01
	604.72	97.62	8.23E-03		7.58E-02
	795.86	85.46	3.67E-02		6.65E-02
	801.95	8.69	1.72E-01		5.75E-01
	1038.61	0.99	2.97E+00		7.26E+00
	1167.97	1.79	-7.63E-01		3.47E+00
	1365.19	3.02	7.91E-01		1.63E+00
Cs-137	661.66	85.10	5.25E-02	7.70E-02	7.70E-02
Eu-152	121.78	28.67	3.98E-02	1.36E-01	1.74E-01
	244.70	7.61	4.65E-01		6.47E-01
	295.94	0.45	5.69E+00		1.11E+01
	344.28	26.60	-2.60E-02		1.36E-01
	367.79	0.86	-3.31E+00		3.87E+00
	411.12	2.24	1.77E+00		2.14E+00
	443.96	2.83	8.29E-01		1.59E+00
	488.68	0.42	7.41E+00		1.13E+01
	563.99	0.49	3.27E-01		1.06E+01
	586.26	0.46	-6.93E+00		1.28E+01
	678.62	0.47	-1.70E+00		9.42E+00
	688.67	0.86	2.42E+00		5.34E+00
	719.35	0.28	1.12E+00		1.80E+01
	778.90	12.96	1.54E-01		3.94E-01
	810.45	0.32	3.70E+00		1.42E+01
	867.37	4.26	-4.15E-01		1.24E+00
	919.33	0.43	4.71E+00		1.34E+01
	964.08	14.65	9.31E-02		5.71E-01
	1085.87	10.24	-3.41E-01		5.62E-01
	1089.74	1.73	1.84E-01		3.42E+00
	1112.07	13.69	-6.61E-01		4.59E-01
	1212.95	1.43	-3.21E+00		5.51E+00
	1249.94	0.19	3.40E+01		3.83E+01
	1299.14	1.63	-2.23E-01		4.30E+00
	1408.01	21.07	3.85E-02		2.72E-01
	1457.64	0.50	1.52E+02		4.85E+01
	1528.10	0.28	-2.08E+01		1.57E+01
Eu-154	123.07	40.40	-4.86E-02	1.20E-01	1.20E-01
	247.93	6.89	1.60E-01		6.16E-01
	591.76	4.95	-4.28E-02		7.98E-01
	692.42	1.78	-1.25E+00		2.70E+00
	723.30	20.06	7.57E-02		2.65E-01
	756.80	4.52	2.60E-01		1.08E+00
	873.18	12.08	-2.07E-01		4.08E-01

Analysis Report for 10-Dec-19-10002

L3-10212B-FRGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	4.25E-01	1.20E-01	6.13E-01
	1004.76	18.01	-3.74E-02		3.25E-01
	1274.43	34.80	8.35E-02		2.11E-01
	1596.48	1.80	4.77E-01		2.74E+00
Eu-155	45.30	1.31	-1.02E+01	2.60E-01	2.95E+01
	60.01	1.22	1.92E+01		3.47E+01
	86.55	30.70	1.07E-01		2.60E-01
	105.31	21.10	-3.20E-02		2.75E-01
Ra-226	186.21	3.64	5.22E-01	1.26E+00	1.26E+00
Pa-231	27.36	10.30	4.06E+00	1.74E+00	3.62E+00
	283.69	1.70	6.99E-01		2.51E+00
	300.07	2.47	-1.51E+00		1.74E+00
	302.65	2.20	7.97E-01		2.02E+00
	330.06	1.40	2.08E+00		3.08E+00
U-235	143.76	10.96	-1.28E-01	8.06E-02	3.87E-01
	163.33	5.08	1.76E-01		8.10E-01
	185.71	57.20	5.35E-02		8.06E-02
	202.11	1.08	7.46E-01		4.00E+00
	205.31	5.01	-6.92E-01		7.69E-01
Am-241	59.54	35.90	7.40E-01	1.25E+00	1.25E+00

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

Apex-Gamma

Analysis Report for 10-Dec-19-10003

L3-10212B-FQGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10003
Sample Description	: L3-10212B-FQGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.126E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:02:00AM
Acquisition Started	: 12/10/2019 8:29:37AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.3 seconds
Dead Time	: 0.14 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81932
Fill Height	: 1125.96 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 8:44:41AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10003

L3-10212B-FQGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.95	740 -	748	744.08	2.56E+01	10.10	3.54E+01	0.52
2	238.58	947 -	960	954.42	1.31E+02	17.29	6.12E+01	0.91
3	295.17	1174 -	1185	1180.59	4.90E+01	11.79	3.60E+01	0.48
4	351.90	1400 -	1415	1407.34	1.01E+02	13.87	3.02E+01	1.16
5	583.15	2326 -	2338	2331.82	4.99E+01	8.80	1.01E+01	1.06
6	609.20	2429 -	2443	2435.98	6.78E+01	10.32	1.32E+01	0.73
7	1460.60	5833 -	5853	5842.24	2.49E+02	16.02	2.35E+00	1.40

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.97E+00	5.41E-01
Tl-208	1.00	583.19	*	85.00	9.21E-02	1.72E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.54E-01	3.94E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.41E-01	3.95E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Dec-19-10003

L3-10212B-FQGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.55E-01	6.47E-02
		351.93	*	35.60	3.09E-01	4.93E-02
		785.96		1.06		
Ra-226	0.98	186.21	*	3.64	5.30E-01	2.13E-01
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.37E-02	1.36E-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
	K-40	0.992	6.97E+00	5.41E-01	
	Tl-208	1.000	9.21E-02	1.72E-02	
X	Bi-211	0.895			
	Pb-212	1.000	2.54E-01	3.94E-02	

Analysis Report for 10-Dec-19-10003

L3-10212B-FQGS-002SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	Bi-214	0.999	2.41E-01	3.95E-02	
	Pb-214	1.000	2.89E-01	3.92E-02	
?	Ra-226	0.989	5.30E-01	2.13E-01	
?	U-235	0.994	3.37E-02	1.36E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10003

L3-10212B-FQGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 8:44:41AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	5.54E-02	6.35E-02	6.35E-02
	BE-7	477.60		10.44	5.06E-02	4.13E-01	4.13E-01
+	K-40	1460.82	*	10.66	6.97E+00	3.48E-01	3.48E-01
	Mn-54	834.85		99.98	-2.38E-02	5.22E-02	5.22E-02
	Co-60	1173.23		99.85	3.51E-02	4.80E-02	6.98E-02
		1332.49		99.98	-1.04E-02		4.80E-02
	Nb-94	702.65		99.81	-4.01E-02	4.81E-02	4.81E-02
		871.09		99.89	9.31E-03		5.26E-02
	Ag-108m	79.13		6.60	1.72E+00	5.36E-02	2.01E+00
		433.94		90.50	-1.59E-02		5.36E-02
		614.28		89.80	-5.20E-02		7.20E-02
		722.94		90.80	9.73E-03		6.11E-02
	Sb-125	176.31		6.84	-2.75E-01	1.46E-01	5.88E-01
		380.45		1.52	-1.32E+00		2.70E+00
		427.87		29.60	-3.75E-02		1.46E-01
		463.36		10.49	3.48E-01		4.27E-01
		600.60		17.65	1.13E-01		2.88E-01
		606.71		4.98	2.88E+00		1.66E+00
		635.95		11.22	1.02E-01		4.40E-01

Analysis Report for 10-Dec-19-10003

L3-10212B-FQGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.54E+00	1.46E-01	2.19E+00
Ba-133	79.61	2.65	-3.55E-01	8.51E-02	4.56E+00
	81.00	32.90	-5.56E-01		2.97E-01
	276.40	7.16	9.74E-02		5.83E-01
	302.85	18.34	-1.43E-01		2.01E-01
	356.01	62.05	-1.59E-02		8.51E-02
	383.85	8.94	-4.47E-01		4.52E-01
Cs-134	475.36	1.48	-3.00E-01	5.42E-02	2.91E+00
	563.25	8.34	3.76E-01		6.44E-01
	569.33	15.37	-3.50E-01		2.60E-01
	604.72	97.62	-2.16E-02		7.56E-02
	795.86	85.46	-1.73E-02		5.42E-02
	801.95	8.69	1.13E-02		5.60E-01
	1038.61	0.99	1.86E+00		6.48E+00
	1167.97	1.79	-7.10E-02		3.75E+00
	1365.19	3.02	8.46E-01		1.62E+00
Cs-137	661.66	85.10	3.23E-02	7.41E-02	7.41E-02
Eu-152	121.78	28.67	6.05E-02	1.36E-01	1.67E-01
	244.70	7.61	4.38E-01		6.37E-01
	295.94	0.45	1.52E+01		1.24E+01
	344.28	26.60	2.77E-02		1.36E-01
	367.79	0.86	-1.37E+00		4.73E+00
	411.12	2.24	-7.59E-01		1.90E+00
	443.96	2.83	-5.21E-01		1.39E+00
	488.68	0.42	3.21E+00		1.04E+01
	563.99	0.49	-4.40E-01		1.05E+01
	586.26	0.46	-8.22E+00		1.55E+01
	678.62	0.47	4.62E+00		1.11E+01
	688.67	0.86	1.13E+00		5.51E+00
	719.35	0.28	-9.11E-01		1.75E+01
	778.90	12.96	8.25E-02		4.44E-01
	810.45	0.32	-1.09E+01		1.24E+01
	867.37	4.26	-7.85E-01		1.15E+00
	919.33	0.43	-4.20E+00		1.23E+01
	964.08	14.65	8.45E-02		5.05E-01
	1085.87	10.24	-3.61E-01		5.21E-01
	1089.74	1.73	-8.61E-01		2.73E+00
	1112.07	13.69	-4.02E-01		4.17E-01
	1212.95	1.43	1.05E+00		5.49E+00
	1249.94	0.19	5.30E+00		3.57E+01
	1299.14	1.63	2.06E+00		4.00E+00
	1408.01	21.07	1.63E-01		3.28E-01
	1457.64	0.50	1.53E+02		4.74E+01
	1528.10	0.28	-2.19E+00		1.23E+01
Eu-154	123.07	40.40	5.56E-02	1.16E-01	1.16E-01
	247.93	6.89	5.62E-01		6.15E-01
	591.76	4.95	4.84E-01		1.00E+00
	692.42	1.78	-2.78E-01		2.86E+00
	723.30	20.06	9.73E-02		2.77E-01
	756.80	4.52	-1.98E-01		1.28E+00
	873.18	12.08	-1.55E-01		4.18E-01

Analysis Report for 10-Dec-19-10003

L3-10212B-FQGS-002SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	7.05E-02	1.16E-01	5.63E-01
		1004.76		18.01	3.00E-02		3.03E-01
		1274.43		34.80	-1.63E-01		2.04E-01
		1596.48		1.80	-6.15E-01		3.22E+00
	Eu-155	45.30		1.31	1.10E+01	2.73E-01	3.15E+01
		60.01		1.22	-2.21E+01		3.03E+01
		86.55		30.70	-1.49E-01		2.78E-01
		105.31		21.10	-2.67E-02		2.73E-01
+	Ra-226	186.21	*	3.64	5.30E-01	6.72E-01	6.72E-01
	Pa-231	27.36		10.30	2.18E+00	1.64E+00	3.46E+00
		283.69		1.70	9.50E-01		2.42E+00
		300.07		2.47	-1.43E+00		1.64E+00
		302.65		2.20	-6.91E-01		1.74E+00
		330.06		1.40	-1.17E+00		3.07E+00
+	U-235	143.76		10.96	2.33E-01	4.28E-02	4.12E-01
		163.33		5.08	-7.79E-01		7.69E-01
		185.71	*	57.20	3.37E-02		4.28E-02
		202.11		1.08	1.00E+00		3.90E+00
		205.31		5.01	-1.11E+00		7.62E-01
	Am-241	59.54		35.90	1.05E-01	1.13E+00	1.13E+00

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

Apex-Gamma

Analysis Report for 10-Dec-19-10004

L3-10212B-FRGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10004
Sample Description	: L3-10212B-FRGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.457E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:04:00AM
Acquisition Started	: 12/10/2019 8:12:02AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81929
Fill Height	: 1457.26 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 8:27:05AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 12/10/19 - 1500

T Graham

Analysis Report for 10-Dec-19-10004

L3-10212B-FRGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.73	947 -	960	954.49	8.15E+01	13.70	3.85E+01	1.05
2	295.31	1175 -	1185	1180.52	3.03E+01	8.98	2.07E+01	0.74
3	582.99	2323 -	2335	2330.06	2.97E+01	7.70	1.13E+01	0.45
4	609.24	2429 -	2442	2435.02	3.27E+01	7.47	8.33E+00	0.94
5	1460.27	5827 -	5849	5839.00	1.37E+02	12.63	5.75E+00	1.60

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.95	1460.82	*	10.66	3.13E+00	3.18E-01
Tl-208	0.99	583.19	*	85.00	4.52E-02	1.20E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.31E-01	2.44E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	9.58E-02	2.27E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		

Analysis Report for 10-Dec-19-10004

L3-10212B-FRGS-003SS

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	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		

* = 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	0.952	3.13E+00	3.18E-01	
Tl-208	0.994	4.52E-02	1.20E-02	
Pb-212	0.999	1.31E-01	2.44E-02	
Bi-214	1.000	9.58E-02	2.27E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10004

L3-10212B-FRGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 8:27:05AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
2	295.31	3.36819E-02	29.62	Tol.	Eu-152 Pb-214

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.55E-02	5.07E-02	5.07E-02
	BE-7	477.60		10.44	-4.92E-03	3.18E-01	3.18E-01
+	K-40	1460.82	*	10.66	3.13E+00	4.30E-01	4.30E-01
	Mn-54	834.85		99.98	1.58E-02	4.45E-02	4.45E-02
	Co-60	1173.23		99.85	-1.03E-02	4.20E-02	4.20E-02
		1332.49		99.98	7.82E-03		4.25E-02
	Nb-94	702.65		99.81	-2.54E-02	2.87E-02	2.87E-02
		871.09		99.89	-1.28E-02		3.44E-02
	Ag-108m	79.13		6.60	7.08E-01	2.95E-02	9.79E-01
		433.94		90.50	-8.77E-03		2.95E-02
		614.28		89.80	-2.14E-02		4.49E-02
		722.94		90.80	8.36E-03		4.11E-02
	Sb-125	176.31		6.84	1.44E-01	8.95E-02	3.80E-01
		380.45		1.52	1.89E-01		1.95E+00
		427.87		29.60	-5.78E-02		8.95E-02
		463.36		10.49	9.84E-02		3.29E-01
		600.60		17.65	1.38E-01		1.94E-01

Analysis Report for 10-Dec-19-10004

L3-10212B-FRGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	606.71	4.98	1.40E-01	8.95E-02	1.02E+00
	635.95	11.22	1.49E-01		2.78E-01
	671.44	1.79	4.46E-01		1.94E+00
Ba-133	79.61	2.65	4.48E-01	5.47E-02	2.34E+00
	81.00	32.90	-2.41E-01		1.47E-01
	276.40	7.16	1.13E-01		3.82E-01
	302.85	18.34	4.42E-02		1.45E-01
	356.01	62.05	-8.26E-02		5.47E-02
	383.85	8.94	-1.12E-01		3.15E-01
Cs-134	475.36	1.48	-7.44E-01	3.65E-02	2.22E+00
	563.25	8.34	-3.60E-01		4.55E-01
	569.33	15.37	6.73E-02		2.45E-01
	604.72	97.62	-2.36E-02		4.62E-02
	795.86	85.46	-3.44E-03		3.65E-02
	801.95	8.69	8.80E-02		3.98E-01
	1038.61	0.99	-9.10E-01		3.78E+00
	1167.97	1.79	-7.38E-01		2.18E+00
	1365.19	3.02	8.41E-01		1.44E+00
Cs-137	661.66	85.10	3.25E-02	5.12E-02	5.12E-02
Eu-152	121.78	28.67	1.57E-02	9.69E-02	9.69E-02
	244.70	7.61	4.94E-01		4.19E-01
	295.94	0.45	4.31E+00		8.10E+00
	344.28	26.60	-3.89E-02		9.92E-02
	367.79	0.86	-2.44E+00		3.07E+00
	411.12	2.24	-4.92E-01		1.40E+00
	443.96	2.83	-6.18E-01		9.20E-01
	488.68	0.42	2.67E+00		6.01E+00
	563.99	0.49	-1.40E+01		7.05E+00
	586.26	0.46	-4.30E+00		1.07E+01
	678.62	0.47	-1.78E+00		7.24E+00
	688.67	0.86	-3.22E+00		4.02E+00
	719.35	0.28	-7.61E+00		1.04E+01
	778.90	12.96	8.22E-02		2.76E-01
	810.45	0.32	-9.20E-01		1.05E+01
	867.37	4.26	8.30E-02		7.76E-01
	919.33	0.43	7.47E-01		8.34E+00
	964.08	14.65	-9.92E-02		4.00E-01
	1085.87	10.24	-5.46E-02		3.89E-01
	1089.74	1.73	-9.41E-01		2.38E+00
	1112.07	13.69	-1.92E-01		3.15E-01
	1212.95	1.43	2.18E+00		3.63E+00
	1249.94	0.19	1.06E+01		3.08E+01
	1299.14	1.63	1.71E-01		2.85E+00
	1408.01	21.07	3.26E-02		1.84E-01
	1457.64	0.50	6.66E+01		2.94E+01
	1528.10	0.28	-1.93E+00		1.30E+01
Eu-154	123.07	40.40	2.40E-02	6.80E-02	6.80E-02
	247.93	6.89	-7.93E-02		3.68E-01
	591.76	4.95	2.17E-01		6.71E-01
	692.42	1.78	-3.62E-01		2.00E+00
	723.30	20.06	5.28E-02		1.94E-01

Analysis Report for 10-Dec-19-10004

L3-10212B-FRGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	756.80	4.52	-2.22E-01	6.80E-02	8.14E-01
	873.18	12.08	3.88E-02		2.94E-01
	996.29	10.48	-5.09E-02		3.47E-01
	1004.76	18.01	9.34E-02		2.65E-01
	1274.43	34.80	2.26E-02		1.14E-01
	1596.48	1.80	1.16E+00		2.38E+00
Eu-155	45.30	1.31	6.33E-01	1.47E-01	9.75E+00
	60.01	1.22	6.81E+00		1.14E+01
	86.55	30.70	3.97E-03		1.47E-01
	105.31	21.10	3.81E-02		1.54E-01
Ra-226	186.21	3.64	7.98E-01	8.49E-01	8.49E-01
Pa-231	27.36	10.30	6.46E-01	1.06E+00	1.06E+00
	283.69	1.70	-1.06E+00		1.48E+00
	300.07	2.47	-5.87E-01		1.15E+00
	302.65	2.20	3.29E-01		1.21E+00
	330.06	1.40	1.38E-01		1.98E+00
U-235	143.76	10.96	-1.03E-02	5.13E-02	2.59E-01
	163.33	5.08	-5.35E-02		4.74E-01
	185.71	57.20	3.31E-03		5.13E-02
	202.11	1.08	-2.28E-02		2.30E+00
	205.31	5.01	2.98E-01		5.54E-01
Am-241	59.54	35.90	6.36E-03	3.69E-01	3.69E-01

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

Apex-Gamma

Analysis Report for 10-Dec-19-10005

L3-10212B-FRGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10005
Sample Description	: L3-10212B-FRGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.468E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:06:00AM
Acquisition Started	: 12/10/2019 8:12:34AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81930
Fill Height	: 1467.89 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 8:27:36AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10005

L3-10212B-FRGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.59	948 -	961	954.82	1.22E+02	15.52	4.33E+01	0.84
2	295.21	1176 -	1186	1181.08	3.67E+01	8.68	1.63E+01	0.82
3	351.62	1400 -	1414	1406.46	6.81E+01	10.26	1.29E+01	1.26
4	582.74	2324 -	2335	2330.27	2.96E+01	7.86	1.24E+01	0.84
5	609.22	2431 -	2442	2436.17	4.18E+01	8.52	1.22E+01	0.51
6	910.83	3637 -	3648	3642.34	1.83E+01	5.52	4.67E+00	0.63
7	1460.52	5831 -	5854	5842.43	1.96E+02	14.00	0.00E+00	1.64

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	4.15E+00	3.47E-01
Tl-208	0.96	583.19	*	85.00	4.27E-02	1.16E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.92E-01	2.90E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.16E-01	2.47E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Dec-19-10005

L3-10212B-FRGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.54E-01	3.84E-02
		351.93	*	35.60	1.67E-01	2.85E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.17E-01	3.56E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Dec-19-10005

L3-10212B-FRGS-004SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.985	4.15E+00	3.47E-01	
	Tl-208	0.968	4.27E-02	1.16E-02	
X	Bi-211	0.953			
	Pb-212	1.000	1.92E-01	2.90E-02	
	Bi-214	0.999	1.16E-01	2.47E-02	
	Pb-214	0.991	1.62E-01	2.29E-02	
	Ac-228	0.993	1.17E-01	3.56E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10005

L3-10212B-FRGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 8:27:36AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	3.63E-02	5.15E-02	5.15E-02
	BE-7	477.60		10.44	7.10E-02	3.62E-01	3.62E-01
+	K-40	1460.82	*	10.66	4.15E+00	6.09E-02	6.09E-02
	Mn-54	834.85		99.98	3.23E-03	4.54E-02	4.54E-02
	Co-60	1173.23		99.85	2.04E-02	4.78E-02	6.31E-02
		1332.49		99.98	-5.35E-02		4.78E-02
	Nb-94	702.65		99.81	-1.22E-02	3.73E-02	3.73E-02
		871.09		99.89	2.46E-03		3.89E-02
	Ag-108m	79.13		6.60	2.80E-01	3.39E-02	1.36E+00
		433.94		90.50	1.50E-02		3.39E-02
		614.28		89.80	-4.22E-02		5.62E-02
		722.94		90.80	2.43E-02		4.99E-02
	Sb-125	176.31		6.84	1.80E-02	1.07E-01	4.50E-01
		380.45		1.52	-6.39E-01		2.13E+00
		427.87		29.60	8.76E-02		1.07E-01
		463.36		10.49	3.26E-02		3.26E-01
		600.60		17.65	3.27E-02		2.46E-01
		606.71		4.98	9.88E-01		1.20E+00
		635.95		11.22	-1.13E-01		3.06E-01

Analysis Report for 10-Dec-19-10005

L3-10212B-FRGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.53E+00	1.07E-01	1.75E+00
Ba-133	79.61	2.65	1.47E+00	6.06E-02	3.31E+00
	81.00	32.90	-3.92E-01		2.21E-01
	276.40	7.16	-2.83E-01		4.42E-01
	302.85	18.34	5.79E-02		1.79E-01
	356.01	62.05	-3.45E-02		6.06E-02
	383.85	8.94	-7.55E-02		3.60E-01
Cs-134	475.36	1.48	6.35E-01	4.56E-02	2.36E+00
	563.25	8.34	-1.42E-01		4.07E-01
	569.33	15.37	-8.13E-02		1.96E-01
	604.72	97.62	-5.17E-02		5.90E-02
	795.86	85.46	-3.93E-02		4.56E-02
	801.95	8.69	-4.66E-01		4.33E-01
	1038.61	0.99	-1.14E+00		3.78E+00
	1167.97	1.79	-2.48E+00		3.34E+00
	1365.19	3.02	7.12E-01		1.29E+00
Cs-137	661.66	85.10	7.84E-03	4.90E-02	4.90E-02
Eu-152	121.78	28.67	4.17E-03	1.16E-01	1.16E-01
	244.70	7.61	-4.10E-02		4.41E-01
	295.94	0.45	1.85E+00		8.70E+00
	344.28	26.60	-3.30E-02		1.19E-01
	367.79	0.86	9.37E-01		3.70E+00
	411.12	2.24	2.45E-01		1.34E+00
	443.96	2.83	-5.39E-01		1.13E+00
	488.68	0.42	3.77E+00		8.12E+00
	563.99	0.49	-7.29E-01		6.69E+00
	586.26	0.46	-4.93E+00		1.10E+01
	678.62	0.47	2.08E+00		7.72E+00
	688.67	0.86	2.76E+00		4.13E+00
	719.35	0.28	9.35E-01		1.47E+01
	778.90	12.96	-3.03E-01		2.91E-01
	810.45	0.32	4.03E+00		1.42E+01
	867.37	4.26	-9.32E-01		9.49E-01
	919.33	0.43	3.08E-01		9.83E+00
	964.08	14.65	-3.10E-03		3.55E-01
	1085.87	10.24	-2.20E-01		4.39E-01
	1089.74	1.73	4.22E-01		2.82E+00
	1112.07	13.69	-3.70E-01		3.68E-01
	1212.95	1.43	6.33E-01		3.74E+00
	1249.94	0.19	-1.04E+01		2.93E+01
	1299.14	1.63	-1.28E+00		3.04E+00
	1408.01	21.07	-3.39E-02		1.53E-01
	1457.64	0.50	8.48E+01		3.16E+01
	1528.10	0.28	-2.17E+00		1.03E+01
Eu-154	123.07	40.40	-5.63E-02	7.89E-02	7.89E-02
	247.93	6.89	-3.52E-01		4.61E-01
	591.76	4.95	-4.36E-01		7.30E-01
	692.42	1.78	3.75E-01		1.96E+00
	723.30	20.06	1.78E-01		2.29E-01
	756.80	4.52	1.29E-01		8.81E-01
	873.18	12.08	1.84E-01		3.22E-01

Analysis Report for 10-Dec-19-10005

L3-10212B-FRGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.67E-01	7.89E-02	3.25E-01
	1004.76	18.01	2.42E-02		2.37E-01
	1274.43	34.80	8.51E-02		1.43E-01
	1596.48	1.80	-2.46E+00		1.68E+00
Eu-155	45.30	1.31	1.23E+00	1.92E-01	1.91E+01
	60.01	1.22	-5.94E+00		1.68E+01
	86.55	30.70	-4.19E-02		2.05E-01
	105.31	21.10	1.75E-02		1.92E-01
Ra-226	186.21	3.64	7.61E-01	9.59E-01	9.59E-01
Pa-231	27.36	10.30	3.43E-01	1.39E+00	1.91E+00
	283.69	1.70	-7.90E-01		1.79E+00
	300.07	2.47	7.17E-02		1.39E+00
	302.65	2.20	-1.14E-02		1.48E+00
	330.06	1.40	1.75E+00		2.55E+00
U-235	143.76	10.96	-1.50E-02	6.09E-02	3.14E-01
	163.33	5.08	-2.26E-01		5.97E-01
	185.71	57.20	2.84E-02		6.09E-02
	202.11	1.08	-1.03E-01		2.99E+00
	205.31	5.01	-7.69E-02		6.68E-01
Am-241	59.54	35.90	-4.85E-01	5.87E-01	5.87E-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 10-Dec-19-10006

L3-10212B-FRGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10006
Sample Description	: L3-10212B-FRGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.044E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:08:00AM
Acquisition Started	: 12/10/2019 8:29:15AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81931
Fill Height	: 1044.42 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 8:44:17AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10006

L3-10212B-FRGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.71	473 -	480	477.61	1.41E+02	18.32	9.70E+01	1.05
2	295.22	585 -	593	590.49	6.50E+01	11.90	3.60E+01	1.50
3	338.02	673 -	680	676.01	2.88E+01	10.21	3.72E+01	1.03
4	351.90	699 -	708	703.75	9.59E+01	13.49	3.81E+01	1.21
5	583.30	1162 -	1171	1166.20	3.49E+01	8.85	1.91E+01	1.26
6	609.51	1212 -	1224	1218.60	7.71E+01	11.14	1.79E+01	1.42
7	911.22	1817 -	1826	1821.89	3.06E+01	8.29	1.64E+01	0.73
8	1460.77	2914 -	2928	2921.60	3.75E+02	19.51	1.87E+00	1.81

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	8.15E+00	5.52E-01
Tl-208	0.99	583.19	*	85.00	5.10E-02	1.33E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.20E-01	3.37E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.17E-01	3.39E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 10-Dec-19-10006

L3-10212B-FRGS-005SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.72E-01	5.43E-02
		351.93	*	35.60	2.36E-01	3.81E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.18E-01	7.90E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.99E-01	5.46E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Dec-19-10006

L3-10212B-FRGS-005SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	8.15E+00	5.52E-01	
	Tl-208	0.998	5.10E-02	1.33E-02	
X	Bi-211	0.895			
	Pb-212	0.999	2.20E-01	3.37E-02	
	Bi-214	0.998	2.17E-01	3.39E-02	
	Pb-214	1.000	2.48E-01	3.12E-02	
	Ac-228	0.998	2.05E-01	4.49E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10006

L3-10212B-FRGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 8:44:17AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.82E-02	5.41E-02	5.41E-02
	BE-7	477.60		10.44	2.04E-01	4.04E-01	4.04E-01
+	K-40	1460.82	*	10.66	8.15E+00	2.34E-01	2.34E-01
	Mn-54	834.85		99.98	3.69E-04	4.55E-02	4.55E-02
	Co-60	1173.23		99.85	1.18E-02	5.14E-02	6.21E-02
		1332.49		99.98	9.98E-03		5.14E-02
	Nb-94	702.65		99.81	1.40E-02	3.58E-02	3.58E-02
		871.09		99.89	6.92E-03		4.60E-02
	Ag-108m	79.13		6.60	-5.89E-02	3.12E-02	1.11E+00
		433.94		90.50	-2.44E-02		3.12E-02
		614.28		89.80	-2.34E-02		5.95E-02
		722.94		90.80	-1.79E-02		4.17E-02
	Sb-125	176.31		6.84	-9.02E-02	1.09E-01	5.07E-01
		380.45		1.52	3.19E-01		2.25E+00
		427.87		29.60	-1.23E-02		1.09E-01
		463.36		10.49	1.39E-01		3.65E-01
		600.60		17.65	2.12E-01		2.36E-01
		606.71		4.98	-1.50E-01		1.31E+00
		635.95		11.22	4.50E-02		3.53E-01

Analysis Report for 10-Dec-19-10006

L3-10212B-FRGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.86E-01	1.09E-01	2.09E+00
Ba-133	79.61	2.65	-8.96E-01	7.60E-02	2.51E+00
	81.00	32.90	-2.01E-01		1.79E-01
	276.40	7.16	-2.05E-01		4.85E-01
	302.85	18.34	6.40E-03		1.83E-01
	356.01	62.05	-3.49E-02		7.60E-02
	383.85	8.94	1.33E-01		4.17E-01
Cs-134	475.36	1.48	5.34E-01	5.65E-02	2.69E+00
	563.25	8.34	1.50E-01		4.78E-01
	569.33	15.37	3.37E-02		2.64E-01
	604.72	97.62	1.33E-02		5.65E-02
	795.86	85.46	2.24E-02		5.67E-02
	801.95	8.69	-3.89E-01		4.67E-01
	1038.61	0.99	-2.25E+00		4.70E+00
	1167.97	1.79	-1.04E+00		3.27E+00
	1365.19	3.02	1.50E-01		1.42E+00
Cs-137	661.66	85.10	1.37E-02	6.06E-02	6.06E-02
Eu-152	121.78	28.67	-7.83E-04	1.14E-01	1.14E-01
	244.70	7.61	-1.55E-01		4.89E-01
	295.94	0.45	-3.41E+00		9.47E+00
	344.28	26.60	-7.92E-02		1.30E-01
	367.79	0.86	-8.03E-01		3.78E+00
	411.12	2.24	-5.88E-02		1.68E+00
	443.96	2.83	-8.28E-02		1.36E+00
	488.68	0.42	-1.32E+00		8.40E+00
	563.99	0.49	6.44E-01		8.02E+00
	586.26	0.46	-6.72E-01		1.13E+01
	678.62	0.47	1.13E-01		8.63E+00
	688.67	0.86	3.54E-01		4.79E+00
	719.35	0.28	-6.47E+00		1.38E+01
	778.90	12.96	-1.00E-01		2.57E-01
	810.45	0.32	1.69E+00		1.45E+01
	867.37	4.26	2.00E-01		1.09E+00
	919.33	0.43	-2.18E+00		1.02E+01
	964.08	14.65	-3.08E-02		3.62E-01
	1085.87	10.24	-8.10E-02		6.05E-01
	1089.74	1.73	1.34E+00		3.67E+00
	1112.07	13.69	8.95E-02		4.37E-01
	1212.95	1.43	-1.38E+00		4.21E+00
	1249.94	0.19	-2.84E+00		2.99E+01
	1299.14	1.63	2.65E-01		2.96E+00
	1408.01	21.07	4.81E-02		2.42E-01
	1457.64	0.50	-2.94E+00		4.44E+01
	1528.10	0.28	-7.01E+00		1.06E+01
Eu-154	123.07	40.40	-1.07E-02	7.88E-02	7.88E-02
	247.93	6.89	-1.03E-02		4.73E-01
	591.76	4.95	-2.11E-01		6.43E-01
	692.42	1.78	1.08E+00		2.32E+00
	723.30	20.06	3.04E-02		2.02E-01
	756.80	4.52	3.34E-01		8.48E-01
	873.18	12.08	5.73E-02		3.81E-01

Analysis Report for 10-Dec-19-10006

L3-10212B-FRGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	8.62E-02	7.88E-02	4.40E-01
	1004.76	18.01	9.86E-02		2.81E-01
	1274.43	34.80	6.97E-02		1.73E-01
	1596.48	1.80	3.79E-01		2.38E+00
Eu-155	45.30	1.31	-3.46E+00	1.79E-01	1.11E+01
	60.01	1.22	-2.90E+00		1.27E+01
	86.55	30.70	-7.14E-03		1.79E-01
	105.31	21.10	-1.59E-02		1.82E-01
Ra-226	186.21	3.64	3.44E-01	1.09E+00	1.09E+00
Pa-231	27.36	10.30	7.79E-01	1.17E+00	1.17E+00
	283.69	1.70	-1.32E+00		1.73E+00
	300.07	2.47	-2.22E+00		1.30E+00
	302.65	2.20	5.34E-02		1.52E+00
	330.06	1.40	4.56E-01		2.53E+00
U-235	143.76	10.96	-7.13E-02	6.88E-02	2.94E-01
	163.33	5.08	-5.20E-03		7.23E-01
	185.71	57.20	6.54E-03		6.88E-02
	202.11	1.08	4.84E-01		3.37E+00
	205.31	5.01	-4.46E-01		6.98E-01
Am-241	59.54	35.90	-6.08E-02	4.46E-01	4.46E-01

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

Apex-Gamma

Analysis Report for 10-Dec-19-10007

L3-10212B-FRGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10007
Sample Description	: L3-10212B-FRGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.467E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:10:00AM
Acquisition Started	: 12/10/2019 8:29:57AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81933
Fill Height	: 1467.09 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 8:45:00AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10007

L3-10212B-FRGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.91	949 -	962	955.23	6.18E+01	13.12	3.92E+01	1.19
2	295.23	1175 -	1186	1180.20	2.52E+01	7.41	1.18E+01	0.66
3	351.98	1401 -	1414	1406.93	6.63E+01	9.91	1.17E+01	1.08
4	1460.24	5829 -	5849	5838.89	1.05E+02	11.09	5.05E+00	0.61

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.94	1460.82	*	10.66	2.38E+00	2.72E-01
Pb-212	0.98	115.18		0.60		
		238.63	*	43.60	9.90E-02	2.25E-02
		300.09		3.30		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.09E-01	3.31E-02
		351.93	*	35.60	1.68E-01	2.86E-02
		785.96		1.06		

Analysis Report for 10-Dec-19-10007

L3-10212B-FRGS-006SS

* = 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	0.947	2.38E+00	2.72E-01	
X	Bi-211	0.876			
	Pb-212	0.988	9.90E-02	2.25E-02	
	Pb-214	1.000	1.43E-01	2.16E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10007

L3-10212B-FRGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 8:45:00AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.12E-02	4.78E-02	4.78E-02
	BE-7	477.60		10.44	4.32E-02	2.93E-01	2.93E-01
+	K-40	1460.82	*	10.66	2.38E+00	3.93E-01	3.93E-01
	Mn-54	834.85		99.98	-1.96E-02	3.75E-02	3.75E-02
	Co-60	1173.23		99.85	6.38E-03	4.08E-02	4.33E-02
		1332.49		99.98	-1.04E-02		4.08E-02
	Nb-94	702.65		99.81	6.04E-03	3.50E-02	3.50E-02
		871.09		99.89	-9.66E-03		3.65E-02
	Ag-108m	79.13		6.60	7.47E-01	3.63E-02	9.52E-01
		433.94		90.50	1.02E-02		3.63E-02
		614.28		89.80	-3.85E-03		4.48E-02
		722.94		90.80	9.07E-03		4.51E-02
	Sb-125	176.31		6.84	5.99E-02	1.07E-01	3.63E-01
		380.45		1.52	3.16E-01		2.05E+00
		427.87		29.60	1.23E-02		1.07E-01
		463.36		10.49	9.49E-02		3.45E-01
		600.60		17.65	9.31E-02		2.08E-01
		606.71		4.98	1.07E+00		1.04E+00
		635.95		11.22	6.12E-03		2.98E-01

Analysis Report for 10-Dec-19-10007

L3-10212B-FRGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.97E-01	1.07E-01	1.85E+00
Ba-133	79.61	2.65	1.88E+00	6.07E-02	2.27E+00
	81.00	32.90	-2.19E-01		1.32E-01
	276.40	7.16	1.79E-01		3.89E-01
	302.85	18.34	-2.57E-03		1.47E-01
	356.01	62.05	-6.76E-03		6.07E-02
	383.85	8.94	-1.99E-01		3.19E-01
Cs-134	475.36	1.48	2.70E-01	4.35E-02	2.04E+00
	563.25	8.34	-4.44E-01		3.77E-01
	569.33	15.37	5.89E-02		2.06E-01
	604.72	97.62	-6.03E-02		4.36E-02
	795.86	85.46	3.37E-02		4.35E-02
	801.95	8.69	-2.45E-01		3.48E-01
	1038.61	0.99	-2.30E+00		3.91E+00
	1167.97	1.79	1.74E+00		2.48E+00
	1365.19	3.02	6.87E-01		1.32E+00
Cs-137	661.66	85.10	-2.03E-02	3.75E-02	3.75E-02
Eu-152	121.78	28.67	1.88E-02	9.86E-02	9.86E-02
	244.70	7.61	2.42E-01		4.08E-01
	295.94	0.45	-1.03E+00		6.94E+00
	344.28	26.60	7.95E-02		1.15E-01
	367.79	0.86	1.92E-01		3.11E+00
	411.12	2.24	1.18E-01		1.32E+00
	443.96	2.83	1.29E-01		1.01E+00
	488.68	0.42	3.57E+00		7.44E+00
	563.99	0.49	-2.58E+00		6.40E+00
	586.26	0.46	7.86E+00		1.05E+01
	678.62	0.47	-4.56E-01		7.06E+00
	688.67	0.86	-3.73E+00		3.04E+00
	719.35	0.28	-6.68E+00		1.08E+01
	778.90	12.96	-5.27E-03		2.61E-01
	810.45	0.32	3.91E+00		1.17E+01
	867.37	4.26	-4.22E-01		8.53E-01
	919.33	0.43	1.55E+00		8.85E+00
	964.08	14.65	2.63E-02		3.79E-01
	1085.87	10.24	2.31E-01		3.75E-01
	1089.74	1.73	-1.14E-01		1.97E+00
	1112.07	13.69	-3.63E-02		3.14E-01
	1212.95	1.43	-6.62E-01		3.19E+00
	1249.94	0.19	2.71E+00		2.46E+01
	1299.14	1.63	1.50E+00		2.57E+00
	1408.01	21.07	1.12E-01		2.02E-01
	1457.64	0.50	5.43E+01		2.59E+01
	1528.10	0.28	1.78E+00		8.60E+00
Eu-154	123.07	40.40	-2.09E-02	6.92E-02	6.92E-02
	247.93	6.89	-6.09E-02		3.82E-01
	591.76	4.95	4.06E-01		6.42E-01
	692.42	1.78	1.64E-01		1.85E+00
	723.30	20.06	1.25E-01		2.08E-01
	756.80	4.52	3.90E-01		7.74E-01
	873.18	12.08	-9.15E-02		3.11E-01

Analysis Report for 10-Dec-19-10007

L3-10212B-FRGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.78E-01	6.92E-02	3.21E-01
	1004.76	18.01	1.13E-01		2.30E-01
	1274.43	34.80	4.38E-02		1.23E-01
	1596.48	1.80	2.11E-01		2.11E+00
Eu-155	45.30	1.31	2.29E+00	1.44E-01	9.67E+00
	60.01	1.22	2.12E+00		1.04E+01
	86.55	30.70	6.69E-02		1.44E-01
	105.31	21.10	6.39E-02		1.61E-01
Ra-226	186.21	3.64	5.98E-01	8.27E-01	8.27E-01
Pa-231	27.36	10.30	7.69E-01	1.08E+00	1.14E+00
	283.69	1.70	7.98E-02		1.48E+00
	300.07	2.47	-3.30E-03		1.08E+00
	302.65	2.20	-3.19E-01		1.21E+00
	330.06	1.40	1.51E+00		2.05E+00
U-235	143.76	10.96	-5.55E-02	5.15E-02	2.64E-01
	163.33	5.08	1.89E-01		4.95E-01
	185.71	57.20	2.51E-02		5.15E-02
	202.11	1.08	5.87E-01		2.55E+00
	205.31	5.01	-3.77E-01		4.37E-01
Am-241	59.54	35.90	4.11E-02	3.54E-01	3.54E-01

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

Apex-Gamma

Analysis Report for 10-Dec-19-10008

L3-10212B-FRGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10008
Sample Description	: L3-10212B-FRGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.295E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:12:00AM
Acquisition Started	: 12/10/2019 8:30:21AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81934
Fill Height	: 1294.67 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 8:45:24AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10008

L3-10212B-FRGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.62	948 -	961	954.96	1.17E+02	15.47	4.40E+01	1.02
2	295.00	1174 -	1185	1180.23	4.31E+01	9.82	2.09E+01	0.64
3	351.80	1401 -	1412	1407.20	6.06E+01	11.14	2.54E+01	1.00
4	583.13	2326 -	2338	2331.85	4.27E+01	8.18	9.30E+00	0.43
5	609.26	2429 -	2443	2436.29	6.98E+01	9.50	7.19E+00	0.77
6	910.83	3637 -	3648	3642.36	3.46E+01	6.75	4.38E+00	0.58
7	1460.52	5830 -	5854	5842.43	2.95E+02	18.89	1.53E+01	1.22

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	6.50E+00	5.04E-01
Tl-208	1.00	583.19	*	85.00	6.38E-02	1.28E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.90E-01	2.94E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.01E-01	2.99E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Dec-19-10008

L3-10212B-FRGS-007SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.86E-01	4.50E-02
		351.93	*	35.60	1.53E-01	3.07E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.30E-01	4.59E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Dec-19-10008

L3-10212B-FRGS-007SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.985	6.50E+00	5.04E-01	
	Tl-208	1.000	6.38E-02	1.28E-02	
X	Bi-211	0.918			
	Pb-212	1.000	1.90E-01	2.94E-02	
	Bi-214	1.000	2.01E-01	2.99E-02	
	Pb-214	0.996	1.64E-01	2.54E-02	
	Ac-228	0.993	2.30E-01	4.59E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10008

L3-10212B-FRGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 8:45:24AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.50E-02	5.58E-02	5.58E-02
	BE-7	477.60		10.44	2.86E-01	3.85E-01	3.85E-01
+	K-40	1460.82	*	10.66	6.50E+00	6.54E-01	6.54E-01
	Mn-54	834.85		99.98	2.92E-02	5.05E-02	5.05E-02
	Co-60	1173.23		99.85	4.88E-02	5.35E-02	5.98E-02
		1332.49		99.98	2.55E-02		5.35E-02
	Nb-94	702.65		99.81	-5.99E-03	4.04E-02	4.50E-02
		871.09		99.89	4.69E-03		4.04E-02
	Ag-108m	79.13		6.60	-4.30E-01	3.95E-02	1.48E+00
		433.94		90.50	-6.61E-03		3.95E-02
		614.28		89.80	-2.53E-02		6.66E-02
		722.94		90.80	4.03E-04		4.98E-02
	Sb-125	176.31		6.84	-1.17E-01	1.21E-01	4.43E-01
		380.45		1.52	-7.41E-01		2.04E+00
		427.87		29.60	-1.80E-02		1.21E-01
		463.36		10.49	0.00E+00		3.41E-01
		600.60		17.65	8.79E-02		2.52E-01
		606.71		4.98	1.93E+00		1.35E+00
		635.95		11.22	-8.54E-02		3.28E-01

Analysis Report for 10-Dec-19-10008

L3-10212B-FRGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.91E-01	1.21E-01	1.90E+00
Ba-133	79.61	2.65	9.90E-02	7.27E-02	3.57E+00
	81.00	32.90	-2.76E-01		2.54E-01
	276.40	7.16	7.92E-02		5.16E-01
	302.85	18.34	5.50E-02		2.00E-01
	356.01	62.05	-8.09E-02		7.27E-02
	383.85	8.94	1.42E-01		3.64E-01
Cs-134	475.36	1.48	-1.77E-01	5.25E-02	2.55E+00
	563.25	8.34	-3.24E-01		4.07E-01
	569.33	15.37	-8.14E-02		2.37E-01
	604.72	97.62	-3.81E-02		6.69E-02
	795.86	85.46	1.21E-02		5.25E-02
	801.95	8.69	-4.55E-01		3.99E-01
	1038.61	0.99	-3.06E+00		4.78E+00
	1167.97	1.79	-3.90E+00		3.18E+00
	1365.19	3.02	-6.90E-01		1.55E+00
Cs-137	661.66	85.10	2.56E-02	4.52E-02	4.52E-02
Eu-152	121.78	28.67	-6.65E-02	1.22E-01	1.22E-01
	244.70	7.61	1.48E-01		4.68E-01
	295.94	0.45	1.35E+00		9.17E+00
	344.28	26.60	-5.56E-02		1.30E-01
	367.79	0.86	-6.50E-01		3.62E+00
	411.12	2.24	-3.25E-01		1.75E+00
	443.96	2.83	8.31E-02		1.34E+00
	488.68	0.42	-5.43E-01		8.17E+00
	563.99	0.49	-4.55E+00		7.15E+00
	586.26	0.46	1.23E+01		1.20E+01
	678.62	0.47	2.62E-01		7.71E+00
	688.67	0.86	2.68E+00		5.03E+00
	719.35	0.28	1.18E+00		1.43E+01
	778.90	12.96	-2.97E-02		2.95E-01
	810.45	0.32	-1.56E+00		1.14E+01
	867.37	4.26	-3.51E-01		1.04E+00
	919.33	0.43	-3.02E+00		8.87E+00
	964.08	14.65	1.93E-01		4.29E-01
	1085.87	10.24	-4.53E-01		4.66E-01
	1089.74	1.73	8.75E-01		3.09E+00
	1112.07	13.69	-6.55E-01		3.83E-01
	1212.95	1.43	1.32E+00		4.22E+00
	1249.94	0.19	3.37E+01		3.57E+01
	1299.14	1.63	-2.33E-01		3.30E+00
	1408.01	21.07	6.27E-03		2.19E-01
	1457.64	0.50	1.48E+02		4.12E+01
	1528.10	0.28	7.77E+00		1.49E+01
Eu-154	123.07	40.40	2.58E-02	9.02E-02	9.02E-02
	247.93	6.89	-3.11E-01		4.23E-01
	591.76	4.95	-9.94E-03		7.56E-01
	692.42	1.78	8.42E-01		2.44E+00
	723.30	20.06	6.09E-02		2.28E-01
	756.80	4.52	4.40E-01		9.89E-01
	873.18	12.08	-4.57E-01		3.19E-01

Analysis Report for 10-Dec-19-10008

L3-10212B-FRGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	6.06E-02	9.02E-02	4.97E-01
	1004.76	18.01	6.86E-02		3.09E-01
	1274.43	34.80	-1.27E-01		1.52E-01
	1596.48	1.80	-1.21E-01		2.42E+00
Eu-155	45.30	1.31	1.39E+00	2.02E-01	1.90E+01
	60.01	1.22	-7.89E+00		2.01E+01
	86.55	30.70	4.93E-02		2.18E-01
	105.31	21.10	-5.89E-02		2.02E-01
Ra-226	186.21	3.64	-3.37E-02	1.02E+00	1.02E+00
Pa-231	27.36	10.30	1.54E+00	1.54E+00	2.22E+00
	283.69	1.70	5.86E-01		1.86E+00
	300.07	2.47	-3.29E-01		1.54E+00
	302.65	2.20	2.94E-01		1.67E+00
	330.06	1.40	-1.25E+00		2.46E+00
U-235	143.76	10.96	-2.66E-01	6.53E-02	3.10E-01
	163.33	5.08	6.30E-01		6.34E-01
	185.71	57.20	1.46E-02		6.53E-02
	202.11	1.08	-5.52E-01		3.13E+00
	205.31	5.01	-1.86E-01		6.70E-01
Am-241	59.54	35.90	-3.16E-01	6.84E-01	6.84E-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 10-Dec-19-10009

L3-10212B-FRGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10009
Sample Description	: L3-10212B-FRGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.247E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:14:00AM
Acquisition Started	: 12/10/2019 8:47:21AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81935
Fill Height	: 1247.29 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 9:02:24AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10009

L3-10212B-FRGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.95	369 -	376	372.20	5.29E+01	14.79	8.11E+01	0.96
2	238.74	473 -	480	477.66	1.47E+02	18.19	9.00E+01	1.21
3	295.33	586 -	595	590.72	6.41E+01	14.28	6.09E+01	1.22
4	352.02	699 -	708	703.98	1.11E+02	13.71	3.39E+01	1.97
5	583.26	1161 -	1171	1166.13	5.24E+01	9.20	1.36E+01	0.87
6	609.20	1213 -	1223	1217.98	9.81E+01	12.63	2.59E+01	0.83
7	727.09	1450 -	1458	1453.66	1.61E+01	6.71	1.29E+01	1.12
8	911.20	1817 -	1828	1821.85	3.90E+01	8.75	1.50E+01	1.42
9	1460.83	2915 -	2929	2921.72	3.36E+02	18.83	6.13E+00	2.01

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	6.75E+00	4.79E-01
Tl-208	0.99	583.19	*	85.00	7.15E-02	1.33E-02
Bi-212	0.99	39.86		1.06		
		727.33	*	6.67	3.25E-01	1.36E-01
		785.37		1.10		
		1620.50		1.47		
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.16E-01	3.19E-02

Analysis Report for 10-Dec-19-10009

L3-10212B-FRGS-008SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	0.99	300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.57E-01	3.66E-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	2.52E-01	5.96E-02
		351.93	*	35.60	2.56E-01	3.77E-02
		785.96		1.06		
Ra-226	0.98	186.21	*	3.64	8.22E-01	2.39E-01
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.36E-01	5.39E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	5.23E-02	1.52E-02
		202.11		1.08		
		205.31		5.01		

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

Analysis Report for 10-Dec-19-10009

L3-10212B-FRGS-008SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	1.000	6.75E+00	4.79E-01	
	Tl-208	0.999	7.15E-02	1.33E-02	
X	Bi-211	0.866			
	Bi-212	0.994	3.25E-01	1.36E-01	
	Pb-212	0.998	2.16E-01	3.19E-02	
	Bi-214	0.999	2.57E-01	3.66E-02	
	Pb-214	0.999	2.55E-01	3.18E-02	
?	Ra-226	0.989	8.22E-01	2.39E-01	
	Ac-228	1.000	2.36E-01	5.39E-02	
?	U-235	0.994	5.23E-02	1.52E-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 10-Dec-19-10009

L3-10212B-FRGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 9:02:24AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	8.00E-02	5.83E-02	5.83E-02
	BE-7	477.60		10.44	1.10E-01	3.23E-01	3.23E-01
+	K-40	1460.82	*	10.66	6.75E+00	3.53E-01	3.53E-01
	Mn-54	834.85		99.98	3.55E-03	4.43E-02	4.43E-02
	Co-60	1173.23		99.85	-9.41E-03	4.53E-02	5.53E-02
		1332.49		99.98	-1.09E-02		4.53E-02
	Nb-94	702.65		99.81	-1.06E-04	3.89E-02	3.89E-02
		871.09		99.89	-3.83E-03		4.14E-02
	Ag-108m	79.13		6.60	6.56E-01	3.24E-02	1.19E+00
		433.94		90.50	-1.99E-02		3.24E-02
		614.28		89.80	-2.16E-02		5.75E-02
		722.94		90.80	-2.32E-02		4.84E-02
	Sb-125	176.31		6.84	6.05E-02	1.14E-01	4.78E-01
		380.45		1.52	-9.01E-01		1.92E+00
		427.87		29.60	4.26E-02		1.14E-01
		463.36		10.49	1.51E-01		3.35E-01
		600.60		17.65	1.31E-02		2.04E-01
		606.71		4.98	-2.17E-02		1.44E+00
		635.95		11.22	-2.98E-01		2.89E-01

Analysis Report for 10-Dec-19-10009

L3-10212B-FRGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	4.48E-02	1.14E-01	1.98E+00
Ba-133	79.61	2.65	1.40E-01	7.45E-02	2.78E+00
	81.00	32.90	-3.52E-01		1.69E-01
	276.40	7.16	5.11E-02		4.88E-01
	302.85	18.34	-3.92E-02		1.67E-01
	356.01	62.05	-7.43E-02		7.45E-02
	383.85	8.94	-4.80E-02		3.69E-01
Cs-134	475.36	1.48	-4.10E-01	4.72E-02	2.19E+00
	563.25	8.34	4.08E-02		3.84E-01
	569.33	15.37	6.90E-03		2.10E-01
	604.72	97.62	3.60E-03		6.53E-02
	795.86	85.46	-6.56E-04		4.72E-02
	801.95	8.69	7.76E-02		4.88E-01
	1038.61	0.99	-5.91E-01		4.86E+00
	1167.97	1.79	-1.16E-01		3.25E+00
	1365.19	3.02	-3.11E-01		9.19E-01
Cs-137	661.66	85.10	4.71E-02	5.60E-02	5.60E-02
Eu-152	121.78	28.67	-1.86E-02	1.07E-01	1.07E-01
	244.70	7.61	-2.03E-01		4.93E-01
	295.94	0.45	1.11E+01		9.91E+00
	344.28	26.60	8.35E-03		1.34E-01
	367.79	0.86	3.38E-01		3.87E+00
	411.12	2.24	1.42E-01		1.53E+00
	443.96	2.83	-3.88E-01		1.08E+00
	488.68	0.42	-6.82E-01		8.59E+00
	563.99	0.49	-1.65E+00		6.20E+00
	586.26	0.46	-2.90E+00		1.13E+01
	678.62	0.47	5.86E+00		9.33E+00
	688.67	0.86	2.25E+00		4.78E+00
	719.35	0.28	5.98E-01		1.39E+01
	778.90	12.96	-2.20E-01		2.75E-01
	810.45	0.32	-2.35E+00		1.29E+01
	867.37	4.26	-6.59E-01		8.80E-01
	919.33	0.43	-3.45E+00		1.07E+01
	964.08	14.65	-8.28E-02		3.72E-01
	1085.87	10.24	-2.40E-01		4.59E-01
	1089.74	1.73	-7.06E-01		2.52E+00
	1112.07	13.69	-8.35E-02		4.06E-01
	1212.95	1.43	-1.70E+00		4.01E+00
	1249.94	0.19	6.02E+00		2.87E+01
	1299.14	1.63	2.12E+00		3.53E+00
	1408.01	21.07	1.06E-01		2.24E-01
	1457.64	0.50	-1.06E+01		3.92E+01
	1528.10	0.28	-3.93E+00		1.07E+01
Eu-154	123.07	40.40	-5.98E-03	7.90E-02	7.90E-02
	247.93	6.89	-1.36E-02		4.67E-01
	591.76	4.95	7.45E-02		6.58E-01
	692.42	1.78	-1.46E+00		2.04E+00
	723.30	20.06	-1.20E-01		2.27E-01
	756.80	4.52	-6.34E-02		8.76E-01
	873.18	12.08	-2.95E-01		3.31E-01

Analysis Report for 10-Dec-19-10009

L3-10212B-FRGS-008SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-1.74E-01	7.90E-02	4.17E-01
		1004.76		18.01	7.10E-02		2.93E-01
		1274.43		34.80	-4.39E-02		1.50E-01
		1596.48		1.80	-6.24E-01		2.20E+00
	Eu-155	45.30		1.31	2.20E+00	1.75E-01	1.03E+01
		60.01		1.22	-8.26E+00		1.18E+01
		86.55		30.70	8.51E-03		1.79E-01
		105.31		21.10	1.74E-02		1.75E-01
+	Ra-226	186.21	*	3.64	8.22E-01	7.22E-01	7.22E-01
	Pa-231	27.36		10.30	3.67E-01	1.03E+00	1.03E+00
		283.69		1.70	-3.69E-02		1.74E+00
		300.07		2.47	1.38E-01		1.32E+00
		302.65		2.20	-3.27E-01		1.39E+00
		330.06		1.40	1.09E+00		2.59E+00
+	U-235	143.76		10.96	1.32E-02	4.60E-02	3.05E-01
		163.33		5.08	1.83E-01		7.02E-01
		185.71	*	57.20	5.23E-02		4.60E-02
		202.11		1.08	-7.09E-01		3.08E+00
		205.31		5.01	-1.80E-01		6.67E-01
	Am-241	59.54		35.90	-1.53E-01	4.27E-01	4.27E-01

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

Apex-Gamma

Analysis Report for 10-Dec-19-10010

L3-10212B-FRGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10010
Sample Description	: L3-10212B-FRGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.326E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:16:00AM
Acquisition Started	: 12/10/2019 8:47:43AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.0 seconds
Dead Time	: 0.11 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81936
Fill Height	: 1326.10 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 9:02:48AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10010

L3-10212B-FRGS-009SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	238.77	948 -	970	955.17	9.15E+01	10.78	3.72E+01	0.83
m	2	241.23	948 -	970	965.00	1.67E+01	5.96	3.16E+01	0.83
	3	352.05	1403 -	1415	1407.95	4.69E+01	9.03	1.31E+01	0.61
	4	1460.85	5833 -	5852	5843.23	1.16E+02	11.56	5.00E+00	1.71

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	1.00	1460.82	*	10.66	3.03E+00	3.30E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.69E-01	2.41E-02
		300.09		3.30		
Pb-214	0.98	241.99	*	7.25	1.86E-01	6.82E-02
		295.22		18.42		
		351.93	*	35.60	1.36E-01	2.84E-02
		785.96		1.06		

Analysis Report for 10-Dec-19-10010

L3-10212B-FRGS-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
	K-40	1.000	3.03E+00	3.30E-01	
X	Bi-211	0.857			
	Pb-212	0.997	1.69E-01	2.41E-02	
	Pb-214	0.988	1.43E-01	2.62E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10010

L3-10212B-FRGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 9:02:48AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.38E-02	5.98E-02	5.98E-02
	BE-7	477.60		10.44	2.18E-01	3.89E-01	3.89E-01
+	K-40	1460.82	*	10.66	3.03E+00	4.47E-01	4.47E-01
	Mn-54	834.85		99.98	1.98E-02	4.17E-02	4.17E-02
	Co-60	1173.23		99.85	8.95E-03	4.48E-02	5.27E-02
		1332.49		99.98	-9.96E-03		4.48E-02
	Nb-94	702.65		99.81	-1.74E-02	4.29E-02	4.52E-02
		871.09		99.89	-9.12E-04		4.29E-02
	Ag-108m	79.13		6.60	5.96E-01	3.16E-02	1.59E+00
		433.94		90.50	8.55E-03		3.16E-02
		614.28		89.80	-7.41E-02		5.47E-02
		722.94		90.80	0.00E+00		5.50E-02
	Sb-125	176.31		6.84	4.15E-01	1.10E-01	5.40E-01
		380.45		1.52	4.69E-01		2.40E+00
		427.87		29.60	-5.04E-02		1.10E-01
		463.36		10.49	4.62E-02		3.75E-01
		600.60		17.65	-7.20E-02		2.30E-01
		606.71		4.98	9.89E-01		1.20E+00
		635.95		11.22	-2.34E-01		3.62E-01

Analysis Report for 10-Dec-19-10010

L3-10212B-FRGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	2.68E-01	1.10E-01	2.06E+00
Ba-133	79.61	2.65	-4.26E-01	6.98E-02	3.80E+00
	81.00	32.90	-2.39E-01		2.71E-01
	276.40	7.16	2.08E-01		4.67E-01
	302.85	18.34	1.59E-01		2.05E-01
	356.01	62.05	-2.00E-02		6.98E-02
	383.85	8.94	1.41E-02		3.80E-01
Cs-134	475.36	1.48	2.21E+00	5.32E-02	2.85E+00
	563.25	8.34	1.33E-01		4.39E-01
	569.33	15.37	-1.51E-02		2.25E-01
	604.72	97.62	-2.72E-02		5.61E-02
	795.86	85.46	-7.51E-02		5.32E-02
	801.95	8.69	3.46E-01		5.37E-01
	1038.61	0.99	-1.57E+00		4.17E+00
	1167.97	1.79	-1.53E+00		2.59E+00
	1365.19	3.02	-1.03E-01		1.37E+00
Cs-137	661.66	85.10	1.65E-02	4.90E-02	4.90E-02
Eu-152	121.78	28.67	2.65E-03	1.15E-01	1.42E-01
	244.70	7.61	-2.37E-01		5.09E-01
	295.94	0.45	1.38E-01		8.06E+00
	344.28	26.60	-9.90E-02		1.15E-01
	367.79	0.86	2.12E-01		3.77E+00
	411.12	2.24	2.95E-01		1.51E+00
	443.96	2.83	-9.28E-01		1.22E+00
	488.68	0.42	3.02E+00		8.04E+00
	563.99	0.49	-1.06E+00		7.15E+00
	586.26	0.46	-4.73E+00		1.03E+01
	678.62	0.47	-5.49E+00		7.01E+00
	688.67	0.86	2.94E+00		5.18E+00
	719.35	0.28	-1.05E+00		1.39E+01
	778.90	12.96	2.50E-01		3.23E-01
	810.45	0.32	2.90E+00		1.24E+01
	867.37	4.26	-1.33E-01		9.76E-01
	919.33	0.43	4.33E-01		9.20E+00
	964.08	14.65	1.89E-02		3.96E-01
	1085.87	10.24	-5.02E-03		4.15E-01
	1089.74	1.73	-2.60E+00		2.37E+00
	1112.07	13.69	7.48E-02		3.15E-01
	1212.95	1.43	-1.71E+00		2.95E+00
	1249.94	0.19	-9.96E+00		2.47E+01
	1299.14	1.63	-9.94E-01		3.17E+00
	1408.01	21.07	-7.39E-02		2.00E-01
	1457.64	0.50	7.19E+01		3.18E+01
	1528.10	0.28	-1.10E+01		1.15E+01
Eu-154	123.07	40.40	-3.30E-02	9.31E-02	9.31E-02
	247.93	6.89	1.33E-02		4.60E-01
	591.76	4.95	7.47E-02		7.65E-01
	692.42	1.78	-4.80E-01		2.56E+00
	723.30	20.06	1.07E-01		2.60E-01
	756.80	4.52	-5.58E-01		8.62E-01
	873.18	12.08	-3.42E-02		3.36E-01

Analysis Report for 10-Dec-19-10010

L3-10212B-FRGS-009SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.15E-01	9.31E-02	4.73E-01
	1004.76	18.01	1.54E-02		2.77E-01
	1274.43	34.80	5.79E-02		1.19E-01
	1596.48	1.80	4.16E-02		1.86E+00
Eu-155	45.30	1.31	-3.70E+00	2.25E-01	2.42E+01
	60.01	1.22	2.78E+00		2.68E+01
	86.55	30.70	-5.67E-02		2.50E-01
	105.31	21.10	-3.92E-02		2.25E-01
Ra-226	186.21	3.64	8.09E-01	1.08E+00	1.08E+00
Pa-231	27.36	10.30	2.04E+00	1.43E+00	2.99E+00
	283.69	1.70	-6.77E-01		1.76E+00
	300.07	2.47	-1.12E+00		1.43E+00
	302.65	2.20	1.88E+00		1.73E+00
	330.06	1.40	1.26E+00		2.38E+00
U-235	143.76	10.96	-3.82E-04	6.94E-02	3.52E-01
	163.33	5.08	-2.96E-01		6.59E-01
	185.71	57.20	9.00E-02		6.94E-02
	202.11	1.08	-1.88E+00		2.80E+00
	205.31	5.01	-2.14E-01		6.31E-01
Am-241	59.54	35.90	2.49E-01	9.50E-01	9.50E-01

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

Apex-Gamma

Analysis Report for 10-Dec-19-10011

L3-10212B-FRGS-010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10011
Sample Description	: L3-10212B-FRGS-010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.430E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:18:00AM
Acquisition Started	: 12/10/2019 8:48:10AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81937
Fill Height	: 1429.67 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 9:03:12AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10011

L3-10212B-FRGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.74	949 -	961	954.55	6.46E+01	14.59	4.94E+01	0.64
2	351.93	1401 -	1412	1406.73	3.84E+01	8.95	1.66E+01	1.24
3	558.38	2227 -	2236	2231.70	1.50E+01	5.12	5.00E+00	0.80
4	582.97	2324 -	2338	2329.99	4.39E+01	7.24	3.15E+00	0.40
5	609.21	2430 -	2439	2434.88	3.17E+01	6.79	6.34E+00	0.68
6	1460.23	5829 -	5849	5838.87	1.33E+02	11.89	2.49E+00	1.53

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.94	1460.82	*	10.66	3.04E+00	3.03E-01
Tl-208	0.99	583.19	*	85.00	6.72E-02	1.18E-02
Bi-211	0.88	351.07	*	13.02	2.69E-01	6.62E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.04E-01	2.49E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	9.33E-02	2.08E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Dec-19-10011

L3-10212B-FRGS-010SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	9.82E-02	2.42E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.946	3.04E+00	3.03E-01	
	Tl-208	0.992	6.72E-02	1.18E-02	
?	Bi-211	0.888	2.69E-01	6.62E-02	
	Pb-212	0.998	1.04E-01	2.49E-02	
	Bi-214	0.999	9.33E-02	2.08E-02	
?	Pb-214	1.000	9.82E-02	2.42E-02	

Analysis Report for 10-Dec-19-10011

L3-10212B-FRGS-010SS

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10011

L3-10212B-FRGS-010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 9:03:12AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
3	558.38	1.66667E-02	34.16		

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	6.31E-02	5.17E-02	5.17E-02
	BE-7	477.60		10.44	1.48E-02	3.30E-01	3.30E-01
+	K-40	1460.82	*	10.66	3.04E+00	2.96E-01	2.96E-01
	Mn-54	834.85		99.98	1.09E-03	3.36E-02	3.36E-02
	Co-60	1173.23		99.85	3.23E-03	3.06E-02	3.06E-02
		1332.49		99.98	2.50E-02		4.28E-02
	Nb-94	702.65		99.81	2.41E-02	3.67E-02	4.05E-02
		871.09		99.89	-2.23E-02		3.67E-02
	Ag-108m	79.13		6.60	1.61E-01	3.03E-02	8.77E-01
		433.94		90.50	-9.33E-03		3.03E-02
		614.28		89.80	-3.91E-02		4.38E-02
		722.94		90.80	3.75E-02		4.69E-02
	Sb-125	176.31		6.84	7.81E-02	1.14E-01	3.62E-01
		380.45		1.52	-6.07E-01		1.65E+00
		427.87		29.60	6.42E-02		1.14E-01
		463.36		10.49	5.59E-02		2.94E-01
		600.60		17.65	-1.95E-01		1.66E-01
		606.71		4.98	1.07E+00		1.04E+00

Analysis Report for 10-Dec-19-10011

L3-10212B-FRGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	635.95	11.22	-2.87E-01	1.14E-01	2.40E-01
	671.44	1.79	-4.02E-01		1.67E+00
Ba-133	79.61	2.65	1.01E+00	5.24E-02	2.16E+00
	81.00	32.90	-1.66E-01		1.35E-01
	276.40	7.16	2.14E-01		3.63E-01
	302.85	18.34	-8.12E-02		1.37E-01
	356.01	62.05	-3.66E-02		5.24E-02
	383.85	8.94	1.92E-01		3.35E-01
Cs-134	475.36	1.48	1.55E+00	4.60E-02	2.36E+00
	563.25	8.34	-2.63E-01		4.17E-01
	569.33	15.37	-4.57E-02		1.94E-01
	604.72	97.62	-3.64E-02		4.60E-02
	795.86	85.46	8.48E-03		5.06E-02
	801.95	8.69	2.56E-01		4.92E-01
	1038.61	0.99	-2.83E+00		3.21E+00
	1167.97	1.79	-2.62E-01		1.71E+00
	1365.19	3.02	-1.05E+00		1.05E+00
Cs-137	661.66	85.10	-1.06E-02	4.40E-02	4.40E-02
Eu-152	121.78	28.67	3.45E-02	8.95E-02	8.95E-02
	244.70	7.61	-1.21E-01		4.19E-01
	295.94	0.45	3.86E+00		7.99E+00
	344.28	26.60	3.23E-02		1.17E-01
	367.79	0.86	-1.88E+00		2.93E+00
	411.12	2.24	7.24E-01		1.44E+00
	443.96	2.83	-1.34E-01		9.45E-01
	488.68	0.42	4.17E-01		8.22E+00
	563.99	0.49	-6.11E+00		6.44E+00
	586.26	0.46	-2.63E+00		1.09E+01
	678.62	0.47	2.24E+00		5.97E+00
	688.67	0.86	1.41E+00		3.65E+00
	719.35	0.28	5.94E-01		1.22E+01
	778.90	12.96	-1.16E-01		2.30E-01
	810.45	0.32	-2.51E+00		1.12E+01
	867.37	4.26	-4.24E-01		8.08E-01
	919.33	0.43	-7.49E+00		7.50E+00
	964.08	14.65	-3.94E-02		3.25E-01
	1085.87	10.24	-2.83E-01		4.04E-01
	1089.74	1.73	-2.47E-01		2.54E+00
	1112.07	13.69	2.01E-01		3.51E-01
	1212.95	1.43	-1.16E-01		3.88E+00
	1249.94	0.19	-1.19E+01		2.55E+01
	1299.14	1.63	-2.46E-01		2.14E+00
	1408.01	21.07	4.51E-02		1.41E-01
	1457.64	0.50	6.64E+01		2.86E+01
	1528.10	0.28	4.49E+00		1.22E+01
Eu-154	123.07	40.40	-3.18E-03	6.13E-02	6.13E-02
	247.93	6.89	-2.20E-01		4.02E-01
	591.76	4.95	5.32E-01		7.01E-01
	692.42	1.78	9.47E-01		1.87E+00
	723.30	20.06	1.72E-01		2.13E-01
	756.80	4.52	-5.05E-01		6.71E-01

Analysis Report for 10-Dec-19-10011

L3-10212B-FRGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	873.18	12.08	-6.38E-02	6.13E-02	3.30E-01
	996.29	10.48	-3.50E-01		3.09E-01
	1004.76	18.01	-6.15E-02		2.12E-01
	1274.43	34.80	-1.11E-02		1.19E-01
	1596.48	1.80	7.28E-01		1.98E+00
Eu-155	45.30	1.31	2.37E+00	1.38E-01	8.92E+00
	60.01	1.22	1.03E+00		1.02E+01
	86.55	30.70	4.91E-02		1.38E-01
	105.31	21.10	-6.02E-03		1.43E-01
Ra-226	186.21	3.64	3.34E-01	6.92E-01	6.92E-01
Pa-231	27.36	10.30	6.74E-02	7.72E-01	7.72E-01
	283.69	1.70	6.25E-02		1.50E+00
	300.07	2.47	-1.21E+00		1.11E+00
	302.65	2.20	-1.86E-01		1.17E+00
	330.06	1.40	2.79E-02		2.14E+00
U-235	143.76	10.96	-6.38E-02	4.33E-02	2.58E-01
	163.33	5.08	3.79E-01		5.28E-01
	185.71	57.20	8.18E-03		4.33E-02
	202.11	1.08	2.14E-01		2.21E+00
	205.31	5.01	-2.23E-01		4.25E-01
Am-241	59.54	35.90	-9.01E-02	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

Apex-Gamma

Analysis Report for 10-Dec-19-10012

L3-10212B-FRGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10012
Sample Description	: L3-10212B-FRGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.142E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:20:00AM
Acquisition Started	: 12/10/2019 8:48:28AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81938
Fill Height	: 1141.90 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 9:03:30AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10012

L3-10212B-FRGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.52	948 -	962	954.54	1.69E+02	22.90	1.18E+02	0.79
2	295.22	1176 -	1187	1181.10	5.65E+01	13.36	4.85E+01	0.83
3	338.00	1345 -	1358	1352.03	4.89E+01	11.26	2.81E+01	0.44
4	351.79	1400 -	1414	1407.16	1.49E+02	16.73	4.52E+01	0.87
5	583.15	2324 -	2339	2331.92	7.83E+01	11.72	1.97E+01	0.49
6	609.25	2427 -	2444	2436.25	9.35E+01	12.69	2.05E+01	0.88
7	910.70	3633 -	3651	3641.84	5.98E+01	9.18	7.17E+00	0.85
8	1460.51	5827 -	5854	5842.41	4.70E+02	22.43	7.22E+00	1.81

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	1.09E+01	7.03E-01
Tl-208	1.00	583.19	*	85.00	1.22E-01	1.97E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.84E-01	4.49E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.81E-01	4.17E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 10-Dec-19-10012

L3-10212B-FRGS-011SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.54E-01	6.33E-02
		351.93	*	35.60	3.92E-01	5.40E-02
		785.96		1.06		
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.95E-01	9.65E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	4.15E-01	6.63E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Dec-19-10012

L3-10212B-FRGS-011SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.985	1.09E+01	7.03E-01	
	Tl-208	1.000	1.22E-01	1.97E-02	
X	Bi-211	0.920			
	Pb-212	0.998	2.84E-01	4.49E-02	
	Bi-214	1.000	2.81E-01	4.17E-02	
	Pb-214	0.998	3.33E-01	4.11E-02	
	Ac-228	0.985	4.09E-01	5.46E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10012

L3-10212B-FRGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 9:03:30AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	9.93E-02	6.72E-02	6.72E-02
	BE-7	477.60		10.44	-3.74E-02	4.25E-01	4.25E-01
+	K-40	1460.82	*	10.66	1.09E+01	5.21E-01	5.21E-01
	Mn-54	834.85		99.98	6.90E-03	5.80E-02	5.80E-02
	Co-60	1173.23		99.85	-4.25E-02	6.73E-02	7.20E-02
		1332.49		99.98	6.92E-02		6.73E-02
	Nb-94	702.65		99.81	-1.09E-02	5.49E-02	5.49E-02
		871.09		99.89	4.29E-02		5.96E-02
	Ag-108m	79.13		6.60	-1.12E+00	4.24E-02	1.78E+00
		433.94		90.50	1.44E-02		4.24E-02
		614.28		89.80	3.43E-03		9.06E-02
		722.94		90.80	2.41E-02		6.86E-02
	Sb-125	176.31		6.84	9.30E-02	1.42E-01	5.55E-01
		380.45		1.52	1.47E-01		2.75E+00
		427.87		29.60	2.60E-02		1.42E-01
		463.36		10.49	-4.39E-02		4.59E-01
		600.60		17.65	4.43E-02		2.69E-01
		606.71		4.98	2.06E+00		1.60E+00
		635.95		11.22	3.89E-01		4.48E-01

Analysis Report for 10-Dec-19-10012

L3-10212B-FRGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.92E+00	1.42E-01	2.68E+00
Ba-133	79.61	2.65	1.46E+00	1.03E-01	4.32E+00
	81.00	32.90	-7.83E-01		2.84E-01
	276.40	7.16	-2.70E-02		6.09E-01
	302.85	18.34	-6.70E-02		2.31E-01
	356.01	62.05	7.86E-04		1.03E-01
	383.85	8.94	1.51E-01		4.77E-01
Cs-134	475.36	1.48	-1.19E+00	6.71E-02	2.96E+00
	563.25	8.34	-4.69E-02		5.34E-01
	569.33	15.37	-1.16E-01		2.79E-01
	604.72	97.62	-3.95E-02		7.72E-02
	795.86	85.46	1.27E-02		6.71E-02
	801.95	8.69	-4.21E-01		5.68E-01
	1038.61	0.99	-5.20E+00		5.67E+00
	1167.97	1.79	1.71E+00		4.01E+00
	1365.19	3.02	-1.21E+00		1.57E+00
Cs-137	661.66	85.10	4.64E-02	6.47E-02	6.47E-02
Eu-152	121.78	28.67	8.18E-02	1.44E-01	1.70E-01
	244.70	7.61	4.31E-01		6.24E-01
	295.94	0.45	1.32E+01		1.27E+01
	344.28	26.60	-4.85E-02		1.44E-01
	367.79	0.86	-2.83E+00		4.42E+00
	411.12	2.24	2.36E-01		2.11E+00
	443.96	2.83	2.01E-01		1.55E+00
	488.68	0.42	-2.50E+00		1.15E+01
	563.99	0.49	2.64E-01		8.97E+00
	586.26	0.46	-2.34E+00		1.62E+01
	678.62	0.47	7.00E+00		1.09E+01
	688.67	0.86	-4.18E-01		5.11E+00
	719.35	0.28	0.00E+00		1.92E+01
	778.90	12.96	-5.30E-01		4.40E-01
	810.45	0.32	-3.34E+00		1.61E+01
	867.37	4.26	-1.37E+00		1.36E+00
	919.33	0.43	6.32E-01		1.15E+01
	964.08	14.65	3.22E-01		5.68E-01
	1085.87	10.24	6.43E-02		6.06E-01
	1089.74	1.73	-1.64E+00		3.50E+00
	1112.07	13.69	-2.70E-01		5.13E-01
	1212.95	1.43	1.67E+00		6.35E+00
	1249.94	0.19	8.93E+00		3.97E+01
	1299.14	1.63	2.48E+00		4.64E+00
	1408.01	21.07	-1.21E-01		2.59E-01
	1457.64	0.50	2.35E+02		5.32E+01
	1528.10	0.28	2.42E+00		1.57E+01
Eu-154	123.07	40.40	4.66E-02	1.20E-01	1.20E-01
	247.93	6.89	-5.29E-01		5.40E-01
	591.76	4.95	1.75E-01		9.29E-01
	692.42	1.78	5.43E-01		2.62E+00
	723.30	20.06	1.38E-01		3.13E-01
	756.80	4.52	9.99E-02		1.19E+00
	873.18	12.08	-1.20E-01		4.78E-01

Analysis Report for 10-Dec-19-10012

L3-10212B-FRGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.14E-01	1.20E-01	6.43E-01
	1004.76	18.01	1.28E-01		3.57E-01
	1274.43	34.80	1.51E-02		2.21E-01
	1596.48	1.80	-7.31E+00		2.15E+00
Eu-155	45.30	1.31	3.51E+00	2.60E-01	2.23E+01
	60.01	1.22	-7.44E+00		2.48E+01
	86.55	30.70	-2.83E-03		2.83E-01
	105.31	21.10	-4.68E-02		2.60E-01
Ra-226	186.21	3.64	1.32E+00	1.25E+00	1.25E+00
Pa-231	27.36	10.30	1.86E+00	1.88E+00	2.80E+00
	283.69	1.70	-3.53E-01		2.52E+00
	300.07	2.47	-5.72E-01		1.88E+00
	302.65	2.20	-1.12E-01		1.95E+00
	330.06	1.40	1.97E+00		3.28E+00
U-235	143.76	10.96	6.68E-02	7.86E-02	3.80E-01
	163.33	5.08	-2.04E-01		8.21E-01
	185.71	57.20	3.37E-02		7.86E-02
	202.11	1.08	-8.97E-01		3.94E+00
	205.31	5.01	6.62E-02		8.58E-01
Am-241	59.54	35.90	2.04E-01	8.80E-01	8.80E-01

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

Apex-Gamma

Analysis Report for 10-Dec-19-10013

L3-10212B-FRGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10013
Sample Description	: L3-10212B-FRGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.355E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:22:00AM
Acquisition Started	: 12/10/2019 9:06:29AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81939
Fill Height	: 1355.15 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 9:21:31AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10013

L3-10212B-FRGS-012SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.67	473 -	481	477.52	1.16E+02	19.64	1.24E+02	1.21
2	295.30	585 -	595	590.66	3.39E+01	14.29	7.11E+01	0.89
3	352.00	699 -	708	703.95	9.17E+01	14.39	5.13E+01	1.38
4	583.21	1162 -	1169	1166.03	3.48E+01	8.71	2.02E+01	1.54
5	609.41	1212 -	1224	1218.39	7.44E+01	11.24	1.96E+01	1.27
6	911.22	1816 -	1827	1821.88	3.28E+01	8.91	1.82E+01	1.30
7	1460.75	2914 -	2928	2921.56	3.88E+02	20.36	9.40E+00	1.98

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	7.56E+00	5.15E-01
Tl-208	1.00	583.19	*	85.00	4.63E-02	1.19E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.67E-01	3.13E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.90E-01	3.09E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 10-Dec-19-10013

L3-10212B-FRGS-012SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.30E-01	5.59E-02
		351.93	*	35.60	2.07E-01	3.64E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.93E-01	5.31E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Dec-19-10013

L3-10212B-FRGS-012SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	7.56E+00	5.15E-01	
	Tl-208	1.000	4.63E-02	1.19E-02	
X	Bi-211	0.870			
	Pb-212	1.000	1.67E-01	3.13E-02	
	Bi-214	1.000	1.90E-01	3.09E-02	
	Pb-214	0.999	1.84E-01	3.05E-02	
	Ac-228	1.000	1.93E-01	5.31E-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 1.000sigma

Analysis Report for 10-Dec-19-10013

L3-10212B-FRGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 9:21:31AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.57E-02	5.15E-02	5.15E-02
	BE-7	477.60		10.44	-1.58E-01	3.00E-01	3.00E-01
+	K-40	1460.82	*	10.66	7.56E+00	4.00E-01	4.00E-01
	Mn-54	834.85		99.98	-5.12E-03	4.60E-02	4.60E-02
	Co-60	1173.23		99.85	-1.96E-02	4.05E-02	4.98E-02
		1332.49		99.98	1.08E-02		4.05E-02
	Nb-94	702.65		99.81	1.29E-02	4.16E-02	4.21E-02
		871.09		99.89	-2.30E-03		4.16E-02
	Ag-108m	79.13		6.60	1.03E+00	3.36E-02	1.23E+00
		433.94		90.50	-1.27E-02		3.36E-02
		614.28		89.80	5.51E-04		5.53E-02
		722.94		90.80	-6.30E-03		4.60E-02
	Sb-125	176.31		6.84	4.78E-02	1.08E-01	5.03E-01
		380.45		1.52	-8.48E-01		2.00E+00
		427.87		29.60	2.60E-02		1.08E-01
		463.36		10.49	2.32E-01		3.61E-01
		600.60		17.65	5.44E-02		2.12E-01
		606.71		4.98	-6.37E-02		1.21E+00
		635.95		11.22	-7.20E-03		3.67E-01

Analysis Report for 10-Dec-19-10013

L3-10212B-FRGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.43E-01	1.08E-01	1.93E+00
Ba-133	79.61	2.65	2.16E+00	7.58E-02	2.90E+00
	81.00	32.90	-2.12E-01		1.83E-01
	276.40	7.16	2.17E-01		4.65E-01
	302.85	18.34	6.80E-02		1.79E-01
	356.01	62.05	-4.12E-02		7.58E-02
	383.85	8.94	-9.45E-02		3.57E-01
Cs-134	475.36	1.48	6.86E-02	4.52E-02	2.09E+00
	563.25	8.34	9.69E-03		4.40E-01
	569.33	15.37	-3.33E-03		2.35E-01
	604.72	97.62	-1.71E-02		5.07E-02
	795.86	85.46	9.18E-03		4.52E-02
	801.95	8.69	-1.33E-01		4.75E-01
	1038.61	0.99	1.91E+00		4.95E+00
	1167.97	1.79	2.01E-01		2.82E+00
	1365.19	3.02	-1.78E-01		1.32E+00
Cs-137	661.66	85.10	3.14E-02	4.57E-02	4.57E-02
Eu-152	121.78	28.67	-2.25E-03	1.11E-01	1.11E-01
	244.70	7.61	-1.45E-01		4.93E-01
	295.94	0.45	-1.04E+00		8.56E+00
	344.28	26.60	-1.16E-01		1.23E-01
	367.79	0.86	8.37E-02		3.69E+00
	411.12	2.24	6.00E-01		1.73E+00
	443.96	2.83	-6.60E-01		9.69E-01
	488.68	0.42	-3.88E+00		7.84E+00
	563.99	0.49	-4.56E+00		6.85E+00
	586.26	0.46	-5.10E+00		1.16E+01
	678.62	0.47	2.00E+00		8.17E+00
	688.67	0.86	1.26E+00		4.28E+00
	719.35	0.28	8.80E+00		1.45E+01
	778.90	12.96	-1.10E-01		2.98E-01
	810.45	0.32	4.83E+00		1.27E+01
	867.37	4.26	-5.44E-01		8.74E-01
	919.33	0.43	-1.69E+00		1.03E+01
	964.08	14.65	-1.99E-02		3.92E-01
	1085.87	10.24	-2.70E-01		4.38E-01
	1089.74	1.73	1.65E+00		2.92E+00
	1112.07	13.69	-2.68E-01		3.57E-01
	1212.95	1.43	-2.67E+00		3.38E+00
	1249.94	0.19	-7.70E-03		2.96E+01
	1299.14	1.63	-8.45E-01		3.27E+00
	1408.01	21.07	-6.24E-02		1.40E-01
	1457.64	0.50	-2.17E+00		4.08E+01
	1528.10	0.28	-4.58E+00		1.12E+01
Eu-154	123.07	40.40	-8.86E-03	7.72E-02	7.72E-02
	247.93	6.89	-2.21E-01		4.68E-01
	591.76	4.95	-3.34E-01		7.66E-01
	692.42	1.78	-1.36E-01		2.17E+00
	723.30	20.06	3.68E-02		2.13E-01
	756.80	4.52	-1.35E-01		7.98E-01
	873.18	12.08	1.72E-01		3.81E-01

Analysis Report for 10-Dec-19-10013

L3-10212B-FRGS-012SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.33E-01	7.72E-02	4.13E-01
	1004.76	18.01	5.91E-02		2.28E-01
	1274.43	34.80	-1.74E-02		1.51E-01
	1596.48	1.80	-1.62E+00		2.23E+00
Eu-155	45.30	1.31	3.59E+00	1.65E-01	1.21E+01
	60.01	1.22	-1.02E+00		1.29E+01
	86.55	30.70	1.09E-01		1.86E-01
	105.31	21.10	-4.38E-02		1.65E-01
Ra-226	186.21	3.64	7.22E-01	1.00E+00	1.00E+00
Pa-231	27.36	10.30	1.01E+00	1.20E+00	1.20E+00
	283.69	1.70	1.52E-01		1.76E+00
	300.07	2.47	5.21E-01		1.34E+00
	302.65	2.20	5.67E-01		1.49E+00
	330.06	1.40	-6.84E-02		2.35E+00
U-235	143.76	10.96	-1.44E-01	6.34E-02	2.60E-01
	163.33	5.08	1.19E-01		6.90E-01
	185.71	57.20	3.60E-02		6.34E-02
	202.11	1.08	-8.76E-01		3.19E+00
	205.31	5.01	-4.11E-01		6.83E-01
Am-241	59.54	35.90	1.62E-01	4.67E-01	4.67E-01

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

Apex-Gamma

Analysis Report for 10-Dec-19-10014

L3-10212B-FRGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10014
Sample Description	: L3-10212B-FRGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.414E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:24:00AM
Acquisition Started	: 12/10/2019 9:07:07AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.0 seconds
Dead Time	: 0.11 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81940
Fill Height	: 1413.91 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 9:22:10AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 12/10/19 - 1500

T Graham

Analysis Report for 10-Dec-19-10014

L3-10212B-FRGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.68	948 -	963	954.83	7.01E+01	15.73	5.89E+01	0.78
2	337.97	1348 -	1358	1351.67	1.92E+01	7.26	1.28E+01	0.86
3	351.92	1403 -	1411	1407.43	3.84E+01	8.59	1.66E+01	1.24
4	911.03	3637 -	3649	3643.06	2.46E+01	6.88	8.36E+00	0.34
5	1460.66	5834 -	5851	5842.46	7.72E+01	9.69	4.83E+00	0.81

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	1.97E+00	2.62E-01
Bi-211	0.89	351.07	*	13.02	3.00E-01	7.12E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.27E-01	3.04E-02
		300.09		3.30		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.10E-01	2.60E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		

Analysis Report for 10-Dec-19-10014

L3-10212B-FRGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Ac-228	0.99	328.00		2.95		
		338.32	*	11.27	1.68E-01	6.50E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.88E-01	5.31E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.996	1.97E+00	2.62E-01	
?	Bi-211	0.890	3.00E-01	7.12E-02	
	Pb-212	1.000	1.27E-01	3.04E-02	
?	Pb-214	1.000	1.10E-01	2.60E-02	
	Ac-228	0.996	1.80E-01	4.11E-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 10-Dec-19-10014

L3-10212B-FRGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 9:22:10AM
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	8.28E-02	6.44E-02	6.44E-02
	BE-7	477.60		10.44	1.30E-01	3.77E-01	3.77E-01
+	K-40	1460.82	*	10.66	1.97E+00	4.29E-01	4.29E-01
	Mn-54	834.85		99.98	8.11E-03	4.09E-02	4.09E-02
	Co-60	1173.23		99.85	-1.77E-02	4.55E-02	4.55E-02
		1332.49		99.98	2.11E-02		5.45E-02
	Nb-94	702.65		99.81	1.44E-02	3.92E-02	3.92E-02
		871.09		99.89	8.22E-03		4.20E-02
	Ag-108m	79.13		6.60	2.42E-01	3.50E-02	1.46E+00
		433.94		90.50	-6.81E-03		3.50E-02
		614.28		89.80	-1.10E-01		5.49E-02
		722.94		90.80	8.37E-03		5.14E-02
	Sb-125	176.31		6.84	-2.00E-01	1.15E-01	5.00E-01
		380.45		1.52	1.37E+00		2.43E+00
		427.87		29.60	3.36E-02		1.15E-01
		463.36		10.49	2.02E-01		3.63E-01
		600.60		17.65	-3.82E-02		1.85E-01
		606.71		4.98	1.26E+00		1.09E+00
		635.95		11.22	-5.58E-02		2.86E-01

Analysis Report for 10-Dec-19-10014

L3-10212B-FRGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	8.03E-01	1.15E-01	2.02E+00
Ba-133	79.61	2.65	1.88E+00	6.45E-02	3.53E+00
	81.00	32.90	-6.92E-02		2.44E-01
	276.40	7.16	-3.95E-01		4.82E-01
	302.85	18.34	-8.03E-02		1.70E-01
	356.01	62.05	-1.10E-01		6.45E-02
	383.85	8.94	-9.02E-02		3.68E-01
Cs-134	475.36	1.48	-5.46E-01	4.37E-02	2.59E+00
	563.25	8.34	1.31E-01		4.22E-01
	569.33	15.37	3.25E-02		2.35E-01
	604.72	97.62	1.20E-02		4.94E-02
	795.86	85.46	-4.46E-03		4.37E-02
	801.95	8.69	1.64E-01		4.04E-01
	1038.61	0.99	-4.62E-01		5.29E+00
	1167.97	1.79	-6.19E-01		2.71E+00
	1365.19	3.02	3.43E-01		1.07E+00
Cs-137	661.66	85.10	3.24E-02	4.81E-02	4.81E-02
Eu-152	121.78	28.67	-5.58E-02	1.21E-01	1.21E-01
	244.70	7.61	1.86E-01		4.64E-01
	295.94	0.45	1.08E+00		8.35E+00
	344.28	26.60	1.07E-02		1.22E-01
	367.79	0.86	1.46E+00		3.90E+00
	411.12	2.24	3.32E-01		1.59E+00
	443.96	2.83	6.70E-01		1.10E+00
	488.68	0.42	9.21E-01		8.19E+00
	563.99	0.49	3.39E+00		7.17E+00
	586.26	0.46	2.68E+00		1.07E+01
	678.62	0.47	-2.62E-01		6.87E+00
	688.67	0.86	-1.37E+00		4.80E+00
	719.35	0.28	-4.68E-01		1.32E+01
	778.90	12.96	-9.36E-02		3.00E-01
	810.45	0.32	3.60E+00		1.02E+01
	867.37	4.26	-9.79E-01		9.56E-01
	919.33	0.43	-6.43E+00		8.34E+00
	964.08	14.65	2.53E-01		3.54E-01
	1085.87	10.24	-6.13E-02		3.73E-01
	1089.74	1.73	1.05E-01		2.41E+00
	1112.07	13.69	3.12E-02		4.00E-01
	1212.95	1.43	-1.31E+00		3.02E+00
	1249.94	0.19	2.06E+01		2.84E+01
	1299.14	1.63	5.70E-01		2.39E+00
	1408.01	21.07	-9.74E-02		1.71E-01
	1457.64	0.50	4.76E+01		2.59E+01
	1528.10	0.28	2.00E+00		9.67E+00
Eu-154	123.07	40.40	-1.27E-02	8.94E-02	8.94E-02
	247.93	6.89	1.76E-01		4.79E-01
	591.76	4.95	3.93E-02		7.94E-01
	692.42	1.78	1.44E+00		2.51E+00
	723.30	20.06	1.47E-01		2.44E-01
	756.80	4.52	6.41E-01		1.06E+00
	873.18	12.08	2.53E-01		3.48E-01

Analysis Report for 10-Dec-19-10014

L3-10212B-FRGS-013SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	8.23E-02	8.94E-02	3.60E-01
	1004.76	18.01	2.22E-01		2.78E-01
	1274.43	34.80	-4.92E-02		1.28E-01
	1596.48	1.80	-1.75E+00		1.82E+00
Eu-155	45.30	1.31	-5.12E+00	2.44E-01	2.52E+01
	60.01	1.22	5.20E+00		2.69E+01
	86.55	30.70	2.20E-01		2.44E-01
	105.31	21.10	1.56E-01		2.51E-01
Ra-226	186.21	3.64	2.70E-01	9.73E-01	9.73E-01
Pa-231	27.36	10.30	2.55E+00	1.23E+00	3.18E+00
	283.69	1.70	1.35E+00		2.10E+00
	300.07	2.47	-1.18E+00		1.23E+00
	302.65	2.20	2.08E-01		1.47E+00
	330.06	1.40	1.63E+00		2.41E+00
U-235	143.76	10.96	-2.94E-01	6.10E-02	3.44E-01
	163.33	5.08	-8.35E-02		7.06E-01
	185.71	57.20	4.83E-03		6.10E-02
	202.11	1.08	7.55E-01		3.04E+00
	205.31	5.01	1.65E-01		6.91E-01
Am-241	59.54	35.90	6.27E-01	1.00E+00	1.00E+00

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

Apex-Gamma

Analysis Report for 10-Dec-19-10015

L3-10212B-FRGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10015
Sample Description	: L3-10212B-FRGS-014SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.370E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:26:00AM
Acquisition Started	: 12/10/2019 9:07:28AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81941
Fill Height	: 1369.65 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 9:22:30AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10015

L3-10212B-FRGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.74	949 -	961	954.55	7.54E+01	13.73	4.26E+01	0.69
2	338.45	1348 -	1357	1352.89	2.20E+01	6.86	1.10E+01	0.35
3	352.23	1401 -	1413	1407.94	4.68E+01	9.46	1.63E+01	1.23
4	582.92	2325 -	2335	2329.82	2.33E+01	6.82	9.68E+00	0.90
5	1460.33	5829 -	5849	5839.24	1.27E+02	11.69	2.56E+00	2.16

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.82	*	10.66	2.96E+00	3.01E-01
Tl-208	0.98	583.19	*	85.00	3.61E-02	1.08E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.23E-01	2.44E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.21E-01	2.63E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		

Analysis Report for 10-Dec-19-10015

L3-10212B-FRGS-014SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Ac-228	1.00	328.00		2.95		
		338.32	*	11.27	1.74E-01	5.62E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.961	2.96E+00	3.01E-01	
Tl-208	0.989	3.61E-02	1.08E-02	
Pb-212	0.998	1.23E-01	2.44E-02	
Pb-214	0.992	1.21E-01	2.63E-02	
Ac-228	1.000	1.74E-01	5.62E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10015

L3-10212B-FRGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 9:22:30AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.93E-02	4.79E-02	4.79E-02
	BE-7	477.60		10.44	6.20E-02	3.24E-01	3.24E-01
+	K-40	1460.82	*	10.66	2.96E+00	3.05E-01	3.05E-01
	Mn-54	834.85		99.98	4.48E-03	2.78E-02	2.78E-02
	Co-60	1173.23		99.85	-4.15E-02	3.99E-02	4.29E-02
		1332.49		99.98	-2.18E-02		3.99E-02
	Nb-94	702.65		99.81	1.54E-02	3.50E-02	3.65E-02
		871.09		99.89	2.26E-02		3.50E-02
	Ag-108m	79.13		6.60	6.03E-01	3.29E-02	1.02E+00
		433.94		90.50	-4.84E-03		3.29E-02
		614.28		89.80	-4.17E-02		3.86E-02
		722.94		90.80	-7.07E-03		4.09E-02
	Sb-125	176.31		6.84	-3.63E-02	9.27E-02	3.55E-01
		380.45		1.52	1.27E+00		1.82E+00
		427.87		29.60	-1.26E-02		9.27E-02
		463.36		10.49	4.92E-02		3.16E-01
		600.60		17.65	4.58E-02		2.08E-01
		606.71		4.98	6.63E-02		9.83E-01
		635.95		11.22	3.38E-02		3.23E-01

Analysis Report for 10-Dec-19-10015

L3-10212B-FRGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.30E+00	9.27E-02	1.79E+00
Ba-133	79.61	2.65	7.95E-01	5.94E-02	2.41E+00
	81.00	32.90	-1.71E-01		1.57E-01
	276.40	7.16	3.60E-02		3.75E-01
	302.85	18.34	6.33E-02		1.57E-01
	356.01	62.05	-2.96E-02		5.94E-02
	383.85	8.94	-7.85E-02		2.95E-01
Cs-134	475.36	1.48	1.00E+00	4.33E-02	2.15E+00
	563.25	8.34	-4.82E-01		4.00E-01
	569.33	15.37	1.02E-01		2.31E-01
	604.72	97.62	-3.23E-02		4.81E-02
	795.86	85.46	1.29E-02		4.33E-02
	801.95	8.69	-9.96E-02		3.41E-01
	1038.61	0.99	-1.27E+00		3.57E+00
	1167.97	1.79	-8.87E-02		2.22E+00
	1365.19	3.02	-5.36E-01		1.41E+00
Cs-137	661.66	85.10	1.71E-02	3.73E-02	3.73E-02
Eu-152	121.78	28.67	2.40E-02	9.67E-02	9.67E-02
	244.70	7.61	-2.09E-02		3.76E-01
	295.94	0.45	1.86E+00		6.90E+00
	344.28	26.60	3.56E-03		1.02E-01
	367.79	0.86	9.10E-01		2.91E+00
	411.12	2.24	-2.81E-01		1.24E+00
	443.96	2.83	-7.85E-01		1.09E+00
	488.68	0.42	5.60E-01		7.17E+00
	563.99	0.49	-3.29E+00		6.52E+00
	586.26	0.46	-3.15E+00		1.07E+01
	678.62	0.47	-4.54E-01		6.46E+00
	688.67	0.86	2.63E+00		4.09E+00
	719.35	0.28	-2.72E+00		1.03E+01
	778.90	12.96	-2.38E-01		2.14E-01
	810.45	0.32	-3.97E+00		8.46E+00
	867.37	4.26	-1.45E-01		7.91E-01
	919.33	0.43	-1.33E+00		8.77E+00
	964.08	14.65	2.98E-01		3.76E-01
	1085.87	10.24	-1.78E-01		3.55E-01
	1089.74	1.73	1.28E+00		2.19E+00
	1112.07	13.69	6.36E-02		3.30E-01
	1212.95	1.43	-7.72E-01		3.45E+00
	1249.94	0.19	-2.96E+00		2.85E+01
	1299.14	1.63	1.25E+00		3.08E+00
	1408.01	21.07	1.72E-01		2.45E-01
	1457.64	0.50	5.92E+01		2.86E+01
	1528.10	0.28	1.82E+00		8.79E+00
Eu-154	123.07	40.40	2.11E-02	6.79E-02	6.79E-02
	247.93	6.89	-3.96E-02		3.77E-01
	591.76	4.95	-2.08E-01		6.55E-01
	692.42	1.78	-2.44E+00		1.44E+00
	723.30	20.06	3.74E-02		1.93E-01
	756.80	4.52	-1.08E+00		7.69E-01
	873.18	12.08	3.95E-02		2.99E-01

Analysis Report for 10-Dec-19-10015

L3-10212B-FRGS-014SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-5.00E-01	6.79E-02	3.41E-01
	1004.76	18.01	-1.82E-01		1.84E-01
	1274.43	34.80	-1.65E-01		1.21E-01
	1596.48	1.80	-8.13E-01		1.43E+00
Eu-155	45.30	1.31	3.37E+00	1.47E-01	9.13E+00
	60.01	1.22	-5.52E+00		9.15E+00
	86.55	30.70	4.21E-03		1.47E-01
	105.31	21.10	8.93E-02		1.59E-01
Ra-226	186.21	3.64	7.30E-01	8.39E-01	8.39E-01
Pa-231	27.36	10.30	4.81E-01	1.01E+00	1.01E+00
	283.69	1.70	-1.30E-01		1.55E+00
	300.07	2.47	-2.25E+00		1.10E+00
	302.65	2.20	6.93E-01		1.31E+00
	330.06	1.40	4.38E-01		2.11E+00
U-235	143.76	10.96	-1.27E-01	5.27E-02	2.23E-01
	163.33	5.08	-2.69E-01		4.65E-01
	185.71	57.20	3.81E-02		5.27E-02
	202.11	1.08	-9.28E-01		2.15E+00
	205.31	5.01	-2.84E-01		4.81E-01
Am-241	59.54	35.90	-1.76E-01	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 10-Dec-19-10016

L3-10212B-FRGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10016
Sample Description	: L3-10212B-FRGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.370E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:28:00AM
Acquisition Started	: 12/10/2019 9:08:00AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.2 seconds
Dead Time	: 0.02 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81942
Fill Height	: 1369.57 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 9:23:02AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10016

L3-10212B-FRGS-015SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.57	948 -	962	954.73	8.18E+01	14.17	4.02E+01	0.66
2	351.87	1400 -	1415	1407.47	5.69E+01	11.12	2.21E+01	1.21
3	608.92	2428 -	2442	2434.93	5.42E+01	8.10	3.82E+00	1.23
4	1460.40	5830 -	5852	5841.96	1.41E+02	11.87	0.00E+00	2.44

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.82	*	10.66	3.05E+00	2.89E-01
Bi-211	0.90	351.07	*	13.02	3.88E-01	8.20E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.31E-01	2.50E-02
		300.09		3.30		
Bi-214	0.98	609.32	*	45.49	1.53E-01	2.47E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		

Analysis Report for 10-Dec-19-10016

L3-10212B-FRGS-015SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.98	1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.42E-01	3.00E-02
		785.96		1.06		

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.972	3.05E+00	2.89E-01	
?	Bi-211	0.903	3.88E-01	8.20E-02	
	Pb-212	0.999	1.31E-01	2.50E-02	
	Bi-214	0.989	1.53E-01	2.47E-02	
?	Pb-214	1.000	1.42E-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 10-Dec-19-10016

L3-10212B-FRGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 9:23:02AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.49E-02	5.15E-02	5.15E-02
	BE-7	477.60		10.44	3.22E-01	3.76E-01	3.76E-01
+	K-40	1460.82	*	10.66	3.05E+00	6.22E-02	6.22E-02
	Mn-54	834.85		99.98	1.86E-02	3.69E-02	3.69E-02
	Co-60	1173.23		99.85	4.73E-02	4.05E-02	5.78E-02
		1332.49		99.98	-7.01E-03		4.05E-02
	Nb-94	702.65		99.81	-1.66E-02	3.69E-02	4.00E-02
		871.09		99.89	-9.90E-03		3.69E-02
	Ag-108m	79.13		6.60	-1.61E-01	3.25E-02	1.37E+00
		433.94		90.50	1.08E-02		3.25E-02
		614.28		89.80	-4.63E-02		5.94E-02
		722.94		90.80	3.57E-03		4.34E-02
	Sb-125	176.31		6.84	1.24E-01	1.14E-01	4.71E-01
		380.45		1.52	1.15E+00		2.01E+00
		427.87		29.60	2.17E-02		1.14E-01
		463.36		10.49	1.34E-02		3.32E-01
		600.60		17.65	-2.83E-02		2.01E-01
		606.71		4.98	1.17E+00		1.15E+00
		635.95		11.22	-1.99E-01		3.06E-01

Analysis Report for 10-Dec-19-10016

L3-10212B-FRGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-1.05E+00	1.14E-01	1.87E+00
Ba-133	79.61	2.65	1.34E+00	6.83E-02	3.29E+00
	81.00	32.90	-2.47E-01		2.20E-01
	276.40	7.16	3.24E-02		4.27E-01
	302.85	18.34	4.94E-02		1.67E-01
	356.01	62.05	1.10E-02		6.83E-02
	383.85	8.94	1.48E-01		3.47E-01
Cs-134	475.36	1.48	2.39E-02	4.07E-02	2.48E+00
	563.25	8.34	-1.50E-01		3.64E-01
	569.33	15.37	1.28E-01		2.03E-01
	604.72	97.62	-1.30E-02		5.41E-02
	795.86	85.46	-1.16E-03		4.07E-02
	801.95	8.69	-1.20E-01		4.60E-01
	1038.61	0.99	2.22E+00		3.61E+00
	1167.97	1.79	-1.66E-01		3.02E+00
	1365.19	3.02	2.80E-01		1.65E+00
Cs-137	661.66	85.10	2.98E-02	4.21E-02	4.21E-02
Eu-152	121.78	28.67	1.39E-02	1.02E-01	1.30E-01
	244.70	7.61	1.60E-01		4.01E-01
	295.94	0.45	9.92E+00		8.66E+00
	344.28	26.60	-7.64E-02		1.02E-01
	367.79	0.86	-1.60E+00		3.23E+00
	411.12	2.24	3.09E-01		1.57E+00
	443.96	2.83	-4.33E-01		1.10E+00
	488.68	0.42	-6.61E-02		7.93E+00
	563.99	0.49	5.24E+00		6.81E+00
	586.26	0.46	7.77E+00		9.94E+00
	678.62	0.47	1.85E+00		7.58E+00
	688.67	0.86	-3.57E-01		4.36E+00
	719.35	0.28	-5.34E+00		1.20E+01
	778.90	12.96	-7.24E-02		2.78E-01
	810.45	0.32	5.02E+00		1.20E+01
	867.37	4.26	-5.20E-01		8.64E-01
	919.33	0.43	-8.11E+00		7.97E+00
	964.08	14.65	3.27E-01		3.77E-01
	1085.87	10.24	-1.41E-01		3.59E-01
	1089.74	1.73	-6.07E-01		2.41E+00
	1112.07	13.69	-1.80E-01		3.33E-01
	1212.95	1.43	1.43E+00		3.13E+00
	1249.94	0.19	9.08E+00		2.41E+01
	1299.14	1.63	-1.57E+00		2.95E+00
	1408.01	21.07	-9.51E-03		1.66E-01
	1457.64	0.50	6.64E+01		2.78E+01
	1528.10	0.28	4.23E+00		1.15E+01
Eu-154	123.07	40.40	3.83E-02	9.00E-02	9.00E-02
	247.93	6.89	-8.06E-02		3.96E-01
	591.76	4.95	-7.92E-02		6.73E-01
	692.42	1.78	3.31E-01		2.37E+00
	723.30	20.06	-1.62E-02		1.96E-01
	756.80	4.52	-2.17E-01		6.63E-01
	873.18	12.08	2.08E-01		3.36E-01

Analysis Report for 10-Dec-19-10016

L3-10212B-FRGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.74E-01	9.00E-02	4.88E-01
	1004.76	18.01	-1.04E-01		2.53E-01
	1274.43	34.80	-1.89E-01		1.09E-01
	1596.48	1.80	-2.28E+00		1.71E+00
Eu-155	45.30	1.31	-4.99E+00	1.77E-01	1.58E+01
	60.01	1.22	-1.79E+01		1.63E+01
	86.55	30.70	-5.44E-02		1.77E-01
	105.31	21.10	-1.60E-02		1.79E-01
Ra-226	186.21	3.64	9.74E-01	9.76E-01	9.76E-01
Pa-231	27.36	10.30	2.22E+00	1.29E+00	2.05E+00
	283.69	1.70	-6.17E-02		1.76E+00
	300.07	2.47	-1.48E+00		1.29E+00
	302.65	2.20	1.06E-01		1.38E+00
	330.06	1.40	-7.30E-01		2.24E+00
U-235	143.76	10.96	-2.87E-01	6.20E-02	2.73E-01
	163.33	5.08	2.98E-01		5.58E-01
	185.71	57.20	3.51E-02		6.20E-02
	202.11	1.08	3.73E-01		2.68E+00
	205.31	5.01	-5.38E-01		5.21E-01
Am-241	59.54	35.90	-1.41E-01	5.95E-01	5.95E-01

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

Apex-Gamma

Analysis Report for 10-Dec-19-10017

L3-10212B-FRGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10017
Sample Description	: L3-10212B-FRGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.171E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:30:00AM
Acquisition Started	: 12/10/2019 9:24:42AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81943
Fill Height	: 1170.93 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 9:39:44AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

Data Validated 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10017

L3-10212B-FRGS-016SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.69	474 -	481	477.57	9.89E+01	18.33	1.11E+02	1.10
2	295.20	585 -	595	590.46	5.01E+01	13.88	5.99E+01	1.11
3	352.01	699 -	707	703.97	8.14E+01	13.22	4.36E+01	0.98
4	583.15	1161 -	1171	1165.91	4.62E+01	11.27	3.38E+01	0.78
5	609.20	1212 -	1223	1217.98	7.86E+01	11.93	2.54E+01	1.31
6	661.59	1317 -	1326	1322.71	1.91E+01	7.26	1.49E+01	1.16
7	911.26	1816 -	1828	1821.98	4.79E+01	9.12	1.31E+01	0.79
8	1460.89	2915 -	2929	2921.83	2.79E+02	17.47	9.19E+00	2.28

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	5.75E+00	4.38E-01
Cs-137	0.99	661.66	*	85.10	2.90E-02	1.11E-02
Tl-208	1.00	583.19	*	85.00	6.44E-02	1.62E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.48E-01	2.99E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.11E-01	3.44E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 10-Dec-19-10017

L3-10212B-FRGS-016SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.01E-01	5.79E-02
		351.93	*	35.60	1.92E-01	3.47E-02
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.97E-01	5.79E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 10-Dec-19-10017

L3-10212B-FRGS-016SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.999	5.75E+00	4.38E-01	
	Cs-137	0.999	2.90E-02	1.11E-02	
	Tl-208	1.000	6.44E-02	1.62E-02	
X	Bi-211	0.867			
	Pb-212	0.999	1.48E-01	2.99E-02	
	Bi-214	0.999	2.11E-01	3.44E-02	
	Pb-214	0.999	1.94E-01	2.97E-02	
	Ac-228	1.000	2.97E-01	5.79E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10017

L3-10212B-FRGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 9:39:44AM
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	5.03E-02	5.36E-02	5.36E-02
	BE-7	477.60		10.44	1.49E-01	3.33E-01	3.33E-01
+	K-40	1460.82	*	10.66	5.75E+00	4.18E-01	4.18E-01
	Mn-54	834.85		99.98	5.36E-03	3.90E-02	3.90E-02
	Co-60	1173.23		99.85	-1.98E-03	4.53E-02	5.59E-02
		1332.49		99.98	2.00E-02		4.53E-02
	Nb-94	702.65		99.81	3.78E-03	3.77E-02	3.86E-02
		871.09		99.89	-2.48E-03		3.77E-02
	Ag-108m	79.13		6.60	7.41E-01	3.30E-02	1.27E+00
		433.94		90.50	-1.48E-03		3.30E-02
		614.28		89.80	-2.43E-02		5.68E-02
		722.94		90.80	1.21E-02		4.77E-02
	Sb-125	176.31		6.84	-2.03E-01	1.09E-01	5.07E-01
		380.45		1.52	-4.42E-01		2.13E+00
		427.87		29.60	4.45E-02		1.09E-01
		463.36		10.49	9.69E-02		3.56E-01
		600.60		17.65	2.73E-02		2.00E-01
		606.71		4.98	1.29E-01		1.36E+00
		635.95		11.22	1.36E-01		3.76E-01

Analysis Report for 10-Dec-19-10017

L3-10212B-FRGS-016SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-1.00E+00	1.09E-01	1.96E+00
	Ba-133	79.61		2.65	1.76E-01	7.57E-02	2.94E+00
		81.00		32.90	-2.89E-01		1.93E-01
		276.40		7.16	-2.13E-01		4.52E-01
		302.85		18.34	8.81E-02		1.81E-01
		356.01		62.05	-7.78E-02		7.57E-02
		383.85		8.94	-6.47E-02		3.67E-01
	Cs-134	475.36		1.48	1.05E-01	5.13E-02	2.29E+00
		563.25		8.34	1.59E-02		4.67E-01
		569.33		15.37	-6.15E-02		2.15E-01
		604.72		97.62	5.47E-03		5.90E-02
		795.86		85.46	3.08E-02		5.13E-02
		801.95		8.69	-1.96E-01		4.69E-01
		1038.61		0.99	2.80E+00		5.21E+00
		1167.97		1.79	-1.17E+00		3.02E+00
		1365.19		3.02	2.60E-01		1.25E+00
+	Cs-137	661.66	*	85.10	2.90E-02	3.41E-02	3.41E-02
	Eu-152	121.78		28.67	-2.05E-02	1.04E-01	1.04E-01
		244.70		7.61	-7.14E-02		5.03E-01
		295.94		0.45	2.73E-01		9.26E+00
		344.28		26.60	-2.57E-02		1.23E-01
		367.79		0.86	5.26E-01		3.82E+00
		411.12		2.24	3.07E-01		1.62E+00
		443.96		2.83	-4.72E-01		1.01E+00
		488.68		0.42	-1.35E+00		7.82E+00
		563.99		0.49	1.89E+00		8.01E+00
		586.26		0.46	-6.47E-03		1.27E+01
		678.62		0.47	-6.12E+00		7.05E+00
		688.67		0.86	5.09E-01		4.76E+00
		719.35		0.28	3.30E+00		1.38E+01
		778.90		12.96	-1.09E-01		3.33E-01
		810.45		0.32	9.34E-01		1.21E+01
		867.37		4.26	-1.89E-01		9.01E-01
		919.33		0.43	-6.97E+00		8.29E+00
		964.08		14.65	-9.32E-03		3.68E-01
		1085.87		10.24	-1.45E-01		4.26E-01
		1089.74		1.73	-1.00E-01		2.94E+00
		1112.07		13.69	-3.27E-01		3.57E-01
		1212.95		1.43	3.38E-02		3.88E+00
		1249.94		0.19	-7.52E+00		2.23E+01
		1299.14		1.63	7.76E-01		3.33E+00
		1408.01		21.07	9.70E-02		1.98E-01
		1457.64		0.50	-1.45E+00		3.68E+01
		1528.10		0.28	2.02E-01		9.02E+00
	Eu-154	123.07		40.40	9.32E-03	7.76E-02	7.76E-02
		247.93		6.89	-5.63E-02		4.83E-01
		591.76		4.95	2.05E-01		7.56E-01
		692.42		1.78	7.65E-01		2.25E+00
		723.30		20.06	-7.60E-03		2.13E-01
		756.80		4.52	1.27E-01		8.82E-01
		873.18		12.08	6.46E-02		3.26E-01

Analysis Report for 10-Dec-19-10017

L3-10212B-FRGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.31E-01	7.76E-02	4.35E-01
	1004.76	18.01	-6.37E-02		2.30E-01
	1274.43	34.80	-6.19E-02		1.56E-01
	1596.48	1.80	2.05E-01		2.46E+00
Eu-155	45.30	1.31	5.44E-01	1.73E-01	1.17E+01
	60.01	1.22	-7.45E-01		1.30E+01
	86.55	30.70	-2.67E-02		1.73E-01
	105.31	21.10	3.57E-02		1.76E-01
Ra-226	186.21	3.64	5.44E-01	1.02E+00	1.02E+00
Pa-231	27.36	10.30	2.04E-01	1.04E+00	1.04E+00
	283.69	1.70	-2.48E-01		1.81E+00
	300.07	2.47	-1.83E-03		1.31E+00
	302.65	2.20	7.34E-01		1.51E+00
	330.06	1.40	2.24E-01		2.41E+00
U-235	143.76	10.96	1.95E-01	6.51E-02	2.95E-01
	163.33	5.08	1.45E-01		7.10E-01
	185.71	57.20	3.51E-02		6.51E-02
	202.11	1.08	1.96E+00		3.33E+00
	205.31	5.01	-4.41E-01		6.67E-01
Am-241	59.54	35.90	5.90E-02	4.60E-01	4.60E-01

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

Apex-Gamma

Analysis Report for 10-Dec-19-10018

L3-10212B-FRGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 10-Dec-19-10018
Sample Description	: L3-10212B-FRGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.455E+03 grams
Facility	: Default
Sample Taken On	: 12/9/2019 9:40:00AM
Acquisition Started	: 12/10/2019 9:25:09AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.0 seconds
Dead Time	: 0.11 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/10/2019
Efficiency Calibration Description	:
Sample Number	: 81944
Fill Height	: 1455.20 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/10/2019 9:40:12AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated 12/10/19 - 1500

J Graham

Analysis Report for 10-Dec-19-10018

L3-10212B-FRGS-017SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.58	948 -	961	954.41	7.64E+01	13.03	3.36E+01	0.87
2	295.39	1178 -	1187	1181.48	2.40E+01	7.83	1.60E+01	0.62
3	583.11	2327 -	2340	2331.66	3.30E+01	8.52	1.40E+01	0.30
4	911.17	3639 -	3648	3643.64	1.70E+01	5.32	5.00E+00	1.05
5	1460.78	5834 -	5852	5842.97	1.21E+02	11.72	4.75E+00	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	1.00	1460.82	*	10.66	3.07E+00	3.25E-01
Tl-208	0.99	583.19	*	85.00	5.58E-02	1.48E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.38E-01	2.60E-02
		300.09		3.30		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.16E-01	3.89E-02
		351.93		35.60		
		785.96		1.06		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		

Analysis Report for 10-Dec-19-10018

L3-10212B-FRGS-017SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Ac-228	1.00	328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.28E-01	4.06E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	1.000	3.07E+00	3.25E-01	
Tl-208	0.999	5.58E-02	1.48E-02	
Pb-212	1.000	1.38E-01	2.60E-02	
Pb-214	0.999	1.16E-01	3.89E-02	
Ac-228	1.000	1.28E-01	4.06E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 10-Dec-19-10018

L3-10212B-FRGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/10/2019 9:40:12AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.23E-02	5.02E-02	5.02E-02
	BE-7	477.60		10.44	-3.70E-02	2.89E-01	2.89E-01
+	K-40	1460.82	*	10.66	3.07E+00	4.17E-01	4.17E-01
	Mn-54	834.85		99.98	-3.46E-02	4.47E-02	4.47E-02
	Co-60	1173.23		99.85	9.69E-03	4.34E-02	5.10E-02
		1332.49		99.98	2.26E-02		4.34E-02
	Nb-94	702.65		99.81	-4.09E-03	3.80E-02	3.80E-02
		871.09		99.89	1.55E-02		3.93E-02
	Ag-108m	79.13		6.60	1.68E+00	3.53E-02	1.71E+00
		433.94		90.50	-2.27E-02		3.53E-02
		614.28		89.80	-4.39E-02		4.29E-02
		722.94		90.80	-2.20E-03		3.93E-02
	Sb-125	176.31		6.84	1.30E-03	1.18E-01	5.15E-01
		380.45		1.52	-6.41E-01		2.11E+00
		427.87		29.60	5.69E-03		1.18E-01
		463.36		10.49	-2.04E-02		3.83E-01
		600.60		17.65	3.44E-02		1.93E-01
		606.71		4.98	4.43E-01		9.63E-01
		635.95		11.22	7.57E-02		3.24E-01

Analysis Report for 10-Dec-19-10018

L3-10212B-FRGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	1.95E+00	1.18E-01	2.24E+00
Ba-133	79.61	2.65	2.54E+00	6.95E-02	4.02E+00
	81.00	32.90	-3.57E-01		2.44E-01
	276.40	7.16	-5.14E-02		4.39E-01
	302.85	18.34	1.23E-01		1.88E-01
	356.01	62.05	-4.08E-03		6.95E-02
	383.85	8.94	-1.46E-01		3.65E-01
Cs-134	475.36	1.48	-1.33E-01	4.47E-02	2.10E+00
	563.25	8.34	5.97E-02		4.27E-01
	569.33	15.37	5.02E-02		2.19E-01
	604.72	97.62	-1.04E-02		4.47E-02
	795.86	85.46	3.23E-02		5.28E-02
	801.95	8.69	-3.73E-01		3.38E-01
	1038.61	0.99	2.22E+00		4.88E+00
	1167.97	1.79	4.83E-01		2.84E+00
	1365.19	3.02	4.25E-01		1.16E+00
Cs-137	661.66	85.10	1.34E-02	4.17E-02	4.17E-02
Eu-152	121.78	28.67	3.52E-02	1.25E-01	1.42E-01
	244.70	7.61	3.51E-01		4.83E-01
	295.94	0.45	5.29E+00		9.24E+00
	344.28	26.60	8.44E-03		1.25E-01
	367.79	0.86	-4.14E-01		3.72E+00
	411.12	2.24	3.46E-01		1.65E+00
	443.96	2.83	1.62E-01		1.30E+00
	488.68	0.42	-2.13E+00		8.95E+00
	563.99	0.49	3.93E+00		7.40E+00
	586.26	0.46	1.10E+01		1.24E+01
	678.62	0.47	2.14E+00		7.85E+00
	688.67	0.86	-9.37E-02		4.46E+00
	719.35	0.28	7.57E+00		1.38E+01
	778.90	12.96	-2.25E-02		3.14E-01
	810.45	0.32	8.94E-01		1.30E+01
	867.37	4.26	-6.26E-01		8.30E-01
	919.33	0.43	2.50E+00		8.27E+00
	964.08	14.65	-5.88E-03		4.59E-01
	1085.87	10.24	-1.61E-01		4.73E-01
	1089.74	1.73	3.04E-01		3.16E+00
	1112.07	13.69	1.14E-01		2.53E-01
	1212.95	1.43	-1.69E+00		2.86E+00
	1249.94	0.19	1.31E+01		3.30E+01
	1299.14	1.63	-1.34E+00		2.97E+00
	1408.01	21.07	-2.15E-01		1.39E-01
	1457.64	0.50	6.96E+01		3.08E+01
	1528.10	0.28	1.98E+00		9.58E+00
Eu-154	123.07	40.40	-1.22E-02	1.00E-01	1.00E-01
	247.93	6.89	9.89E-03		4.75E-01
	591.76	4.95	-2.15E-01		6.98E-01
	692.42	1.78	1.55E+00		2.35E+00
	723.30	20.06	3.94E-02		1.78E-01
	756.80	4.52	3.72E-01		1.00E+00
	873.18	12.08	1.15E-01		3.16E-01

Analysis Report for 10-Dec-19-10018

L3-10212B-FRGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-6.22E-02	1.00E-01	3.85E-01
	1004.76	18.01	-3.50E-02		2.82E-01
	1274.43	34.80	-2.63E-02		1.21E-01
	1596.48	1.80	8.05E-01		2.19E+00
Eu-155	45.30	1.31	-1.37E+01	2.31E-01	2.58E+01
	60.01	1.22	-9.55E+00		2.30E+01
	86.55	30.70	1.68E-01		2.33E-01
	105.31	21.10	2.66E-02		2.31E-01
Ra-226	186.21	3.64	1.21E+00	1.05E+00	1.05E+00
Pa-231	27.36	10.30	2.60E+00	1.41E+00	2.97E+00
	283.69	1.70	5.20E-01		1.88E+00
	300.07	2.47	1.03E-02		1.41E+00
	302.65	2.20	1.08E+00		1.59E+00
	330.06	1.40	-1.48E-01		2.41E+00
U-235	143.76	10.96	-1.76E-01	6.66E-02	3.27E-01
	163.33	5.08	4.94E-03		6.85E-01
	185.71	57.20	4.12E-02		6.66E-02
	202.11	1.08	1.60E-01		3.02E+00
	205.31	5.01	-4.42E-01		6.22E-01
Am-241	59.54	35.90	1.23E-01	8.65E-01	8.65E-01

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

Apex-Gamma

Analysis Report for 09-Dec-19-10011
L3-10212B-FIGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Dec-19-10011
Sample Description	: L3-10212B-FIGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.432E+03 grams
Facility	: Default
Sample Taken On	: 12/6/2019 1:30:00PM
Acquisition Started	: 12/9/2019 7:37:54AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 1/28/2020
Efficiency Calibration Description	:
Sample Number	: 81902
Fill Height	: 1431.59 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

Reprinted with corrected sample date. 1-28-20

1-28-20

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 1/28/2020 8:49:27AM

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

Data Validated
0930 1-28-20

Analysis Report for 09-Dec-19-10011

L3-10212B-FIGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.70	949 -	960	954.38	6.26E+01	14.10	5.24E+01	1.16
2	351.98	1400 -	1413	1406.92	6.30E+01	11.28	2.30E+01	0.80
3	608.95	2428 -	2439	2433.84	2.40E+01	7.37	1.20E+01	1.07
4	661.29	2638 -	2650	2643.05	3.27E+01	7.41	8.27E+00	1.00
5	910.54	3634 -	3647	3639.61	3.55E+01	6.73	3.50E+00	1.22
6	1459.85	5826 -	5848	5837.33	1.79E+02	13.81	2.93E+00	1.85

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	0.85	1460.82	*	10.66	4.10E+00	3.63E-01
Cs-137	0.97	661.66	*	85.10	5.45E-02	1.28E-02
Bi-211	0.87	351.07	*	13.02	4.40E-01	8.64E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.01E-01	2.41E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	7.08E-02	2.21E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 09-Dec-19-10011

L3-10212B-FIGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.61E-01	3.16E-02
		785.96		1.06		
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		
		794.95		4.25		
		911.20	*	25.80	2.43E-01	4.73E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 09-Dec-19-10011

L3-10212B-FIGS-001SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.859	4.10E+00	3.63E-01	
	Cs-137	0.978	5.45E-02	1.28E-02	
?	Bi-211	0.877	4.40E-01	8.64E-02	
	Pb-212	0.999	1.01E-01	2.41E-02	
	Bi-214	0.991	7.08E-02	2.21E-02	
?	Pb-214	1.000	1.61E-01	3.16E-02	
	Ac-228	0.979	2.43E-01	4.73E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Dec-19-10011
L3-10212B-FIGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 1/28/2020 8:49:27AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.23E-02	5.66E-02	5.66E-02
	BE-7	477.60		10.44	-2.81E-03	4.10E-01	4.10E-01
+	K-40	1460.82	*	10.66	4.10E+00	3.30E-01	3.30E-01
	Mn-54	834.85		99.98	-3.35E-02	3.98E-02	3.98E-02
	Co-60	1173.23		99.85	2.57E-02	5.16E-02	5.53E-02
		1332.49		99.98	9.68E-03		5.16E-02
	Nb-94	702.65		99.81	1.15E-02	3.98E-02	4.05E-02
		871.09		99.89	2.50E-03		3.98E-02
	Ag-108m	79.13		6.60	8.12E-01	3.61E-02	1.10E+00
		433.94		90.50	-1.14E-02		3.61E-02
		614.28		89.80	-1.29E-02		4.81E-02
		722.94		90.80	-2.07E-02		5.26E-02
	Sb-125	176.31		6.84	-2.26E-01	1.08E-01	3.86E-01
		380.45		1.52	1.15E-01		1.94E+00
		427.87		29.60	-6.91E-02		1.08E-01
		463.36		10.49	2.38E-01		3.51E-01
		600.60		17.65	-1.42E-01		2.16E-01
		606.71		4.98	6.47E-01		1.09E+00
		635.95		11.22	8.91E-02		3.06E-01

Analysis Report for 09-Dec-19-10011

L3-10212B-FIGS-001SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Sb-125	671.44		1.79	-9.65E-01	1.08E-01	1.72E+00
	Ba-133	79.61		2.65	2.29E+00	6.15E-02	2.69E+00
		81.00		32.90	-1.60E-01		1.76E-01
		276.40		7.16	6.60E-02		4.02E-01
		302.85		18.34	2.24E-03		1.56E-01
		356.01		62.05	-7.51E-03		6.15E-02
		383.85		8.94	-7.33E-02		3.35E-01
	Cs-134	475.36		1.48	2.64E+00	4.49E-02	2.87E+00
		563.25		8.34	-5.81E-01		4.32E-01
		569.33		15.37	9.61E-02		2.28E-01
		604.72		97.62	7.75E-03		5.18E-02
		795.86		85.46	2.70E-02		4.49E-02
		801.95		8.69	-8.48E-03		4.73E-01
		1038.61		0.99	-2.53E-01		4.31E+00
		1167.97		1.79	-5.96E-01		3.08E+00
		1365.19		3.02	-5.58E-01		1.13E+00
+	Cs-137	661.66	*	85.10	5.45E-02	3.14E-02	3.14E-02
	Eu-152	121.78		28.67	-5.12E-03	9.60E-02	9.60E-02
		244.70		7.61	-6.66E-02		4.42E-01
		295.94		0.45	4.59E+00		8.23E+00
		344.28		26.60	1.65E-02		1.21E-01
		367.79		0.86	-2.12E+00		3.23E+00
		411.12		2.24	2.57E-01		1.39E+00
		443.96		2.83	3.23E-01		1.17E+00
		488.68		0.42	-8.70E-01		8.45E+00
		563.99		0.49	-8.54E+00		6.70E+00
		586.26		0.46	6.96E+00		9.54E+00
		678.62		0.47	-2.84E-01		8.65E+00
		688.67		0.86	-1.06E+00		4.40E+00
		719.35		0.28	-1.92E+01		1.34E+01
		778.90		12.96	2.14E-02		2.39E-01
		810.45		0.32	-9.69E+00		1.29E+01
		867.37		4.26	-1.19E+00		8.83E-01
		919.33		0.43	9.54E+00		1.19E+01
		964.08		14.65	2.01E-01		4.26E-01
		1085.87		10.24	4.53E-02		3.78E-01
		1089.74		1.73	-3.97E-01		2.08E+00
		1112.07		13.69	-4.57E-01		3.25E-01
		1212.95		1.43	-2.33E-01		3.12E+00
		1249.94		0.19	-3.05E+01		2.61E+01
		1299.14		1.63	-1.03E-01		2.68E+00
		1408.01		21.07	-1.01E-01		2.12E-01
		1457.64		0.50	8.35E+01		3.30E+01
		1528.10		0.28	2.37E+00		1.40E+01
	Eu-154	123.07		40.40	-6.61E-03	6.91E-02	6.91E-02
		247.93		6.89	1.11E-01		4.43E-01
		591.76		4.95	3.58E-01		6.88E-01
		692.42		1.78	-7.42E-01		2.01E+00
		723.30		20.06	1.30E-01		2.53E-01
		756.80		4.52	8.81E-02		8.56E-01
		873.18		12.08	8.16E-02		3.21E-01

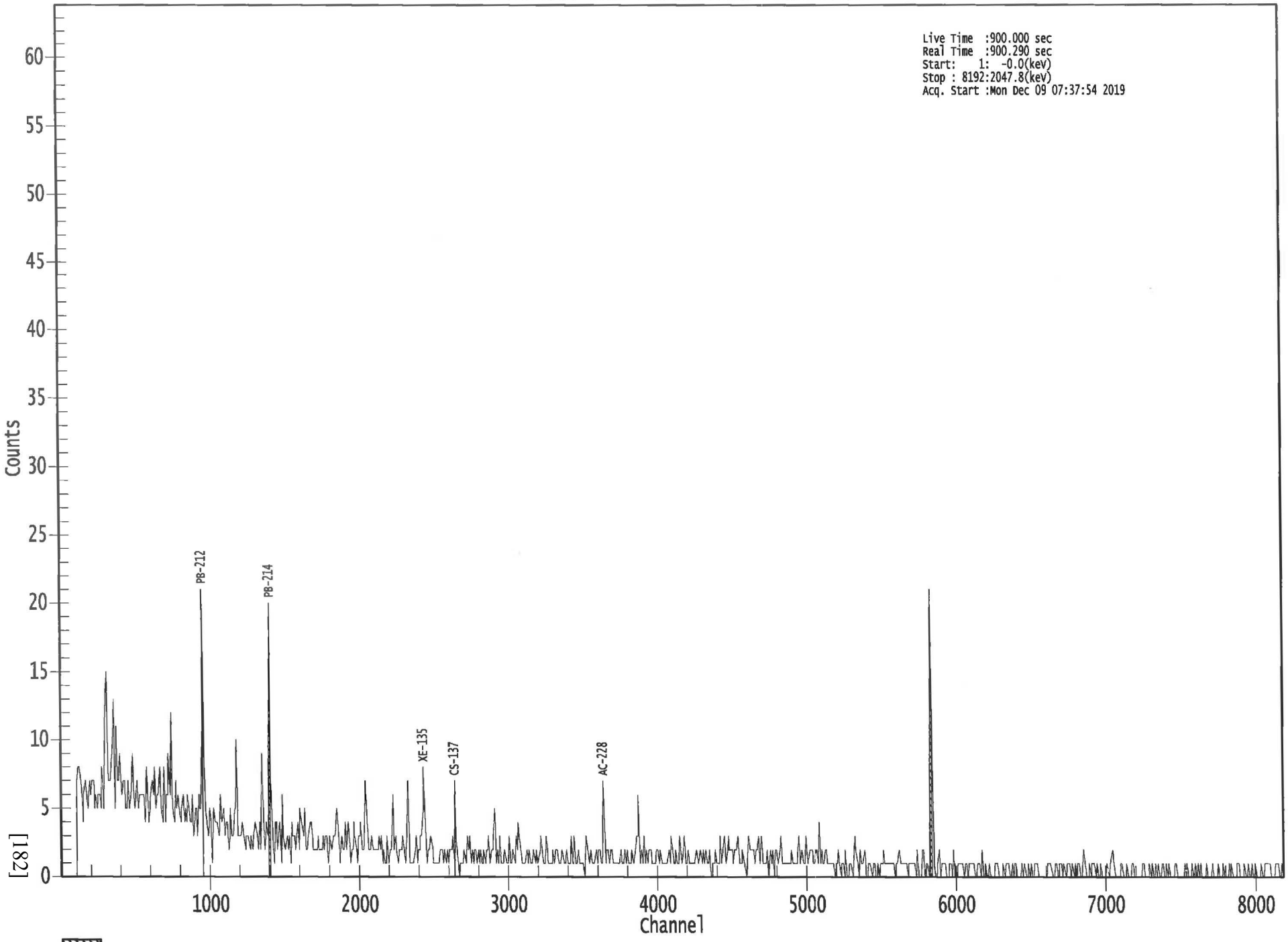
Analysis Report for 09-Dec-19-10011

L3-10212B-FIGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-2.02E-01	6.91E-02	3.85E-01
	1004.76	18.01	6.72E-02		2.71E-01
	1274.43	34.80	-4.30E-02		1.48E-01
	1596.48	1.80	1.17E+00		2.40E+00
Eu-155	45.30	1.31	3.69E+00	1.51E-01	1.00E+01
	60.01	1.22	2.77E-01		1.06E+01
	86.55	30.70	-8.39E-02		1.51E-01
	105.31	21.10	-2.72E-02		1.67E-01
Ra-226	186.21	3.64	7.47E-01	8.99E-01	8.99E-01
Pa-231	27.36	10.30	9.74E-01	1.16E+00	1.27E+00
	283.69	1.70	-2.47E-01		1.69E+00
	300.07	2.47	-1.47E+00		1.16E+00
	302.65	2.20	-3.50E-02		1.28E+00
	330.06	1.40	-1.12E+00		2.20E+00
U-235	143.76	10.96	1.71E-02	5.74E-02	2.45E-01
	163.33	5.08	-1.25E-01		5.44E-01
	185.71	57.20	3.97E-02		5.74E-02
	202.11	1.08	-1.19E+00		2.42E+00
	205.31	5.01	-1.49E-01		5.56E-01
Am-241	59.54	35.90	-7.78E-02	3.72E-01	3.72E-01

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

09-DEC-19-100118972.CNF



Apex-Gamma

Analysis Report for 09-Dec-19-10012

L3-10212B-QIGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Dec-19-10012
Sample Description	: L3-10212B-QIGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.577E+03 grams
Facility	: Default
Sample Taken On	: 12/6/2019 1:30:00PM
Acquisition Started	: 12/9/2019 8:01:01AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/9/2019
Efficiency Calibration Description	:
Sample Number	: 81904
Fill Height	: 1576.82 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/9/2019 8:16:05AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/9/19 - 1600

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Analysis Report for 09-Dec-19-10012

L3-10212B-QIGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.87	739 -	747	743.36	2.56E+01	8.56	2.24E+01	0.53
2	238.76	948 -	959	954.64	1.06E+02	15.51	5.37E+01	0.98
3	295.25	1175 -	1187	1180.29	3.22E+01	11.64	3.88E+01	0.75
4	352.01	1401 -	1415	1407.06	8.34E+01	11.46	1.66E+01	1.07
5	582.73	2322 -	2334	2329.04	3.25E+01	7.97	1.15E+01	1.39
6	608.88	2428 -	2440	2433.58	4.56E+01	9.14	1.44E+01	1.14
7	1460.04	5824 -	5848	5838.11	1.70E+02	13.94	6.03E+00	1.21

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.90	1460.82	*	10.66	3.78E+00	3.51E-01
Tl-208	0.96	583.19	*	85.00	4.85E-02	1.23E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.68E-01	2.80E-02
		300.09		3.30		
Bi-214	0.98	609.32	*	45.49	1.31E-01	2.74E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 09-Dec-19-10012

L3-10212B-QIGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.98	1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.37E-01	5.07E-02
		351.93	*	35.60	2.09E-01	3.32E-02
		785.96		1.06		
Ra-226	0.98	186.21	*	3.64	4.25E-01	1.46E-01
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	2.70E-02	9.31E-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
	K-40	0.908	3.78E+00	3.51E-01	
	Tl-208	0.967	4.85E-02	1.23E-02	
X	Bi-211	0.867			
	Pb-212	0.997	1.68E-01	2.80E-02	

Analysis Report for 09-Dec-19-10012

L3-10212B-QIGS-001SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	Bi-214	0.988	1.31E-01	2.74E-02	
	Pb-214	0.999	1.87E-01	2.78E-02	
?	Ra-226	0.982	4.25E-01	1.46E-01	
?	U-235	0.997	2.70E-02	9.31E-03	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Dec-19-10012
L3-10212B-QIGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/9/2019 8:16:05AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.59E-02	4.96E-02	4.96E-02
	BE-7	477.60		10.44	3.87E-01	4.29E-01	4.29E-01
+	K-40	1460.82	*	10.66	3.78E+00	4.37E-01	4.37E-01
	Mn-54	834.85		99.98	-2.08E-03	4.82E-02	4.82E-02
	Co-60	1173.23		99.85	-2.22E-02	4.85E-02	4.85E-02
		1332.49		99.98	-1.03E-02		5.26E-02
	Nb-94	702.65		99.81	2.17E-03	2.44E-02	3.59E-02
		871.09		99.89	-2.26E-02		2.44E-02
	Ag-108m	79.13		6.60	3.98E-01	3.62E-02	1.03E+00
		433.94		90.50	-1.80E-02		3.62E-02
		614.28		89.80	-2.21E-02		4.64E-02
		722.94		90.80	1.05E-02		4.50E-02
	Sb-125	176.31		6.84	8.08E-02	1.12E-01	4.06E-01
		380.45		1.52	5.76E-01		1.92E+00
		427.87		29.60	4.21E-02		1.12E-01
		463.36		10.49	2.91E-01		3.98E-01
		600.60		17.65	-3.14E-02		2.18E-01
		606.71		4.98	7.28E-01		1.20E+00
		635.95		11.22	-2.71E-02		3.35E-01

Analysis Report for 09-Dec-19-10012

L3-10212B-QIGS-001SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-6.85E-02	1.12E-01	1.73E+00
Ba-133	79.61	2.65	1.01E+00	6.51E-02	2.52E+00
	81.00	32.90	-2.49E-01		1.57E-01
	276.40	7.16	-1.15E-01		4.14E-01
	302.85	18.34	-5.00E-02		1.66E-01
	356.01	62.05	-1.10E-03		6.51E-02
	383.85	8.94	5.25E-02		3.28E-01
Cs-134	475.36	1.48	4.42E-01	4.27E-02	2.88E+00
	563.25	8.34	-4.38E-01		4.41E-01
	569.33	15.37	2.15E-01		2.41E-01
	604.72	97.62	-5.07E-02		5.98E-02
	795.86	85.46	1.78E-02		4.27E-02
	801.95	8.69	-2.27E-02		3.14E-01
	1038.61	0.99	1.22E+00		4.08E+00
	1167.97	1.79	2.52E-02		2.64E+00
	1365.19	3.02	6.78E-02		1.65E+00
Cs-137	661.66	85.10	2.90E-02	6.10E-02	6.10E-02
Eu-152	121.78	28.67	3.72E-02	1.04E-01	1.04E-01
	244.70	7.61	-7.71E-02		4.35E-01
	295.94	0.45	1.53E+01		9.63E+00
	344.28	26.60	6.97E-03		1.14E-01
	367.79	0.86	6.81E-01		3.63E+00
	411.12	2.24	-6.30E-02		1.39E+00
	443.96	2.83	4.74E-01		1.22E+00
	488.68	0.42	-1.07E+00		7.92E+00
	563.99	0.49	-1.13E+01		6.79E+00
	586.26	0.46	-8.71E+00		1.12E+01
	678.62	0.47	-8.86E-01		6.59E+00
	688.67	0.86	1.57E+00		4.03E+00
	719.35	0.28	-5.80E-01		1.39E+01
	778.90	12.96	2.24E-01		3.42E-01
	810.45	0.32	3.71E-01		9.29E+00
	867.37	4.26	3.51E-01		6.73E-01
	919.33	0.43	3.64E+00		6.99E+00
	964.08	14.65	1.97E-01		3.76E-01
	1085.87	10.24	-1.04E-01		4.39E-01
	1089.74	1.73	4.28E-02		2.54E+00
	1112.07	13.69	-2.58E-01		4.12E-01
	1212.95	1.43	1.73E-01		4.31E+00
	1249.94	0.19	2.48E-01		3.07E+01
	1299.14	1.63	6.36E-02		3.26E+00
	1408.01	21.07	-2.50E-02		1.70E-01
	1457.64	0.50	8.57E+01		3.18E+01
	1528.10	0.28	2.61E+00		9.74E+00
Eu-154	123.07	40.40	3.09E-02	7.50E-02	7.50E-02
	247.93	6.89	1.56E-01		4.60E-01
	591.76	4.95	-7.80E-02		7.45E-01
	692.42	1.78	-1.48E+00		2.04E+00
	723.30	20.06	8.35E-03		2.04E-01
	756.80	4.52	-4.04E-01		8.85E-01
	873.18	12.08	4.45E-02		2.39E-01

Analysis Report for 09-Dec-19-10012

L3-10212B-QIGS-001SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	-1.79E-01	7.50E-02	4.15E-01
		1004.76		18.01	-1.89E-01		2.19E-01
		1274.43		34.80	-1.80E-02		1.36E-01
		1596.48		1.80	-4.15E-01		1.76E+00
	Eu-155	45.30		1.31	8.32E-01	1.58E-01	1.03E+01
		60.01		1.22	-6.22E+00		1.07E+01
		86.55		30.70	-4.98E-03		1.58E-01
		105.31		21.10	1.11E-01		1.76E-01
+	Ra-226	186.21	*	3.64	4.25E-01	4.37E-01	4.37E-01
	Pa-231	27.36		10.30	7.19E-01	1.19E+00	1.24E+00
		283.69		1.70	2.17E-01		1.80E+00
		300.07		2.47	-8.32E-01		1.19E+00
		302.65		2.20	-6.86E-01		1.37E+00
		330.06		1.40	6.43E-01		2.33E+00
+	U-235	143.76		10.96	-1.72E-02	2.78E-02	2.76E-01
		163.33		5.08	1.24E-01		5.53E-01
		185.71	*	57.20	2.70E-02		2.78E-02
		202.11		1.08	-9.98E-01		2.58E+00
		205.31		5.01	-1.63E-01		5.98E-01
	Am-241	59.54		35.90	-1.11E-01	3.91E-01	3.91E-01

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

Apex-Gamma

Analysis Report for 09-Dec-19-10013

L3-10212B-FIGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 09-Dec-19-10013
Sample Description	: L3-10212B-FIGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.570E+03 grams
Facility	: Default
Sample Taken On	: 12/6/2019 1:34:00PM
Acquisition Started	: 12/9/2019 7:39:20AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/9/2019
Efficiency Calibration Description	:
Sample Number	: 81903
Fill Height	: 1569.99 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/9/2019 7:54:22AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 12/9/19 - 1600

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Analysis Report for 09-Dec-19-10013

L3-10212B-FIGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.08	306 -	314	309.62	2.75E+01	13.13	6.75E+01	0.31
2	185.79	738 -	749	743.87	4.19E+01	15.59	8.01E+01	0.58
3	238.73	948 -	963	955.40	1.59E+02	21.52	9.81E+01	1.01
4	295.17	1173 -	1187	1180.89	7.75E+01	15.12	5.25E+01	1.18
5	352.16	1400 -	1417	1408.62	1.25E+02	14.54	2.65E+01	1.30
6	583.16	2326 -	2340	2331.95	6.90E+01	11.50	2.20E+01	1.52
7	609.46	2430 -	2444	2437.11	9.90E+01	11.93	1.50E+01	0.54
8	911.33	3639 -	3653	3644.37	3.86E+01	9.50	1.74E+01	0.60
9	969.29	3871 -	3882	3876.23	3.09E+01	7.37	9.09E+00	0.56
10	1461.15	5832 -	5856	5844.96	4.05E+02	21.36	1.25E+01	2.18

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	8.41E+00	5.75E-01
Tl-208	1.00	583.19	*	85.00	9.82E-02	1.74E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.48E-01	3.91E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	2.56E-01	1.25E-01

Analysis Report for 09-Dec-19-10013

L3-10212B-FIGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	1.00	87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.71E-01	3.65E-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	3.21E-01	6.76E-02
		351.93	*	35.60	3.04E-01	4.28E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	4.52E-01	2.21E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.97	186.21	*	3.64	7.01E-01	2.67E-01
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.42E-01	6.06E-02
		964.77		4.99		
		968.97	*	15.80	3.30E-01	8.01E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	4.46E-02	1.70E-02
		202.11		1.08		
		205.31		5.01		

Analysis Report for 09-Dec-19-10013

L3-10212B-FIGS-002SS

* = 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	0.983	8.41E+00	5.75E-01	
	Tl-208	1.000	9.82E-02	1.74E-02	
	Pb-212	0.998	2.48E-01	3.91E-02	
?	Pb212-XR	1.000	2.56E-01	1.25E-01	
	Bi-214	0.999	2.71E-01	3.65E-02	
	Pb-214	0.995	3.09E-01	3.62E-02	
?	Pb214-XR	1.000	4.52E-01	2.21E-01	
?	Ra-226	0.972	7.01E-01	2.67E-01	
	Ac-228	0.996	2.74E-01	4.83E-02	
?	U-235	0.999	4.46E-02	1.70E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Dec-19-10013
L3-10212B-FIGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/9/2019 7:54:22AM
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	4.83E-02	5.52E-02	5.52E-02
	BE-7	477.60		10.44	3.78E-01	4.76E-01	4.76E-01
+	K-40	1460.82	*	10.66	8.41E+00	5.67E-01	5.67E-01
	Mn-54	834.85		99.98	-7.95E-03	4.87E-02	4.87E-02
	Co-60	1173.23		99.85	2.95E-02	5.57E-02	7.03E-02
		1332.49		99.98	-6.85E-02		5.57E-02
	Nb-94	702.65		99.81	-1.39E-02	4.65E-02	4.65E-02
		871.09		99.89	3.39E-02		5.40E-02
	Ag-108m	79.13		6.60	-4.74E-01	5.14E-02	1.62E+00
		433.94		90.50	3.36E-02		5.14E-02
		614.28		89.80	-1.23E-02		8.22E-02
		722.94		90.80	1.04E-02		5.99E-02
	Sb-125	176.31		6.84	-4.63E-01	1.40E-01	5.30E-01
		380.45		1.52	-8.68E-01		2.42E+00
		427.87		29.60	3.96E-02		1.40E-01
		463.36		10.49	-4.65E-03		4.35E-01
		600.60		17.65	-2.65E-02		2.64E-01
		606.71		4.98	1.90E+00		1.54E+00
		635.95		11.22	2.91E-01		4.05E-01

Analysis Report for 09-Dec-19-10013

L3-10212B-FIGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-5.21E-01	1.40E-01	2.70E+00
Ba-133	79.61	2.65	-2.08E-01	8.74E-02	4.01E+00
	81.00	32.90	1.31E-01		2.86E-01
	276.40	7.16	-8.17E-02		5.47E-01
	302.85	18.34	-6.35E-03		2.11E-01
	356.01	62.05	-2.55E-02		8.74E-02
	383.85	8.94	-2.05E-02		4.46E-01
Cs-134	475.36	1.48	-2.65E-02	5.70E-02	3.10E+00
	563.25	8.34	2.13E-01		5.27E-01
	569.33	15.37	2.13E-02		2.96E-01
	604.72	97.62	-1.10E-02		7.21E-02
	795.86	85.46	-3.48E-02		5.70E-02
	801.95	8.69	-6.18E-02		5.50E-01
	1038.61	0.99	2.58E+00		5.79E+00
	1167.97	1.79	2.59E-01		3.69E+00
	1365.19	3.02	8.38E-01		1.63E+00
Cs-137	661.66	85.10	-3.16E-05	6.23E-02	6.23E-02
Eu-152	121.78	28.67	-7.90E-02	1.33E-01	1.48E-01
	244.70	7.61	3.89E-01		5.91E-01
	295.94	0.45	7.61E+00		1.19E+01
	344.28	26.60	-6.83E-02		1.33E-01
	367.79	0.86	1.36E+00		4.25E+00
	411.12	2.24	6.24E-01		1.87E+00
	443.96	2.83	-9.93E-01		1.30E+00
	488.68	0.42	-1.55E+00		9.42E+00
	563.99	0.49	-4.60E+00		8.86E+00
	586.26	0.46	2.26E+01		1.46E+01
	678.62	0.47	-1.34E+00		1.04E+01
	688.67	0.86	-2.23E+00		5.56E+00
	719.35	0.28	2.77E+00		1.76E+01
	778.90	12.96	-4.04E-01		3.52E-01
	810.45	0.32	-7.58E+00		1.46E+01
	867.37	4.26	-1.33E+00		1.31E+00
	919.33	0.43	-2.70E+00		1.00E+01
	964.08	14.65	-2.93E-01		5.26E-01
	1085.87	10.24	-5.21E-01		5.09E-01
	1089.74	1.73	-1.76E-01		3.37E+00
	1112.07	13.69	-6.13E-01		4.81E-01
	1212.95	1.43	2.06E+00		4.88E+00
	1249.94	0.19	-1.66E+01		2.97E+01
	1299.14	1.63	1.73E+00		3.48E+00
	1408.01	21.07	-1.34E-01		2.20E-01
	1457.64	0.50	1.86E+02		4.48E+01
	1528.10	0.28	1.14E+01		1.69E+01
Eu-154	123.07	40.40	-1.44E-02	1.09E-01	1.09E-01
	247.93	6.89	3.04E-01		5.86E-01
	591.76	4.95	-1.22E-02		8.65E-01
	692.42	1.78	9.33E-01		2.70E+00
	723.30	20.06	2.49E-01		2.84E-01
	756.80	4.52	1.07E+00		1.19E+00
	873.18	12.08	-2.73E-01		4.07E-01

Analysis Report for 09-Dec-19-10013

L3-10212B-FIGS-002SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	996.29		10.48	9.54E-02	1.09E-01	4.71E-01
		1004.76		18.01	7.20E-02		2.92E-01
		1274.43		34.80	5.35E-02		1.78E-01
		1596.48		1.80	-1.46E+00		2.28E+00
	Eu-155	45.30		1.31	1.48E+00	2.40E-01	2.22E+01
		60.01		1.22	5.65E+00		2.54E+01
		86.55		30.70	-1.97E-01		2.51E-01
		105.31		21.10	5.94E-04		2.40E-01
+	Ra-226	186.21	*	3.64	7.01E-01	8.52E-01	8.52E-01
	Pa-231	27.36		10.30	3.15E+00	1.75E+00	2.68E+00
		283.69		1.70	-4.47E-01		2.19E+00
		300.07		2.47	1.70E-01		1.75E+00
		302.65		2.20	-3.57E-01		1.75E+00
		330.06		1.40	1.21E+00		3.10E+00
+	U-235	143.76		10.96	1.16E-01	5.42E-02	4.10E-01
		163.33		5.08	1.16E-01		7.33E-01
		185.71	*	57.20	4.46E-02		5.42E-02
		202.11		1.08	-6.21E-01		3.66E+00
		205.31		5.01	-4.32E-01		7.77E-01
	Am-241	59.54		35.90	-1.40E-02	8.73E-01	8.73E-01

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

Apex-Gamma

Analysis Report for 09-Dec-19-10019

L3-10212B-FIGS-003SS

GAMMA SPECTRUM ANALYSIS

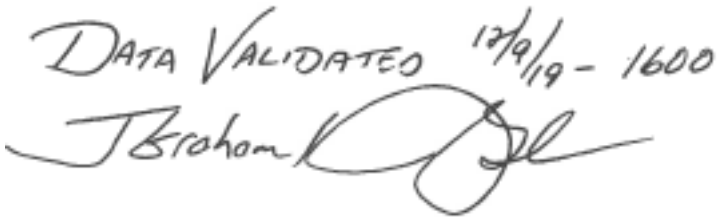
Sample Identification	: 09-Dec-19-10019
Sample Description	: L3-10212B-FIGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.570E+03 grams
Facility	: Default
Sample Taken On	: 12/6/2019 1:34:00PM
Acquisition Started	: 12/9/2019 8:01:41AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/9/2019
Efficiency Calibration Description	:
Sample Number	: 81905
Fill Height	: 1569.99 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/9/2019 8:16:43AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096



Analysis Report for 09-Dec-19-10019

L3-10212B-FIGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.20	151 -	158	155.00	5.04E+01	16.41	1.08E+02	0.66
2	238.62	472 -	481	477.42	1.22E+02	19.98	1.20E+02	1.05
3	295.18	585 -	595	590.42	4.35E+01	14.65	7.15E+01	1.04
4	351.93	698 -	708	703.80	6.93E+01	13.43	4.68E+01	1.09
5	609.13	1213 -	1223	1217.83	5.96E+01	9.85	1.54E+01	1.58
6	911.10	1816 -	1825	1821.66	2.83E+01	7.69	1.37E+01	1.56
7	1460.42	2915 -	2928	2920.90	2.35E+02	15.95	7.00E+00	1.85

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.97	1460.82	*	10.66	4.39E+00	3.53E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.70E-01	3.11E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	3.28E-01	1.12E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.47E-01	2.58E-02
		768.36		4.89		

Analysis Report for 09-Dec-19-10019

L3-10212B-FIGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	1.62E-01	5.61E-02
		351.93	*	35.60	1.51E-01	3.17E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	5.79E-01	1.99E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.60E-01	4.41E-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 09-Dec-19-10019

L3-10212B-FIGS-003SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.975	4.39E+00	3.53E-01	
X	Bi-211	0.889			
	Pb-212	1.000	1.70E-01	3.11E-02	
?	Pb212-XR	0.999	3.28E-01	1.12E-01	
	Bi-214	0.998	1.47E-01	2.58E-02	
	Pb-214	1.000	1.54E-01	2.76E-02	
?	Pb214-XR	0.999	5.79E-01	1.99E-01	
	Ac-228	1.000	1.60E-01	4.41E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Dec-19-10019

L3-10212B-FIGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/9/2019 8:16:43AM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.11E-02	4.74E-02	4.74E-02
	BE-7	477.60		10.44	4.40E-01	3.94E-01	3.94E-01
+	K-40	1460.82	*	10.66	4.39E+00	3.33E-01	3.33E-01
	Mn-54	834.85		99.98	-1.45E-03	3.58E-02	3.58E-02
	Co-60	1173.23		99.85	-1.17E-03	4.69E-02	4.69E-02
		1332.49		99.98	1.94E-02		5.00E-02
	Nb-94	702.65		99.81	2.36E-03	3.59E-02	3.59E-02
		871.09		99.89	1.91E-02		4.07E-02
	Ag-108m	79.13		6.60	-1.75E-01	3.13E-02	9.90E-01
		433.94		90.50	-1.94E-03		3.13E-02
		614.28		89.80	-1.28E-02		4.44E-02
		722.94		90.80	-1.34E-02		3.64E-02
	Sb-125	176.31		6.84	1.84E-01	9.97E-02	4.73E-01
		380.45		1.52	7.45E-01		2.05E+00
		427.87		29.60	7.59E-02		9.97E-02
		463.36		10.49	-9.85E-02		2.68E-01
		600.60		17.65	1.04E-01		1.97E-01
		606.71		4.98	-5.22E-02		1.08E+00
		635.95		11.22	-7.03E-02		2.82E-01

Analysis Report for 09-Dec-19-10019

L3-10212B-FIGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.19E-01	9.97E-02	1.73E+00
Ba-133	79.61	2.65	-7.55E-01	6.38E-02	2.40E+00
	81.00	32.90	-1.45E-01		1.63E-01
	276.40	7.16	5.04E-02		4.35E-01
	302.85	18.34	6.86E-02		1.64E-01
	356.01	62.05	-1.80E-02		6.38E-02
	383.85	8.94	1.08E-01		3.52E-01
Cs-134	475.36	1.48	1.38E+00	3.89E-02	2.56E+00
	563.25	8.34	-1.15E-01		3.44E-01
	569.33	15.37	8.33E-02		2.07E-01
	604.72	97.62	-1.45E-02		4.79E-02
	795.86	85.46	-1.29E-03		3.89E-02
	801.95	8.69	3.96E-02		3.51E-01
	1038.61	0.99	1.74E+00		4.47E+00
	1167.97	1.79	1.41E+00		2.75E+00
	1365.19	3.02	-9.65E-01		8.56E-01
Cs-137	661.66	85.10	2.04E-02	4.78E-02	4.78E-02
Eu-152	121.78	28.67	-2.36E-03	1.11E-01	1.11E-01
	244.70	7.61	-3.45E-02		4.51E-01
	295.94	0.45	-5.88E-01		8.64E+00
	344.28	26.60	-1.03E-01		1.12E-01
	367.79	0.86	-8.19E-01		3.57E+00
	411.12	2.24	-3.16E-02		1.30E+00
	443.96	2.83	-1.40E-01		1.07E+00
	488.68	0.42	-1.92E+00		7.12E+00
	563.99	0.49	-2.88E+00		5.83E+00
	586.26	0.46	8.22E+00		9.14E+00
	678.62	0.47	-1.85E+00		6.97E+00
	688.67	0.86	1.35E+00		4.00E+00
	719.35	0.28	4.15E+00		1.14E+01
	778.90	12.96	-1.57E-01		2.05E-01
	810.45	0.32	7.36E-01		9.28E+00
	867.37	4.26	-7.10E-02		9.36E-01
	919.33	0.43	-1.23E+00		8.35E+00
	964.08	14.65	-2.37E-01		3.15E-01
	1085.87	10.24	2.59E-02		3.88E-01
	1089.74	1.73	-6.77E-01		2.25E+00
	1112.07	13.69	-8.59E-02		3.47E-01
	1212.95	1.43	-8.58E-01		3.52E+00
	1249.94	0.19	-5.52E+00		2.03E+01
	1299.14	1.63	-4.06E-01		2.34E+00
	1408.01	21.07	1.32E-01		2.24E-01
	1457.64	0.50	-7.11E+00		3.10E+01
	1528.10	0.28	9.58E-01		9.10E+00
Eu-154	123.07	40.40	1.52E-02	7.77E-02	7.77E-02
	247.93	6.89	-4.12E-02		4.16E-01
	591.76	4.95	-5.69E-02		6.08E-01
	692.42	1.78	-5.56E-01		1.78E+00
	723.30	20.06	-6.50E-02		1.68E-01
	756.80	4.52	-6.97E-02		7.54E-01
	873.18	12.08	-2.24E-01		2.86E-01

Analysis Report for 09-Dec-19-10019

L3-10212B-FIGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	6.97E-02	7.77E-02	3.59E-01
	1004.76	18.01	6.48E-02		2.01E-01
	1274.43	34.80	6.63E-02		1.32E-01
	1596.48	1.80	4.88E-01		1.73E+00
Eu-155	45.30	1.31	-5.01E+00	1.59E-01	1.01E+01
	60.01	1.22	-5.69E+00		1.12E+01
	86.55	30.70	-1.45E-02		1.59E-01
	105.31	21.10	-1.30E-03		1.73E-01
Ra-226	186.21	3.64	6.85E-01	9.46E-01	9.46E-01
Pa-231	27.36	10.30	8.55E-01	1.14E+00	1.14E+00
	283.69	1.70	4.39E-01		1.63E+00
	300.07	2.47	-3.15E-01		1.22E+00
	302.65	2.20	5.71E-01		1.37E+00
	330.06	1.40	1.96E-01		2.20E+00
U-235	143.76	10.96	-4.16E-02	6.01E-02	2.61E-01
	163.33	5.08	2.47E-01		6.63E-01
	185.71	57.20	3.99E-02		6.01E-02
	202.11	1.08	9.51E-01		2.96E+00
	205.31	5.01	2.21E-01		6.65E-01
Am-241	59.54	35.90	1.08E-03	4.04E-01	4.04E-01

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

Apex-Gamma

Analysis Report for 09-Dec-19-10014

L3-10212B-FIGS-004SS

GAMMA SPECTRUM ANALYSIS

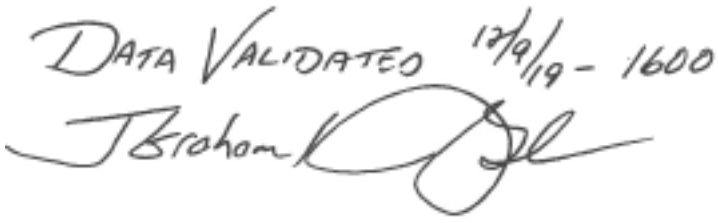
Sample Identification	: 09-Dec-19-10014
Sample Description	: L3-10212B-FIGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.579E+03 grams
Facility	: Default
Sample Taken On	: 12/6/2019 1:36:00PM
Acquisition Started	: 12/9/2019 8:03:01AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.2 seconds
Dead Time	: 0.13 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/9/2019
Efficiency Calibration Description	:
Sample Number	: 81906
Fill Height	: 1578.92 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/9/2019 8:18:05AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192



Analysis Report for 09-Dec-19-10014

L3-10212B-FIGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.08	306 -	314	309.05	2.60E+01	11.16	4.50E+01	0.49
2	238.61	949 -	961	954.53	8.77E+01	16.54	6.83E+01	0.77
3	338.33	1349 -	1357	1353.11	1.88E+01	7.63	1.82E+01	0.51
4	351.99	1398 -	1414	1407.69	7.03E+01	11.08	1.67E+01	1.04
5	609.19	2430 -	2442	2435.94	6.05E+01	9.16	8.50E+00	0.97
6	1460.58	5830 -	5852	5842.16	2.03E+02	14.63	2.81E+00	1.43

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	5.02E+00	4.22E-01
Bi-211	0.87	351.07	*	13.02	5.35E-01	9.47E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.56E-01	3.20E-02
		300.09		3.30		
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	3.18E-01	1.40E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	0.99	609.32	*	45.49	1.93E-01	3.14E-02
		768.36		4.89		

Analysis Report for 09-Dec-19-10014

L3-10212B-FIGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	1.96E-01	3.46E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	5.60E-01	2.48E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	1.00	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	1.60E-01	6.64E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

Analysis Report for 09-Dec-19-10014

L3-10212B-FIGS-004SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.991	5.02E+00	4.22E-01	
?	Bi-211	0.874	5.35E-01	9.47E-02	
	Pb-212	1.000	1.56E-01	3.20E-02	
?	Pb212-XR	1.000	3.18E-01	1.40E-01	
	Bi-214	0.999	1.93E-01	3.14E-02	
?	Pb-214	1.000	1.96E-01	3.46E-02	
?	Pb214-XR	1.000	5.60E-01	2.48E-01	
	Ac-228	1.000	1.60E-01	6.64E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 09-Dec-19-10014

L3-10212B-FIGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/9/2019 8:18:05AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	4.40E-02	5.65E-02	5.65E-02
	BE-7	477.60		10.44	3.17E-01	4.40E-01	4.40E-01
+	K-40	1460.82	*	10.66	5.02E+00	3.46E-01	3.46E-01
	Mn-54	834.85		99.98	3.19E-02	5.26E-02	5.26E-02
	Co-60	1173.23		99.85	-4.47E-02	4.96E-02	5.12E-02
		1332.49		99.98	-4.21E-03		4.96E-02
	Nb-94	702.65		99.81	1.66E-02	3.85E-02	4.81E-02
		871.09		99.89	-2.97E-02		3.85E-02
	Ag-108m	79.13		6.60	-7.04E-02	4.36E-02	1.64E+00
		433.94		90.50	3.35E-03		4.36E-02
		614.28		89.80	-2.94E-02		5.92E-02
		722.94		90.80	6.30E-03		4.37E-02
	Sb-125	176.31		6.84	2.24E-01	1.28E-01	5.59E-01
		380.45		1.52	7.80E-01		2.45E+00
		427.87		29.60	-3.68E-02		1.28E-01
		463.36		10.49	-7.69E-02		3.98E-01
		600.60		17.65	-1.82E-01		2.34E-01
		606.71		4.98	1.31E+00		1.36E+00
		635.95		11.22	2.62E-01		3.71E-01

Analysis Report for 09-Dec-19-10014

L3-10212B-FIGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-2.21E+00	1.28E-01	2.11E+00
Ba-133	79.61	2.65	4.34E-02	7.11E-02	3.88E+00
	81.00	32.90	-9.54E-02		2.61E-01
	276.40	7.16	-4.44E-02		4.93E-01
	302.85	18.34	1.14E-01		2.02E-01
	356.01	62.05	-1.13E-02		7.11E-02
	383.85	8.94	-1.89E-01		4.18E-01
Cs-134	475.36	1.48	1.08E+00	4.96E-02	3.00E+00
	563.25	8.34	1.76E-01		5.10E-01
	569.33	15.37	3.42E-02		2.47E-01
	604.72	97.62	-2.12E-02		6.83E-02
	795.86	85.46	1.83E-02		4.96E-02
	801.95	8.69	-1.33E-01		4.32E-01
	1038.61	0.99	4.22E+00		5.13E+00
	1167.97	1.79	-2.05E-01		3.13E+00
	1365.19	3.02	-2.29E-01		1.50E+00
Cs-137	661.66	85.10	4.42E-03	5.34E-02	5.34E-02
Eu-152	121.78	28.67	-5.89E-02	1.40E-01	1.48E-01
	244.70	7.61	-1.56E-01		5.50E-01
	295.94	0.45	3.62E-01		9.52E+00
	344.28	26.60	-8.67E-02		1.40E-01
	367.79	0.86	7.22E-01		4.16E+00
	411.12	2.24	1.33E-01		1.80E+00
	443.96	2.83	-2.66E-01		1.31E+00
	488.68	0.42	-3.49E+00		9.40E+00
	563.99	0.49	5.77E+00		8.65E+00
	586.26	0.46	1.53E+01		1.25E+01
	678.62	0.47	5.08E+00		9.65E+00
	688.67	0.86	-1.70E+00		4.47E+00
	719.35	0.28	-6.86E+00		1.42E+01
	778.90	12.96	-2.64E-02		2.99E-01
	810.45	0.32	7.15E-02		1.42E+01
	867.37	4.26	-5.07E-01		9.54E-01
	919.33	0.43	-6.69E+00		1.04E+01
	964.08	14.65	2.74E-01		4.93E-01
	1085.87	10.24	-2.98E-01		5.21E-01
	1089.74	1.73	1.65E+00		3.34E+00
	1112.07	13.69	7.23E-03		4.04E-01
	1212.95	1.43	2.23E+00		4.92E+00
	1249.94	0.19	-2.36E+01		2.82E+01
	1299.14	1.63	1.49E+00		2.68E+00
	1408.01	21.07	-9.88E-02		2.37E-01
	1457.64	0.50	1.08E+02		3.79E+01
	1528.10	0.28	2.90E+00		1.08E+01
Eu-154	123.07	40.40	4.00E-02	1.06E-01	1.06E-01
	247.93	6.89	-3.20E-01		5.43E-01
	591.76	4.95	1.72E-02		7.44E-01
	692.42	1.78	1.03E-01		2.26E+00
	723.30	20.06	8.74E-02		2.02E-01
	756.80	4.52	-9.30E-02		8.85E-01
	873.18	12.08	1.34E-01		3.73E-01

Analysis Report for 09-Dec-19-10014

L3-10212B-FIGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-1.73E-01	1.06E-01	4.71E-01
	1004.76	18.01	6.53E-02		2.87E-01
	1274.43	34.80	-1.03E-01		1.59E-01
	1596.48	1.80	1.10E+00		2.45E+00
Eu-155	45.30	1.31	-8.74E+00	2.57E-01	2.95E+01
	60.01	1.22	-4.59E+00		2.98E+01
	86.55	30.70	1.55E-01		2.57E-01
	105.31	21.10	6.27E-02		2.65E-01
Ra-226	186.21	3.64	-3.28E-02	1.00E+00	1.00E+00
Pa-231	27.36	10.30	7.98E-01	1.57E+00	3.04E+00
	283.69	1.70	1.89E-01		2.18E+00
	300.07	2.47	-8.13E-01		1.57E+00
	302.65	2.20	7.23E-01		1.67E+00
	330.06	1.40	9.08E-02		2.65E+00
U-235	143.76	10.96	8.15E-02	6.54E-02	3.83E-01
	163.33	5.08	-1.72E-01		7.84E-01
	185.71	57.20	2.79E-02		6.54E-02
	202.11	1.08	1.98E-01		3.48E+00
	205.31	5.01	-4.25E-01		7.52E-01
Am-241	59.54	35.90	5.07E-01	1.10E+00	1.10E+00

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

Apex-Gamma

Analysis Report for 13-Dec-19-10014

L3-10212B-FIGS-001SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 13-Dec-19-10014
Sample Description	: L3-10212B-FIGS-001SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.666E+03 grams
Facility	: Default
Sample Taken On	: 12/11/2019 1:35:00PM
Acquisition Started	: 12/13/2019 10:15:24AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.15 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/13/2019
Efficiency Calibration Description	:
Sample Number	: 82046
Fill Height	: 1665.62 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/13/2019 10:30:27AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0900 12/15/19

[illegible]

Analysis Report for 13-Dec-19-10014

L3-10212B-FIGS-001SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.61	947 -	961	954.53	1.41E+02	18.62	7.10E+01	0.75
2	295.13	1177 -	1186	1180.44	5.20E+01	11.42	3.40E+01	1.06
3	338.05	1346 -	1356	1351.96	2.85E+01	8.23	1.65E+01	0.97
4	351.93	1400 -	1415	1407.46	8.36E+01	13.28	3.04E+01	0.91
5	583.23	2325 -	2338	2332.14	4.13E+01	9.19	1.57E+01	0.95
6	609.34	2430 -	2443	2436.54	6.37E+01	9.73	1.13E+01	0.77
7	1120.02	4473 -	4485	4479.19	2.04E+01	6.76	9.58E+00	0.83
8	1460.64	5832 -	5854	5842.39	2.48E+02	15.75	0.00E+00	1.25

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.04E+00	4.65E-01
Tl-208	1.00	583.19	*	85.00	6.77E-02	1.56E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.48E-01	3.85E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.01E-01	3.30E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 13-Dec-19-10014

L3-10212B-FIGS-001SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29	*	14.92	2.96E-01	9.86E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.44E-01	5.70E-02
		351.93	*	35.60	2.30E-01	4.09E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	2.41E-01	7.23E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20		25.80		
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 13-Dec-19-10014

L3-10212B-FIGS-001SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.995	6.04E+00	4.65E-01	
	Tl-208	1.000	6.77E-02	1.56E-02	
X	Bi-211	0.888			
	Pb-212	1.000	2.48E-01	3.85E-02	
	Bi-214	0.998	2.10E-01	3.13E-02	
	Pb-214	1.000	2.35E-01	3.33E-02	
	Ac-228	0.998	2.41E-01	7.23E-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 13-Dec-19-10014

L3-10212B-FIGS-001SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/13/2019 10:30:27AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	7.12E-02	5.86E-02	5.86E-02
	BE-7	477.60		10.44	9.79E-02	3.86E-01	3.86E-01
+	K-40	1460.82	*	10.66	6.04E+00	7.00E-02	7.00E-02
	Mn-54	834.85		99.98	-2.08E-02	4.69E-02	4.69E-02
	Co-60	1173.23		99.85	2.40E-02	5.35E-02	6.88E-02
		1332.49		99.98	2.37E-02		5.35E-02
	Nb-94	702.65		99.81	5.49E-03	4.75E-02	4.75E-02
		871.09		99.89	-7.74E-03		4.81E-02
	Ag-108m	79.13		6.60	-3.35E-01	4.83E-02	2.05E+00
		433.94		90.50	1.28E-02		4.83E-02
		614.28		89.80	-3.89E-02		6.33E-02
		722.94		90.80	1.74E-02		6.21E-02
	Sb-125	176.31		6.84	-3.58E-01	1.33E-01	5.70E-01
		380.45		1.52	2.44E-01		2.56E+00
		427.87		29.60	2.19E-02		1.33E-01
		463.36		10.49	-8.72E-02		3.98E-01
		600.60		17.65	1.08E-01		2.77E-01
		606.71		4.98	1.84E+00		1.48E+00
		635.95		11.22	-7.27E-02		3.60E-01

Analysis Report for 13-Dec-19-10014

L3-10212B-FIGS-001SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-4.95E-01	1.33E-01	2.46E+00
Ba-133	79.61	2.65	-2.88E+00	8.14E-02	4.73E+00
	81.00	32.90	-3.40E-01		3.25E-01
	276.40	7.16	2.56E-01		5.33E-01
	302.85	18.34	5.35E-02		2.09E-01
	356.01	62.05	-2.27E-02		8.14E-02
	383.85	8.94	-1.14E-01		4.01E-01
Cs-134	475.36	1.48	-1.55E+00	5.40E-02	2.63E+00
	563.25	8.34	8.24E-02		4.62E-01
	569.33	15.37	7.83E-02		2.68E-01
	604.72	97.62	-4.17E-02		7.05E-02
	795.86	85.46	-4.15E-02		5.40E-02
	801.95	8.69	8.40E-02		5.62E-01
	1038.61	0.99	-3.90E+00		4.33E+00
	1167.97	1.79	1.30E+00		3.88E+00
	1365.19	3.02	4.71E-01		1.60E+00
Cs-137	661.66	85.10	2.05E-02	5.27E-02	5.27E-02
Eu-152	121.78	28.67	-1.33E-02	1.31E-01	1.58E-01
	244.70	7.61	-6.36E-02		5.65E-01
	295.94	0.45	6.54E+00		1.16E+01
	344.28	26.60	-4.08E-02		1.31E-01
	367.79	0.86	-1.55E+00		4.55E+00
	411.12	2.24	4.24E-01		1.93E+00
	443.96	2.83	-5.26E-01		1.26E+00
	488.68	0.42	1.04E+00		1.01E+01
	563.99	0.49	3.99E+00		8.08E+00
	586.26	0.46	-1.73E+00		1.43E+01
	678.62	0.47	5.08E+00		9.39E+00
	688.67	0.86	1.67E+00		5.21E+00
	719.35	0.28	1.17E+01		1.80E+01
	778.90	12.96	-3.70E-02		3.38E-01
	810.45	0.32	8.39E+00		1.71E+01
	867.37	4.26	-1.01E+00		1.17E+00
	919.33	0.43	-1.75E+00		1.19E+01
	964.08	14.65	2.68E-01		5.13E-01
	1085.87	10.24	-2.13E-01		5.45E-01
	1089.74	1.73	1.02E+00		3.35E+00
	1112.07	13.69	-3.18E-01		3.82E-01
	1212.95	1.43	-5.00E+00		4.58E+00
	1249.94	0.19	2.12E+01		3.18E+01
	1299.14	1.63	-2.56E-01		2.75E+00
	1408.01	21.07	6.24E-02		2.34E-01
	1457.64	0.50	1.30E+02		4.08E+01
	1528.10	0.28	4.77E+00		1.30E+01
Eu-154	123.07	40.40	-5.04E-02	1.11E-01	1.11E-01
	247.93	6.89	4.32E-01		5.48E-01
	591.76	4.95	-4.33E-01		7.77E-01
	692.42	1.78	-7.04E-01		2.68E+00
	723.30	20.06	1.93E-01		2.84E-01
	756.80	4.52	5.38E-01		1.07E+00
	873.18	12.08	2.08E-01		4.06E-01

Analysis Report for 13-Dec-19-10014

L3-10212B-FIGS-001SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	1.72E-01	1.11E-01	5.39E-01
	1004.76	18.01	-1.04E-01		2.66E-01
	1274.43	34.80	-8.42E-02		1.64E-01
	1596.48	1.80	1.70E+00		2.91E+00
Eu-155	45.30	1.31	-1.42E+00	2.76E-01	3.00E+01
	60.01	1.22	3.13E+00		3.22E+01
	86.55	30.70	-4.80E-02		2.83E-01
	105.31	21.10	-1.24E-02		2.76E-01
Ra-226	186.21	3.64	5.19E-01	1.22E+00	1.22E+00
Pa-231	27.36	10.30	1.11E+00	1.64E+00	3.51E+00
	283.69	1.70	-1.78E+00		2.18E+00
	300.07	2.47	-7.39E-01		1.64E+00
	302.65	2.20	8.17E-01		1.77E+00
	330.06	1.40	-5.91E-01		2.91E+00
U-235	143.76	10.96	1.63E-01	7.80E-02	4.19E-01
	163.33	5.08	2.17E-01		7.98E-01
	185.71	57.20	4.01E-02		7.80E-02
	202.11	1.08	5.99E-01		3.73E+00
	205.31	5.01	-1.46E-01		7.39E-01
Am-241	59.54	35.90	-1.91E-01	1.14E+00	1.14E+00

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

Analysis Report for 13-Dec-19-10015

L3-10212B-FIGS-002SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 13-Dec-19-10015
Sample Description	: L3-10212B-FIGS-002SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.769E+03 grams
Facility	: Default
Sample Taken On	: 12/11/2019 1:25:00PM
Acquisition Started	: 12/13/2019 10:15:31AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 11/4/2019
Efficiency Calibration Used Done On	: 12/13/2019
Efficiency Calibration Description	:
Sample Number	: 82047
Fill Height	: 1768.79 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 12/13/2019 10:30:42AM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

Data Validated

0900 12-15-19

Analysis Report for 13-Dec-19-10015

L3-10212B-FIGS-002SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.74	949 -	960	954.56	1.20E+02	17.03	6.76E+01	1.15
2	295.30	1174 -	1184	1180.47	4.80E+01	11.03	3.10E+01	0.87
3	338.27	1349 -	1360	1352.17	4.88E+01	9.49	1.62E+01	1.14
4	352.01	1401 -	1413	1407.04	1.05E+02	13.05	2.50E+01	1.01
5	583.16	2323 -	2337	2330.76	5.60E+01	9.97	1.50E+01	0.78
6	609.22	2428 -	2443	2434.92	8.10E+01	10.94	1.30E+01	1.43
7	910.93	3634 -	3647	3641.19	4.67E+01	8.60	9.26E+00	0.73
8	1460.24	5827 -	5851	5838.91	3.00E+02	18.45	9.53E+00	1.95

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.94	1460.82	*	10.66	6.49E+00	4.88E-01
Tl-208	1.00	583.19	*	85.00	8.18E-02	1.54E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	1.87E-01	3.04E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.28E-01	3.36E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 13-Dec-19-10015

L3-10212B-FIGS-002SB

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.00E-01	4.87E-02
		351.93	*	35.60	2.58E-01	3.81E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32	*	11.27	3.67E-01	7.75E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.04E-01	5.74E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 13-Dec-19-10015

L3-10212B-FIGS-002SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.948	6.49E+00	4.88E-01	
	Tl-208	1.000	8.18E-02	1.54E-02	
X	Bi-211	0.869			
	Pb-212	0.998	1.87E-01	3.04E-02	
	Bi-214	0.999	2.28E-01	3.36E-02	
	Pb-214	0.999	2.36E-01	3.00E-02	
	Ac-228	0.996	3.26E-01	4.61E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 13-Dec-19-10015

L3-10212B-FIGS-002SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 12/13/2019 10:30:42AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.30E-02	5.96E-02	5.96E-02
	BE-7	477.60		10.44	-4.06E-03	3.28E-01	3.28E-01
+	K-40	1460.82	*	10.66	6.49E+00	5.25E-01	5.25E-01
	Mn-54	834.85		99.98	2.50E-02	4.33E-02	4.33E-02
	Co-60	1173.23		99.85	1.50E-02	5.00E-02	5.32E-02
		1332.49		99.98	-4.35E-02		5.00E-02
	Nb-94	702.65		99.81	1.94E-02	4.35E-02	4.35E-02
		871.09		99.89	-1.91E-02		4.74E-02
	Ag-108m	79.13		6.60	7.48E-01	3.67E-02	1.27E+00
		433.94		90.50	-1.04E-02		3.67E-02
		614.28		89.80	-8.35E-04		6.03E-02
		722.94		90.80	2.36E-02		5.42E-02
	Sb-125	176.31		6.84	1.63E-01	1.22E-01	4.65E-01
		380.45		1.52	1.15E-01		2.40E+00
		427.87		29.60	7.38E-02		1.22E-01
		463.36		10.49	-9.72E-03		3.79E-01
		600.60		17.65	-6.69E-02		2.16E-01
		606.71		4.98	1.98E-01		1.43E+00
		635.95		11.22	-8.22E-02		3.53E-01

Analysis Report for 13-Dec-19-10015

L3-10212B-FIGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-3.04E-01	1.22E-01	1.94E+00
Ba-133	79.61	2.65	2.26E+00	6.90E-02	3.09E+00
	81.00	32.90	-3.91E-01		1.96E-01
	276.40	7.16	2.29E-01		5.25E-01
	302.85	18.34	2.00E-01		2.00E-01
	356.01	62.05	-1.13E-02		6.90E-02
	383.85	8.94	4.42E-02		4.23E-01
Cs-134	475.36	1.48	2.22E-01	5.22E-02	2.26E+00
	563.25	8.34	-1.20E-01		4.84E-01
	569.33	15.37	4.33E-02		2.45E-01
	604.72	97.62	6.56E-03		6.22E-02
	795.86	85.46	8.96E-05		5.22E-02
	801.95	8.69	2.78E-01		5.61E-01
	1038.61	0.99	2.01E+00		5.23E+00
	1167.97	1.79	-1.43E+00		3.31E+00
	1365.19	3.02	2.36E-01		1.60E+00
Cs-137	661.66	85.10	5.73E-02	6.11E-02	6.11E-02
Eu-152	121.78	28.67	4.70E-02	1.21E-01	1.21E-01
	244.70	7.61	4.61E-01		5.14E-01
	295.94	0.45	2.41E+00		9.74E+00
	344.28	26.60	-1.28E-01		1.22E-01
	367.79	0.86	-1.08E+00		3.78E+00
	411.12	2.24	1.85E-01		1.77E+00
	443.96	2.83	2.22E-04		1.22E+00
	488.68	0.42	3.54E+00		8.29E+00
	563.99	0.49	-2.09E+01		7.20E+00
	586.26	0.46	-4.02E+00		1.28E+01
	678.62	0.47	2.70E+00		8.87E+00
	688.67	0.86	-3.56E+00		4.85E+00
	719.35	0.28	-5.40E+00		1.58E+01
	778.90	12.96	1.72E-01		3.12E-01
	810.45	0.32	5.38E-01		1.32E+01
	867.37	4.26	-3.36E-01		1.14E+00
	919.33	0.43	-3.15E+00		9.37E+00
	964.08	14.65	1.23E-01		4.25E-01
	1085.87	10.24	1.70E-01		4.57E-01
	1089.74	1.73	-1.59E+00		2.77E+00
	1112.07	13.69	-6.40E-03		3.24E-01
	1212.95	1.43	-6.73E-01		4.25E+00
	1249.94	0.19	2.04E+01		3.23E+01
	1299.14	1.63	1.07E+00		3.23E+00
	1408.01	21.07	-4.50E-02		2.28E-01
	1457.64	0.50	1.37E+02		4.04E+01
	1528.10	0.28	5.07E+00		1.24E+01
Eu-154	123.07	40.40	-1.20E-02	8.43E-02	8.43E-02
	247.93	6.89	2.62E-03		4.89E-01
	591.76	4.95	-2.13E-02		6.43E-01
	692.42	1.78	5.12E-01		2.52E+00
	723.30	20.06	1.75E-01		2.51E-01
	756.80	4.52	-1.96E-01		1.02E+00
	873.18	12.08	1.01E-01		4.26E-01

Analysis Report for 13-Dec-19-10015

L3-10212B-FIGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-8.20E-02	8.43E-02	4.40E-01
	1004.76	18.01	3.35E-02		2.76E-01
	1274.43	34.80	-1.46E-01		1.67E-01
	1596.48	1.80	9.61E-01		2.14E+00
Eu-155	45.30	1.31	1.47E-01	1.85E-01	1.25E+01
	60.01	1.22	9.00E-01		1.34E+01
	86.55	30.70	5.73E-02		1.85E-01
	105.31	21.10	-2.95E-02		1.96E-01
Ra-226	186.21	3.64	5.88E-01	1.01E+00	1.01E+00
Pa-231	27.36	10.30	1.16E+00	1.35E+00	1.35E+00
	283.69	1.70	-1.71E+00		1.68E+00
	300.07	2.47	-2.83E+00		1.47E+00
	302.65	2.20	1.45E+00		1.67E+00
	330.06	1.40	1.35E+00		2.58E+00
U-235	143.76	10.96	-7.36E-02	6.30E-02	3.15E-01
	163.33	5.08	5.07E-01		6.87E-01
	185.71	57.20	5.52E-03		6.30E-02
	202.11	1.08	-1.38E+00		2.85E+00
	205.31	5.01	-4.10E-01		6.26E-01
Am-241	59.54	35.90	1.66E-01	4.72E-01	4.72E-01

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

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-46722

February 7, 2020

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

CASE NARRATIVE
Work Order # 20-01102-OR

SAMPLE RECEIPT

This work order contains three soil samples received 01/23/2020. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID
L310212BFRGS002SS-A	20-01102-04
L310212BFRGS011SS-A	20-01102-05
L310212BFIGS001SS-A	20-01102-06

ANALYTICAL METHODS

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

Laboratory qualifiers are as follows:

U - Result is less than the MDA.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

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

ANALYTICAL RESULTS CONTINUED

TOTAL STRONTIUM

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

Samples demonstrated acceptable results for all Total Strontium analyses. Strontium-90 results are reported from Total Strontium. Chemical recovery was acceptable for all samples. The Total Strontium method blank demonstrated an acceptable result. Results for the Total Strontium duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Total Strontium laboratory control sample demonstrated an acceptable percent recovery.

TRITIUM

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

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

NICKEL-63

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

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

GAMMA SPECTROSCOPY

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

ANALYTICAL RESULTS CONTINUED

GAMMA SPECTROSCOPY CONTINUED

Samples demonstrated acceptable results for all gamma-emitting radionuclides as reported. The method blank demonstrated acceptable results for all radionuclides as reported. Results for the Bismuth-214 and Potassium-40 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Cesium-137 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: 2/7/2020

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

Eberline Analytical
Final Report of Analysis

Report To:

Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

Work Order Details:

SDG:	**20-01102**
Purchase Order:	677118
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01102-01	LCS	KNOWN	01/23/20 00:00	1/23/2020	1/28/2020	20-01102	Tritium	LANL ER-210 Modified	2.11E+02	7.59E+00				pCi/g
20-01102-01	LCS	SPIKE	01/23/20 00:00	1/23/2020	1/28/2020	20-01102	Tritium	LANL ER-210 Modified	2.14E+02	7.82E+00	1.43E+01	5.41E+00		pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/28/2020	20-01102	Tritium	LANL ER-210 Modified	5.58E-01	3.10E+00	3.10E+00	5.35E+00	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/28/2020	20-01102	Tritium	LANL ER-210 Modified	7.24E-01	3.03E+00	3.03E+00	5.21E+00	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/28/2020	20-01102	Tritium	LANL ER-210 Modified	1.80E+00	3.05E+00	3.05E+00	5.18E+00	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/28/2020	20-01102	Tritium	LANL ER-210 Modified	9.29E-01	3.11E+00	3.11E+00	5.34E+00	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/28/2020	20-01102	Tritium	LANL ER-210 Modified	-5.31E-01	2.91E+00	2.91E+00	5.10E+00	U	pCi/g
20-01102-01	LCS	KNOWN	01/23/20 00:00	1/23/2020	1/28/2020	20-01102	Nickel-63	ASTM 3500-Ni Modified	1.50E+03	4.50E+01				pCi/g
20-01102-01	LCS	SPIKE	01/23/20 00:00	1/23/2020	1/28/2020	20-01102	Nickel-63	ASTM 3500-Ni Modified	1.50E+03	1.29E+01	8.92E+01	3.29E+00		pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/28/2020	20-01102	Nickel-63	ASTM 3500-Ni Modified	-2.35E+00	1.84E+00	1.85E+00	3.29E+00	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/28/2020	20-01102	Nickel-63	ASTM 3500-Ni Modified	-6.10E-01	1.96E+00	1.96E+00	3.41E+00	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/28/2020	20-01102	Nickel-63	ASTM 3500-Ni Modified	-1.67E+00	1.95E+00	1.95E+00	3.44E+00	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/28/2020	20-01102	Nickel-63	ASTM 3500-Ni Modified	-2.33E+00	1.98E+00	1.98E+00	3.52E+00	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/28/2020	20-01102	Nickel-63	ASTM 3500-Ni Modified	-9.64E-01	2.17E+00	2.17E+00	3.78E+00	U	pCi/g
20-01102-01	LCS	KNOWN	01/23/20 00:00	1/23/2020	1/28/2020	20-01102	Strontium-90	EIChroM SRW01 Modified	4.93E+01	2.76E-01				pCi/g
20-01102-01	LCS	SPIKE	01/23/20 00:00	1/23/2020	1/28/2020	20-01102	Strontium-90	EIChroM SRW01 Modified	4.81E+01	1.37E+00	1.68E+01	6.43E-01		pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/28/2020	20-01102	Strontium-90	EIChroM SRW01 Modified	1.92E-01	3.69E-01	3.75E-01	7.68E-01	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/28/2020	20-01102	Strontium-90	EIChroM SRW01 Modified	3.46E-01	3.53E-01	3.73E-01	7.16E-01	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/28/2020	20-01102	Strontium-90	EIChroM SRW01 Modified	3.15E-01	2.96E-01	3.16E-01	5.97E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/28/2020	20-01102	Strontium-90	EIChroM SRW01 Modified	3.29E-01	3.46E-01	3.64E-01	7.03E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/28/2020	20-01102	Strontium-90	EIChroM SRW01 Modified	2.16E-01	3.41E-01	3.49E-01	7.05E-01	U	pCi/g
20-01102-01	LCS	KNOWN	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
20-01102-01	LCS	KNOWN	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
20-01102-01	LCS	SPIKE	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Cobalt-60	EPA 901.1 Modified	1.31E+02	7.97E+00	1.04E+01	1.59E+00		pCi/g
20-01102-01	LCS	SPIKE	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Cesium-137	EPA 901.1 Modified	8.58E+01	7.69E+00	8.86E+00	2.30E+00		pCi/g

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

Eberline Analytical
Final Report of Analysis

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Jeffrey Graham
Zion Solutions
2701 Deborah Ave
Zion, IL 60099

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Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Actinium-228	EPA 901.1 Modified	1.48E-02	7.65E-02	7.65E-02	1.18E-01	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Silver-108m	EPA 901.1 Modified	4.88E-03	1.91E-02	1.91E-02	2.60E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Americium-241	EPA 901.1 Modified	-8.61E-02	5.11E-02	5.13E-02	6.29E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Barium-133	EPA 901.1 Modified	5.48E-03	2.51E-02	2.51E-02	3.97E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Bismuth-214	EPA 901.1 Modified	-7.25E-03	4.83E-02	4.83E-02	6.37E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Cobalt-60	EPA 901.1 Modified	1.06E-03	1.10E-02	1.10E-02	2.08E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Cesium-134	EPA 901.1 Modified	3.39E-03	1.08E-02	1.08E-02	3.12E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Cesium-137	EPA 901.1 Modified	3.04E-03	2.00E-02	2.00E-02	3.04E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Europium-152	EPA 901.1 Modified	2.32E-02	7.41E-02	7.41E-02	6.90E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Europium-154	EPA 901.1 Modified	9.55E-03	4.63E-02	4.63E-02	3.62E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Europium-155	EPA 901.1 Modified	-5.78E-02	4.97E-02	4.98E-02	6.13E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Holmium-166m	EPA 901.1 Modified	8.36E-03	3.30E-02	3.30E-02	3.24E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Iodine-129	EPA 901.1 Modified	-2.02E-02	7.64E-02	7.64E-02	1.10E-01	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Potassium-40	EPA 901.1 Modified	1.21E-01	2.19E-01	2.19E-01	4.00E-01	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Manganese-54	EPA 901.1 Modified	8.58E-03	1.04E-02	1.04E-02	3.18E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Molybdenum-93	EPA 901.1 Modified	2.75E-03	1.10E-02	1.10E-02	2.21E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Niobium-94	EPA 901.1 Modified	-9.85E-03	2.13E-02	2.13E-02	2.77E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Lead-210	EPA 901.1 Modified	3.08E-01	3.89E-01	3.89E-01	6.26E-01	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Lead-212	EPA 901.1 Modified	3.49E-02	3.18E-02	3.19E-02	5.36E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Lead-214	EPA 901.1 Modified	1.24E-02	3.95E-02	3.95E-02	6.29E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Promethium-145	EPA 901.1 Modified	-1.72E-03	5.95E-02	5.95E-02	8.88E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Radium-226	EPA 901.1 Modified	-7.25E-03	4.83E-02	4.83E-02	6.37E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Antimony-125	EPA 901.1 Modified	5.48E-03	4.03E-02	4.03E-02	6.57E-02	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Thorium-234	EPA 901.1 Modified	1.09E+00	3.86E-01	3.90E-01	6.84E-01	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Thallium-208	EPA 901.1 Modified	3.91E-02	6.51E-02	6.51E-02	1.03E-01	U	pCi/g
20-01102-02	MBL	BLANK	01/23/20 00:00	1/23/2020	1/24/2020	20-01102	Uranium-235	EPA 901.1 Modified	8.27E-02	1.11E-01	1.11E-01	1.80E-01	U	pCi/g

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Eberline Analytical
Final Report of Analysis

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Zion, IL 60099

Work Order Details:
SDG: 20-01102
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Actinium-228	EPA 901.1 Modified	4.37E-01	2.13E-01	2.14E-01	3.64E-01		pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Silver-108m	EPA 901.1 Modified	-4.33E-02	6.41E-02	6.42E-02	5.71E-02	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Americium-241	EPA 901.1 Modified	-2.35E-01	1.63E-01	1.64E-01	1.70E-01	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Barium-133	EPA 901.1 Modified	6.87E-03	4.49E-02	4.49E-02	8.18E-02	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Bismuth-214	EPA 901.1 Modified	5.62E-01	1.55E-01	1.58E-01	2.53E-01		pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Cobalt-60	EPA 901.1 Modified	2.75E-02	6.30E-02	6.30E-02	9.39E-02	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Cesium-134	EPA 901.1 Modified	-4.50E-01	1.63E-01	1.64E-01	7.82E-02	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Cesium-137	EPA 901.1 Modified	2.21E-01	1.16E-01	1.16E-01	1.81E-01		pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Europium-152	EPA 901.1 Modified	9.37E-02	1.99E-01	1.99E-01	2.35E-01	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Europium-154	EPA 901.1 Modified	1.62E-02	1.35E-01	1.35E-01	1.21E-01	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Europium-155	EPA 901.1 Modified	-8.41E-02	1.71E-01	1.71E-01	2.12E-01	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Holmium-166m	EPA 901.1 Modified	0.00E+00	4.49E-02	4.49E-02	9.47E-02	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Iodine-129	EPA 901.1 Modified	2.38E-01	1.82E-01	1.82E-01	2.80E-01	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Potassium-40	EPA 901.1 Modified	1.44E+01	2.04E+00	2.17E+00	9.49E-01		pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Manganese-54	EPA 901.1 Modified	2.83E-02	5.70E-02	5.70E-02	9.62E-02	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Molybdenum-93	EPA 901.1 Modified	-3.42E-03	4.14E-02	4.14E-02	5.85E-02	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Niobium-94	EPA 901.1 Modified	3.51E-02	4.49E-02	4.49E-02	7.86E-02	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Lead-210	EPA 901.1 Modified	1.44E+00	1.47E+00	1.48E+00	2.45E+00	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Lead-212	EPA 901.1 Modified	6.82E-01	1.76E-01	1.80E-01	2.17E-01		pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Lead-214	EPA 901.1 Modified	6.89E-01	1.58E-01	1.61E-01	2.07E-01		pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Promethium-145	EPA 901.1 Modified	-6.14E-03	2.17E-01	2.17E-01	2.81E-01	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Radium-226	EPA 901.1 Modified	5.62E-01	1.55E-01	1.58E-01	2.53E-01		pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Antimony-125	EPA 901.1 Modified	-2.39E-02	1.02E-01	1.02E-01	1.69E-01	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Thorium-234	EPA 901.1 Modified	9.70E-01	1.29E+00	1.29E+00	1.76E+00	U	pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Thallium-208	EPA 901.1 Modified	4.70E-01	1.44E-01	1.46E-01	3.08E-01		pCi/g
20-01102-03	DUP	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Uranium-235	EPA 901.1 Modified	-3.34E-01	4.07E-01	4.08E-01	4.66E-01	U	pCi/g

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

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Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Actinium-228	EPA 901.1 Modified	4.34E-01	2.12E-01	2.14E-01	4.21E-01		pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Silver-108m	EPA 901.1 Modified	-3.90E-02	6.27E-02	6.28E-02	6.87E-02	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Americium-241	EPA 901.1 Modified	-1.78E-01	1.53E-01	1.53E-01	1.69E-01	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Barium-133	EPA 901.1 Modified	1.39E-02	3.49E-02	3.49E-02	9.65E-02	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Bismuth-214	EPA 901.1 Modified	6.37E-01	1.48E-01	1.52E-01	2.04E-01		pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Cobalt-60	EPA 901.1 Modified	1.08E-02	6.24E-02	6.24E-02	9.39E-02	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Cesium-134	EPA 901.1 Modified	9.45E-03	3.32E-02	3.32E-02	8.63E-02	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Cesium-137	EPA 901.1 Modified	8.51E-02	6.33E-02	6.34E-02	1.00E-01	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Europium-152	EPA 901.1 Modified	2.94E-02	1.63E-01	1.63E-01	2.25E-01	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Europium-154	EPA 901.1 Modified	1.37E-01	1.58E-01	1.58E-01	1.16E-01	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Europium-155	EPA 901.1 Modified	1.48E-01	9.58E-02	9.61E-02	2.46E-01	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Holmium-166m	EPA 901.1 Modified	8.30E-02	7.36E-02	7.37E-02	9.43E-02	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Iodine-129	EPA 901.1 Modified	1.25E-01	1.76E-01	1.76E-01	2.59E-01	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Potassium-40	EPA 901.1 Modified	1.40E+01	2.10E+00	2.22E+00	1.47E+00		pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Manganese-54	EPA 901.1 Modified	-3.67E-02	5.93E-02	5.93E-02	8.28E-02	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Molybdenum-93	EPA 901.1 Modified	5.10E-02	4.08E-02	4.09E-02	6.71E-02	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Niobium-94	EPA 901.1 Modified	-3.56E-02	5.42E-02	5.43E-02	7.48E-02	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Lead-210	EPA 901.1 Modified	3.10E+00	1.43E+00	1.44E+00	2.23E+00		pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Lead-212	EPA 901.1 Modified	6.81E-01	1.91E-01	1.95E-01	2.53E-01		pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Lead-214	EPA 901.1 Modified	5.22E-01	1.64E-01	1.66E-01	2.58E-01		pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Promethium-145	EPA 901.1 Modified	-7.06E-02	2.05E-01	2.05E-01	2.58E-01	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Radium-226	EPA 901.1 Modified	6.37E-01	1.48E-01	1.52E-01	2.04E-01		pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Antimony-125	EPA 901.1 Modified	-2.11E-02	1.18E-01	1.18E-01	1.98E-01	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Thorium-234	EPA 901.1 Modified	2.42E-01	1.36E+00	1.36E+00	1.76E+00	U	pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Thallium-208	EPA 901.1 Modified	4.16E-01	1.25E-01	1.27E-01	2.12E-01		pCi/g
20-01102-04	DO	L310212BFRGS002SS-A	12/09/19 09:02	1/23/2020	1/24/2020	20-01102	Uranium-235	EPA 901.1 Modified	1.24E-01	3.86E-01	3.86E-01	5.18E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

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

Work Order Details:
SDG: 20-01102
Purchase Order: 677118
Analysis Category: ENVIRONMENTAL
Sample Matrix: SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Actinium-228	EPA 901.1 Modified	8.92E-01	2.93E-01	2.97E-01	5.87E-01		pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Silver-108m	EPA 901.1 Modified	9.94E-03	5.66E-02	5.66E-02	8.73E-02	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Americium-241	EPA 901.1 Modified	-2.90E-01	1.43E-01	1.44E-01	2.00E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Barium-133	EPA 901.1 Modified	1.87E-01	1.50E-01	1.50E-01	1.87E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Bismuth-214	EPA 901.1 Modified	1.19E+00	2.18E-01	2.26E-01	2.85E-01		pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Cobalt-60	EPA 901.1 Modified	2.93E-02	8.19E-02	8.19E-02	1.22E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Cesium-134	EPA 901.1 Modified	1.37E-02	2.76E-02	2.76E-02	9.58E-02	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Cesium-137	EPA 901.1 Modified	-2.21E-02	7.78E-02	7.78E-02	1.13E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Europium-152	EPA 901.1 Modified	1.26E-01	1.78E-01	1.78E-01	3.00E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Europium-154	EPA 901.1 Modified	-5.66E-03	2.03E-01	2.03E-01	1.52E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Europium-155	EPA 901.1 Modified	1.80E-01	1.69E-01	1.69E-01	2.56E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Holmium-166m	EPA 901.1 Modified	1.15E-01	7.86E-02	7.89E-02	1.47E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Iodine-129	EPA 901.1 Modified	-6.13E-02	2.23E-01	2.23E-01	5.07E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Potassium-40	EPA 901.1 Modified	2.02E+01	2.78E+00	2.96E+00	1.47E+00		pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Manganese-54	EPA 901.1 Modified	-1.68E-02	7.06E-02	7.06E-02	1.06E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Molybdenum-93	EPA 901.1 Modified	-2.62E-02	5.71E-02	5.71E-02	8.20E-02	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Niobium-94	EPA 901.1 Modified	-1.14E-02	5.90E-02	5.90E-02	8.93E-02	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Lead-210	EPA 901.1 Modified	2.78E+00	1.46E+00	1.46E+00	2.48E+00	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Lead-212	EPA 901.1 Modified	6.36E-01	1.65E-01	1.68E-01	2.67E-01		pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Lead-214	EPA 901.1 Modified	1.11E+00	2.41E-01	2.48E-01	3.22E-01		pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Promethium-145	EPA 901.1 Modified	-2.32E-01	2.24E-01	2.25E-01	3.37E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Radium-226	EPA 901.1 Modified	1.19E+00	2.18E-01	2.26E-01	2.85E-01		pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Antimony-125	EPA 901.1 Modified	2.56E-01	1.82E-01	1.82E-01	3.09E-01	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Thorium-234	EPA 901.1 Modified	1.84E+00	1.24E+00	1.24E+00	2.07E+00	U	pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Thallium-208	EPA 901.1 Modified	7.13E-01	2.00E-01	2.03E-01	2.42E-01		pCi/g
20-01102-05	TRG	L310212BFRGS011SS-A	12/09/19 09:20	1/23/2020	1/24/2020	20-01102	Uranium-235	EPA 901.1 Modified	-2.25E-01	4.16E-01	4.17E-01	5.88E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Jeffrey Graham	SDG:	20-01102
Zion Solutions	Purchase Order:	677118
2701 Deborah Ave	Analysis Category:	ENVIRONMENTAL
Zion, IL 60099	Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Actinium-228	EPA 901.1 Modified	2.60E-01	1.44E-01	1.45E-01	3.47E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Silver-108m	EPA 901.1 Modified	-2.33E-02	4.68E-02	4.68E-02	5.84E-02	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Americium-241	EPA 901.1 Modified	-9.73E-02	8.57E-02	8.59E-02	1.30E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Barium-133	EPA 901.1 Modified	-2.59E-02	8.53E-02	8.53E-02	1.04E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Bismuth-214	EPA 901.1 Modified	2.30E-01	1.26E-01	1.27E-01	2.41E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Cobalt-60	EPA 901.1 Modified	9.33E-02	6.49E-02	6.51E-02	1.31E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Cesium-134	EPA 901.1 Modified	-1.35E-02	2.13E-02	2.13E-02	6.85E-02	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Cesium-137	EPA 901.1 Modified	1.27E-01	6.85E-02	6.88E-02	1.05E-01		pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Europium-152	EPA 901.1 Modified	-1.53E-02	9.20E-02	9.20E-02	1.99E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Europium-154	EPA 901.1 Modified	-4.66E-03	1.25E-01	1.25E-01	1.03E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Europium-155	EPA 901.1 Modified	6.17E-02	1.07E-01	1.07E-01	1.60E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Holmium-166m	EPA 901.1 Modified	-7.32E-03	3.46E-02	3.46E-02	6.67E-02	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Iodine-129	EPA 901.1 Modified	1.99E-02	2.20E-01	2.20E-01	3.52E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Potassium-40	EPA 901.1 Modified	6.09E+00	1.22E+00	1.26E+00	1.05E+00		pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Manganese-54	EPA 901.1 Modified	-2.95E-02	4.97E-02	4.97E-02	6.88E-02	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Molybdenum-93	EPA 901.1 Modified	1.26E-02	3.65E-02	3.65E-02	5.42E-02	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Niobium-94	EPA 901.1 Modified	-3.41E-03	1.85E-02	1.85E-02	6.63E-02	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Lead-210	EPA 901.1 Modified	1.24E+00	1.08E+00	1.08E+00	1.78E+00	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Lead-212	EPA 901.1 Modified	3.30E-01	9.33E-02	9.48E-02	1.55E-01		pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Lead-214	EPA 901.1 Modified	2.95E-01	1.09E-01	1.11E-01	2.48E-01		pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Promethium-145	EPA 901.1 Modified	1.26E-01	1.46E-01	1.46E-01	2.46E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Radium-226	EPA 901.1 Modified	2.30E-01	1.26E-01	1.27E-01	2.41E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Antimony-125	EPA 901.1 Modified	-6.06E-02	1.30E-01	1.30E-01	1.84E-01	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Thorium-234	EPA 901.1 Modified	4.21E-01	7.42E-01	7.42E-01	1.23E+00	U	pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Thallium-208	EPA 901.1 Modified	3.16E-01	1.31E-01	1.32E-01	2.58E-01		pCi/g
20-01102-06	TRG	L310212BFIGS001SS-A	12/06/19 13:30	1/23/2020	1/24/2020	20-01102	Uranium-235	EPA 901.1 Modified	-8.86E-02	2.62E-01	2.62E-01	3.78E-01	U	pCi/g

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

ZION SOLUTIONS LLC
An EnergySolutions Company

ZS-WM-131
Revision 0
Information Use

REC'D JAN 23 2020

Attachment 1 – Chain-of-Custody Form

20-01102

Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
4 L310212BFRGS002SS-A	NA	NA	Soil	500	mL	Marinelli	1	12/09/19	09:02	HTD	NA	528.27g
5 L310212BFRGS011SS-A	NA	NA	Soil	500	mL	Marinelli	1	12/09/19	09:20	HTD	NA	550.49g
6 L310212BFIGS001SS-A	NA	NA	Soil	500	mL	Marinelli	1	12/06/19	13:30	HTD	NA	714.36g

Laboratory: **EBERLINE LABS**	Date Submitted To Lab:	Ship Container No.: NA	Cooler Temperature: NA	Airbill Number: FedEx Standard Overnight 8132 0229 4915

Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	Time:
Vicky M. Baldwin	01/22/2020	1315	Richard F. Rickert	01/22/2020	1315
Richard F. Rickert	01/22/2020	1600	FedEx Standard Overnight	01/22/2020	1600
Fed Ex	01/23/2020	0911	Kenneth Spencer	01-23-2020	0911

Comments

P.O.# 67116 Hard to Detects / 7 Day Turn around