ZION SOLUTIONS LLC
An EnergySolutions Company

ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

SOUTH OF PROTECTED AREA - LAKESHORE
SURVEY UNIT 10221F

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LIST OF ACRONYMS AND ABBREVIATIONS

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

TSD	Technical Support Document
UBGR	Upper Bound of the Gray Region
VSP	Visual Sample Plan
ZNPS	Zion Nuclear Power Station
ZSRP	Zion Station Restoration Project

1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for Survey Unit 10221F, "South of Protected Area - Lakeshore," 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).

A FSS package (L1-10221F-F) was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, *"Final Status Survey Package Development"* (Reference 3), the ZSRP LTP, and guidance from NUREG-1575, "*Multi-Agency Radiation Survey and Site Investigation Manual"* (MARSSIM) (Reference 4).

This open land survey unit has a MARSSIM classification of 1. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I (α) and Type II (β) decision error rates were set at 0.05. Seventeen (17) systematic surface soil samples were acquired from the survey unit. In addition, surface scanning was performed on 100% of the accessible surface area in the survey unit. No areas of elevated activity were detected during the scans. The analytical results for all soil samples taken in survey unit 10221F indicated that the Sum of Fractions (SOF) for each sample, when compared to the Operational Derived Concentration Guideline Levels (OpDCGL), was less than 1.0, with a maximum Operational SOF (OpSOF) of 0.114. The mean OpSOF for the systematic samples was 0.052. The mean Base Case SOF (BcSOF), when the analytical results were compared to the Base Case DCGLs (BcDCGL), was 0.013, which results in a dose assigned to the survey unit of 0.331 mrem/yr. Therefore, the null hypothesis is rejected and survey unit 10221F is acceptable for unrestricted release.

2. SURVEY UNIT DESCRIPTION

Survey unit 10221F, South of Protected Area – Lakeshore, is a Class 1 open land survey unit. It is bounded on the west by survey unit 10221D, the east by survey unit 10224, the north by survey unit 10221E, and the south by survey unit 10221G.

The topography of the survey unit is mainly flat with some small dips and depressions. The soil is mostly loam. A fence runs along the eastern border of the survey unit.

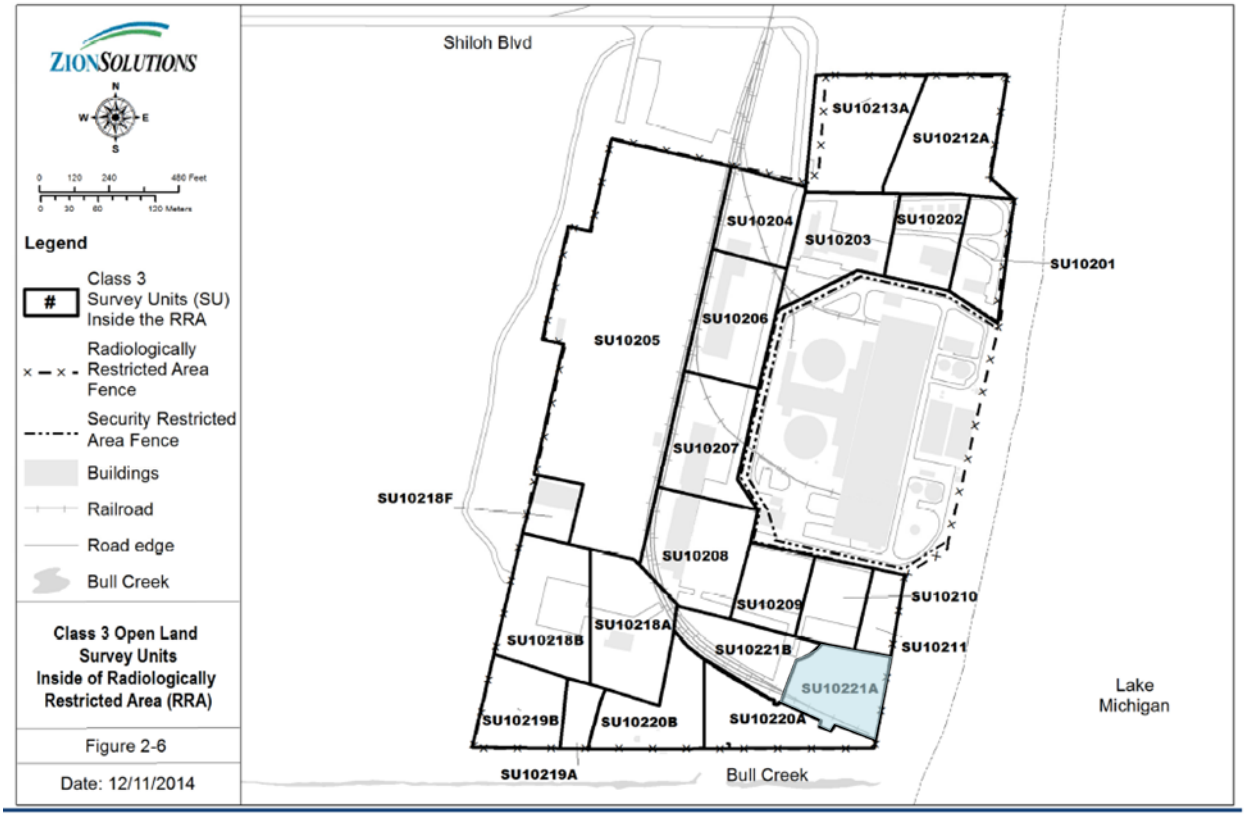
The boundary of the survey unit was defined using a Global Positioning System (GPS) based on the Illinois State Plane System North American Datum (NAD) 1983 East. The reference coordinates associated with the sample locations in this survey unit are presented in Table 8.

3. CLASSIFICATION BASIS

Survey unit 10221F was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, "*Survey Unit Classification*" (Reference 5).

The area encompassing this survey unit was described as "South of Fenced Area - Lakeshore" and was located within survey unit 10221 as identified in Figure 4 of the *"Zion Station Historical Site Assessment"* (Reference 6). Subsequently, this area was described as "South of Protected Area - Lakeshore" (survey unit 10221A) in Table 2-29 of the ZSRP LTP as represented in Figure 2-6 of the LTP and replicated below as Figure 1. Survey unit 10221A was initially classified in both the HSA and LTP as a Class 3 open land survey unit.

Figure 1 - Class 3 Open Land Survey Units from Figure 2-6 of the LTP

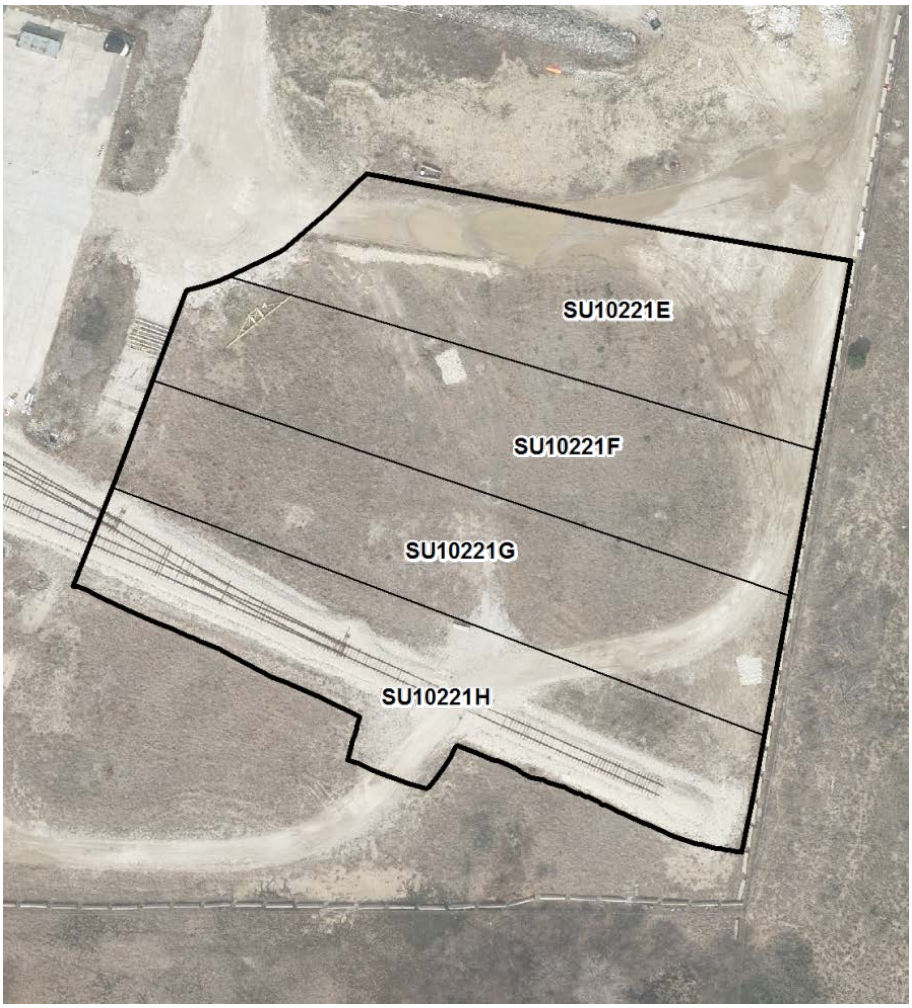


Characterization surveys were performed in this survey unit in July 2012. The survey design for the characterization of this survey unit called for gamma walkover scans of 50% of the survey unit area, and the acquisition of thirty (30) surface soil samples taken at systematic locations. The survey design also required the acquisition of subsurface soil samples at all surface sample locations to a depth of one (1) meter.

Approximately 50% of the survey unit was scanned using a Ludlum Model 2350-1 and a Model 44-10 (2" x 2") sodium iodide (NaI) detector. Three (3) of the thirty (30) surface samples had positive results for Cs-137, with the highest activity at 0.23 pCi/g. One (1) of the thirty (30) sub-surface samples had positive results for Cs-137, with an activity of 0.04 pCi/g.

On June 12, 2017, due to changing radiological and operational conditions brought about by site decommissioning activities inside or adjacent to this area, survey unit 10221A was reclassified as a Class 1 open land survey unit and divided into four survey units: 10221E, 10221F, 10221G and 10221H, as depicted in Figure 2 below, to comply with the survey unit size recommendations from MARSSIM section 4.6. The change in classification was a conservative response and ensured that the survey unit was surveyed with the appropriate rigor.

Figure 2 - The Four Class 1 Open Land Survey Units Created from the Class 3 Survey Unit 10221A



A Radiological Engineer (RE) and a Characterization/License Termination (C/LT) Supervisor performed a visual inspection and walk-down of the survey unit on October 23, 2018 prior to performing FSS. The purpose of the walk-down was to assess the physical condition of the survey unit, evaluate access points and travel paths and identify potentially hazardous conditions. A final classification assessment was performed in accordance with ZS-LT-300-

001-002, as part of the survey design for FSS. The assessment confirmed that survey unit 10221F was correctly classified as Class 1.

4. DATA QUALITY OBJECTIVES

FSS planning and design hinges on coherence with the Data Quality Objective (DQO) process to ensure, through compliance with explicitly defined inputs and boundaries, that the primary objective of the survey is satisfied. The DQO process is described in the ZSRP LTP in accordance with MARSSIM. 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 10221F 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), written in 2012, established the basis for an initial suite of potential Radionuclides of Concern (ROC) for the decommissioning of the Zion Nuclear Power Station (ZNPS).

Zion*Solutions* TSD 14-019, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* (Reference 8), completed in February 2017, was written to refine the initial selection of ROCs for decommissioning at ZSRP. The list of ROCs was evaluated using Containment Building(s) and Auxiliary Building concrete core analysis data to evaluate the dose significance of each radionuclide in the end state model. Section 4.4 of the TSD evaluated the results of the characterization data of surveys taken of soils. The following conclusion was reached: *"The results of surface and subsurface soil characterization in the impacted area surrounding Zion indicate that there is minimal residual radioactivity in soil. Essentially all of the soil results were reported as non-detectable. Other than Cs-137 at very low levels, and Co-60 at a concentration of 0.24 pCi/g in one sample, the results for all radionuclides were less than MDC. Therefore, the direct determination of radionuclide mixture fractions for initial suite radionuclides*

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

The ROC for surface soils is 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 Chapter 6, section 6.8 provides the exposure scenarios and modeling parameters that were used to calculate the site-specific DCGLs for soils (referred to as Base Case Soil DCGLs [BcDCGL] in this Release Record).

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

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

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

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

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

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

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

Each radionuclide-specific BcDCGL is equivalent to the level of residual radioactivity (above background levels) that could, when considered independently, result in a Total Effective Dose Equivalent (TEDE) of 25 mrem per year to an Average Member of the Critical Group (AMCG). To ensure that the summation of dose from each source term is 25 mrem/yr 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 Historical Site Assessment (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, Zion proposes to perform minimal subsurface sampling during FSS.

Instrument DQOs included a verification of the ability of the survey instrument to detect the radiation(s) of interest at the required scan Minimum Detectable Concentration (MDC), which for Class 1 Open Land survey units, is the *a priori* DCGL Elevated Measurement Comparison ($DCGL_{EMC}$). Survey instrument response checks were required prior to issuance and after the

instrument had been used. Control and accountability of survey instruments was required to ensure the quality and prevent the loss of data.

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

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

5. SURVEY DESIGN

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

The DQO process determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 would be the ROC in survey unit 10221F. During FSS, concentrations for Hard-to-Detect (HTD) ROC Ni-63 and Sr-90 are inferred using a surrogate approach. Cs-137 is the principle surrogate radionuclide for Sr-90 and Co-60 is the principle surrogate radionuclide for Ni-63. The mean, maximum and 95% Upper Confidence Level (UCL) of the surrogate ratios for concrete core samples taken in the Auxiliary Building basement were calculated in Zion*Solutions* TSD 14-019, 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 10221F, 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.

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

Equation 4

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

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

Equation 5

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

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

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

Table 7 - Investigation Levels

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

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

- background count rate of 5000 counts per minute (cpm)
- scan speed of 0.5 m/sec
- distance from detector to surface of 2-inches
- isotopic mix of 95% Cs-137 and 5% Co-60

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

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

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

will be used for Δ/σ. A conservative estimate of the sample variability of 0.30 was used as the coefficient of variation to calculate Δ/σ.

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

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/CAD Specialist, with coordinates based on the NAD standard topographical grid coordinate system. The number of samples generated by VSP for a systematic triangular grid was seventeen. The Prospective Power Curve generated by VSP showed adequate power for the survey design.

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

- To calculate the area bounded by the systematic samples: $A = \frac{A_{SU}}{N} = \frac{1968}{17} = 115.8\ m^2$
- From the LTP, Table 5-16, the Area Factors for the next larger area, 300 m^2 area were used:
  - Cs-137 - 1.46
  - Cs-134 - 1.30
  - Co-60 - 1.16
- The $DCGL_{EMC}$ is the Surrogate Base Case DCGL times the Area Factor:
  - The $DCGL_{EMC}$ for Cs-137 = $1.46 * 14.15 = 20.66\ pCi/g$
  - The $DCGL_{EMC}$ for Cs-134 = $1.30 * 6.77 = 8.80\ pCi/g$
  - The $DCGL_{EMC}$ for Co-60 = $1.16 * 3.51 = 4.07\ pCi/g$

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

The implementation of quality control (QC) measures as referenced by LTP Chapter 5, section 5.9 and Zion*Solutions* procedure ZS-LT-01, "*Quality Assurance Project Plan (for Characterization and FSS)*" (Reference 12) includes the collection of a soil sample for "split sample" analysis on 5% of the soil samples taken in a survey unit with the locations selected at random. One (1) surface soil sample, L1-10221F-FQGS-004-SS, was selected randomly for split sample analysis for the FSS of this survey unit.

In accordance with section 5.7.1.6.2 of the LTP, a subsurface soil sample was taken at 10% of the systematic surface soil sample locations in the survey unit with the location(s)

selected at random. Locations L1-10221F-FSGS-002-SB and L1-10221F-FSGS-011-SB were selected for this survey unit.

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

Table 8 - Systematic Sample Measurement Locations

MEASUREMENT ID	NORTHING (meters)	EASTING (meters)
L1-10221F-FSGS-001-SS	641476.97	343684.20
L1-10221F-FSGS-002-SS	641476.97	343695.09
L1-10221F-FSGS-003-SS	641486.39	343657.00
L1-10221F-FSGS-004-SS	641486.39	343667.88
L1-10221F-FSGS-005-SS	641486.39	343678.76
L1-10221F-FSGS-006-SS	641486.39	343689.64
L1-10221F-FSGS-007-SS	641486.39	343700.53
L1-10221F-FSGS-008-SS	641495.82	343629.79
L1-10221F-FSGS-009-SS	641495.82	343640.67
L1-10221F-FSGS-010-SS	641495.82	343651.56
L1-10221F-FSGS-011-SS	641495.82	343662.44
L1-10221F-FSGS-012-SS	641495.82	343673.32
L1-10221F-FSGS-013-SS	641495.82	343684.20
L1-10221F-FSGS-014-SS	641505.24	343613.47
L1-10221F-FSGS-015-SS	641505.24	343624.35
L1-10221F-FSGS-016-SS	641505.24	343635.23
L1-10221F-FSGS-017-SS	641505.24	343646.12
L1-10221F-FSGS-002-SB	641476.97	343695.09
L1-10221F-FSGS-011-SB	641495.82	343662.44

ZSRP LTP Chapter 5, section 5.1 states that soil samples will be collected during FSS to confirm the HTD to surrogate radionuclide ratios (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 (see Table 6). The maximum ratios (Table 6) 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 Chapter 5, 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. Two (2) samples, L1-10221F-FSGS-005-SS and L1-10221F-FSGS-011-SS, exceeded a SOF of 0.1 during the FSS of survey unit 10221F.

These soil samples satisfy the requirement that 10% of the samples collected for the FSS of survey unit 10221F be analyzed for HTD ROC. Each sample was sent off-site (Eberline Analytical) for analysis of the HTD ROC as specified in LTP Chapter 5, section 5.1. Table 9 provides a synopsis of the survey design for survey unit 10221F.

Table 9 - Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	1,968 m^2	GPS measurements of area
Number of Surface Soil Samples	17 (Systematic)	• $\sigma = 0.30$ • UBGR = SOF of 1 • LBGR = SOF of 0.5 • Type I error = 0.05 • Type II error = 0.05 • $\Delta/\sigma = 1.67$ (MARSSIM Table 5.5)
Grid Spacing	11.6 m	(LTP Chapter 5, 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 Chapter 5, Table 5-7)
HTD ROC Analysis	Two (2) surface soil samples selected for HTD ROC analysis	(LTP Chapter 5, section 5.1)
Measurement Investigation Level	Operational DCGL	(LTP Chapter 5, Table 5-25)
Scan Survey Area Coverage	100% of accessible areas	(LTP Chapter 5, Table 5-24)
QC	One (1) surface soil sample selected randomly for split sample analysis	(LTP Chapter 5, section 5.9)
Number of Subsurface Soil Samples	Two (2) systematic surface soil sample locations selected, at locations 2 and 11	(LTP Chapter 5, section 5.7.1.6.2)

6. SURVEY IMPLEMENTATION

Survey instructions for this FSS were incorporated into and performed in accordance with FSS Sample Plan L1-10221F-F, which was developed in accordance with Zion*Solutions* procedure 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 10221F, compliance with the unrestricted release criteria was demonstrated through a combination of surface scanning with a Ludlum Model 44-10 gamma detector and the sampling of surface soil for isotopic analysis. In accordance with the LTP Chapter 5, two (2) subsurface samples were obtained. Also, if during the performance of FSS, the analysis of a surface soil sample, or the results of a surface gamma scan indicated the potential presence of residual radioactivity at a concentration of 75% of the subsurface Operational DCGL, then a biased subsurface soil sample(s) would have been taken to the appropriate depth within the area of concern as part of the investigation. This threshold was not encountered during the FSS of survey unit 10221F.

FSS field activities were conducted under FSS Sample Plan L1-10221F-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 October 24, 2018 and concluding on December 18, 2018.

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

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

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

Table 10 - Instruments and Detectors

Instrument/Detector Type	Serial #	Calibration Due Date
Ludlum 2350-1/Ludlum 44-10	304711/PR321902	8/13/2019
Ludlum 2350-1/Ludlum 44-10	304708/PR321892	5/5/2019
Ludlum 2350-1/Ludlum 44-10	304726/PR363452	9/6/2019
Ludlum 2350-1/Ludlum 44-10	293136/PR316938	8/14/2019

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

Two (2) samples (L1-10221F-FSGS-005-SS and L1-10221F-FSGS-011-SS) were selected for HTD radionuclide analysis.

7. SURVEY RESULTS

One hundred percent (100%) of the accessible surface area of the survey unit was scanned for elevated radiation levels. One hundred (100) 1-meter wide scan rows, as shown on the map in Attachment 1, were marked in the field. All but six rows (Rows 29 through 34 were not accessible for scanning due to standing water and ice being present in the area) were scanned with the 2350-1/44-10 using latching mode. Readings were recorded at approximately 10-meter intervals during the scans. No elevated measurement locations were identified by surface scan. Table 11 provides an overview of the scan results. Complete scan results are provided in Attachment 2.

Table 11 - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[(1)] (cpm)	# of Scan Alarms	Investigation Samples
Row 1	2370	2747	None	None
Row 2	2420	2747	None	None
Row 3	2231	2747	None	None
Row 4	2243	2747	None	None
Row 5	2300	2747	None	None
Row 6	2305	2747	None	None
Row 7	2383	2747	None	None
Row 8	2412	2747	None	None
Row 9	2280	2747	None	None
Row 10	2342	2747	None	None
Row 11	2331	2759	None	None

Table 11 (continued) - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[1] (cpm)	# of Scan Alarms	Investigation Samples
Row 12	2445	2759	None	None
Row 13	2372	2759	None	None
Row 14	2535	2759	None	None
Row 15	2732	2759	None	None
Row 16	2700	2759	None	None
Row 17	2712	2759	None	None
Row 18	2612	2801	None	None
Row 19	2681	2801	None	None
Row 20	2761	2801	None	None
Row 21	2499	2801	None	None
Row 22	2590	2801	None	None
Row 23	2618	2801	None	None
Row 24	2731	2801	None	None
Row 25	2518	2801	None	None
Row 26	2418	2801	None	None
Row 27	2518	2801	None	None
Row 28	2560	2801	None	None
Row 35	2588	3033	None	None
Row 36	2217	2669	None	None
Row 37	2280	2669	None	None
Row 38	2383	2669	None	None
Row 39	2452	2669	None	None
Row 40	2327	2669	None	None
Row 41	2358	2669	None	None
Row 42	2243	2669	None	None
Row 43	2306	2669	None	None
Row 44	2283	2669	None	None
Row 45	2635	3033	None	None
Row 46	2609	3033	None	None
Row 47	2644	3033	None	None
Row 48	2686	3033	None	None
Row 49	2613	3033	None	None
Row 50	2629	3033	None	None
Row 51	2972	3033	None	None
Row 52	2893	3033	None	None
Row 53	2946	3033	None	None
Row 54	2740	3033	None	None
Row 55	2997	3033	None	None

Table 11 (continued) - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[1] (cpm)	# of Scan Alarms	Investigation Samples
Row 56	2884	3033	None	None
Row 57	3428	3535	None	None
Row 58	3028	3535	None	None
Row 59	3067	3535	None	None
Row 60	3100	3535	None	None
Row 61	2923	3535	None	None
Row 62	3233	3535	None	None
Row 63	3530	3535	None	None
Row 64	3397	3535	None	None
Row 65	3154	3535	None	None
Row 66	3286	3535	None	None
Row 67	3008	3535	None	None
Row 68	3126	3535	None	None
Row 69	3152	3535	None	None
Row 70	3092	3535	None	None
Row 71	3073	3535	None	None
Row 72	3116	3535	None	None
Row 73	2786	2888	None	None
Row 74	2649	2888	None	None
Row 75	2631	2888	None	None
Row 76	2621	2888	None	None
Row 77	2545	2888	None	None
Row 78	2578	2888	None	None
Row 79	2459	2888	None	None
Row 80	2443	2888	None	None
Row 81	2635	2888	None	None
Row 82	2427	2888	None	None
Row 83	2496	2888	None	None
Row 84	2404	2888	None	None
Row 85	2386	2888	None	None
Row 86	2408	2888	None	None
Row 87	2443	2888	None	None
Row 88	2513	2888	None	None
Row 89	2397	2888	None	None
Row 90	2520	2888	None	None
Row 91	2602	2888	None	None
Row 92	2396	2888	None	None
Row 93	2528	2888	None	None

Table 11 (continued) - Synopsis of Scan Results

Scan Area	Highest Logged Reading (cpm)	Action Level[(1)] (cpm)	# of Scan Alarms	Investigation Samples
Row 94	2372	2888	None	None
Row 95	2351	2888	None	None
Row 96	2501	2888	None	None
Row 97	2363	2888	None	None
Row 98	2411	2888	None	None
Row 99	2565	2888	None	None
Row 100	2405	2888	None	None

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

The seventeen (17) soil samples taken for non-parametric statistical testing and two (2) subsurface soil samples were analyzed using the on-site gamma spectroscopy system. Summaries of the sample analysis results are provided in Tables 12 and 13, respectively. The basic statistics for the systematic sample population are summarized in Table 19. The gamma spectroscopy results revealed four (4) samples with activity levels above MDC for Cs-137 and no samples with activity levels above the MDC for Co-60 or Cs-134. The concentration for Ni-63 and Sr-90 are inferred based on the maximum ratios as specified in Table 6. The mean of the gamma spectroscopic analysis results for the sample population indicated that Cs-137 was present at levels lower than the concentrations of Cs-137 expected to be found in off-site soil in the vicinity of the ZNPS as presented in Zion*Solutions* TSD 13-004, "*Examination of Cs-137 Global Fallout In Soils At Zion Station*" (Reference 15). The complete gamma spectroscopy reports are presented in Attachment 7.

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

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L1-10221F-FSGS-001-SS	5.54E-02	0.00E+00	0.00E+00	1.00E+01	0.00E+00
L1-10221F-FSGS-002-SS	8.73E-03	7.90E-03	4.26E-02	1.58E+00	8.52E-05
L1-10221F-FSGS-003-SS	4.05E-02	4.49E-03	**7.37E-02**	7.31E+00	1.47E-04
L1-10221F-FSGS-004-SS	9.36E-03	0.00E+00	6.32E-02	1.69E+00	1.26E-04
L1-10221F-FSGS-005-SS	6.63E-02	0.00E+00	**1.35E-01**	1.20E+01	2.70E-04
L1-10221F-FSGS-006-SS	4.10E-02	2.45E-03	4.72E-03	7.40E+00	9.44E-06
L1-10221F-FSGS-007-SS	0.00E+00	0.00E+00	2.14E-02	0.00E+00	4.28E-05
L1-10221F-FSGS-008-SS	2.72E-02	0.00E+00	3.77E-02	4.91E+00	7.54E-05

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

MEASUREMENT ID	Co-60[1] (pCi/g)	Cs-134[1] (pCi/g)	Cs-137[1] (pCi/g)	Ni-63[2] (pCi/g)	Sr-90[2] (pCi/g)
L1-10221F-FSGS-009-SS	3.28E-02	2.74E-02	3.73E-02	5.92E+00	7.46E-05
L1-10221F-FSGS-010-SS	2.23E-02	0.00E+00	**1.69E-01**	4.02E+00	3.38E-04
L1-10221F-FSGS-011-SS	4.36E-02	1.10E-02	**2.15E-01**	7.87E+00	4.30E-04
L1-10221F-FSGS-012-SS	5.90E-02	3.40E-03	5.24E-02	1.06E+01	1.05E-04
L1-10221F-FSGS-013-SS	0.00E+00	7.51E-03	2.89E-02	0.00E+00	5.78E-05
L1-10221F-FSGS-014-SS	2.35E-02	6.86E-03	4.01E-02	4.24E+00	8.02E-05
L1-10221F-FSGS-015-SS	1.51E-02	2.04E-02	2.26E-02	2.72E+00	4.52E-05
L1-10221F-FSGS-016-SS	0.00E+00	1.72E-02	7.13E-02	0.00E+00	1.43E-04
L1-10221F-FSGS-017-SS	2.39E-02	0.00E+00	4.70E-02	4.31E+00	9.40E-05

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

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

MEASUREMENT ID	Co-60[1] (pCi/g)	Cs-134[1] (pCi/g)	Cs-137[1] (pCi/g)	Ni-63[2] (pCi/g)	Sr-90[2] (pCi/g)
L1-10221F-FSGS-002-SB	1.26E-02	1.57E-02	0.00E+00	2.27E+00	0.00E+00
L1-10221F-FSGS-011-SB	1.93E-02	0.00E+00	5.10E-02	3.48E+00	1.02E-04

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

The off-site laboratory, Eberline Analytical, processed the two (2) samples selected for HTD ROC analysis as specified in the survey design. Samples L1-10221F-FSGS-005-SS and L1-10221F-FSGS-011-SS 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 of the samples, L1-10221F-FSGS-011-SS, at a concentration greater than MDC. Consequently, comparison of existing ratios verses the maximum ratios from Table 6 was not required. The results are provided in Table 14.

Table 14 - Off-Site Analysis Results

Sample # L1-10221F-FSGS-005-SS

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	7.40E-02	1.05E-01	1.29E-01	No
Cs-134	2.33E-02	5.14E-02	1.31E-01	No
Cs-137	2.04E-01	8.82E-02	2.56E-01	No
Ni-63	1.62E-01	1.20E+00	2.06E+00	No
Sr-90	1.29E-01	2.69E-01	5.62E-01	No

Table 14 (continued) - Off-Site Analysis Results

Sample # L1-10221F-FSGS-011-SS

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	6.41E-03	4.18E-02	6.52E-02	No
Cs-134	-1.48E-01	5.56E-02	4.92E-02	No
Cs-137	3.62E-01	7.98E-02	9.46E-02	Yes
Ni-63	-7.28E-01	1.18E+00	2.05E+00	No
Sr-90	8.45E-02	3.06E-01	6.46E-01	No

The implementation of survey specific QC measures included the collection of one (1) sample (L1-10221F-FQGS-004-SS) for "split sample" analysis. The on-site laboratory analyzed the designated QC sample using the on-site gamma spectroscopy system. Gamma spectroscopy results (summarized in Table 15) indicated that concentrations for Co-60, Cs-134 and Cs-137 were less than MDC in the sample. The concentration for Ni-63 and Sr-90 are inferred based on the maximum ratios as specified in Table 6.

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

MEASUREMENT ID	Co-60[(1)] (pCi/g)	Cs-134[(1)] (pCi/g)	Cs-137[(1)] (pCi/g)	Ni-63[(2)] (pCi/g)	Sr-90[(2)] (pCi/g)
L1-10221F-FQGS-004-SS	2.45E-02	2.43E-02	2.58E-02	4.42E+00	5.16E-05

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

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

Equation 6

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

Where: C_n = concentration of radionuclide n

$DCGL_n$ = DCGL of radionuclide n.

The results of the unity rule calculation for the ROC in the systematic sample population when compared against the OpDCGLs for surface soils for survey unit 10221F are provided in Table 16. The results of the unity rule calculation for the ROC for the subsurface samples are provided in Table 17 and the results for the QC sample are presented in Table 18.

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-10221F-FSGS-001-SS	5.08E-02	0.00E+00	0.00E+00	1.09E-02	0.00E+00	0.062
L1-10221F-FSGS-002-SS	8.00E-03	4.56E-03	1.17E-02	1.72E-03	2.75E-05	0.026
L1-10221F-FSGS-003-SS	3.71E-02	2.59E-03	2.03E-02	7.99E-03	4.76E-05	0.068
L1-10221F-FSGS-004-SS	8.58E-03	0.00E+00	1.74E-02	1.85E-03	4.08E-05	0.028
L1-10221F-FSGS-005-SS	6.08E-02	0.00E+00	3.72E-02	1.31E-02	8.72E-05	0.111
L1-10221F-FSGS-006-SS	3.76E-02	1.41E-03	1.30E-03	8.09E-03	3.05E-06	0.048
L1-10221F-FSGS-007-SS	0.00E+00	0.00E+00	5.90E-03	0.00E+00	1.38E-05	0.006
L1-10221F-FSGS-008-SS	2.49E-02	0.00E+00	1.04E-02	5.37E-03	2.44E-05	0.041
L1-10221F-FSGS-009-SS	3.01E-02	1.58E-02	1.03E-02	6.47E-03	2.41E-05	0.063
L1-10221F-FSGS-010-SS	2.04E-02	0.00E+00	4.66E-02	4.40E-03	1.09E-04	0.072
L1-10221F-FSGS-011-SS	4.00E-02	6.35E-03	5.92E-02	8.60E-03	1.39E-04	0.114
L1-10221F-FSGS-012-SS	5.41E-02	1.96E-03	1.44E-02	1.16E-02	3.39E-05	0.082
L1-10221F-FSGS-013-SS	0.00E+00	4.33E-03	7.96E-03	0.00E+00	1.87E-05	0.012
L1-10221F-FSGS-014-SS	2.15E-02	3.96E-03	1.10E-02	4.64E-03	2.59E-05	0.041
L1-10221F-FSGS-015-SS	1.38E-02	1.18E-02	6.23E-03	2.98E-03	1.46E-05	0.035
L1-10221F-FSGS-016-SS	0.00E+00	9.92E-03	1.96E-02	0.00E+00	4.61E-05	0.030
L1-10221F-FSGS-017-SS	2.19E-02	0.00E+00	1.29E-02	4.72E-03	3.04E-05	0.040

Systematic Measurements

Number of Systematic Measurements =	17
# of Systematic Measurements with OpSOF $\geq$ 1 =	0
# of Systematic Measurements with OpSOF > 0.1 (HTD Assessment) =	2
Max Individual Systematic Measurement OpSOF =	0.114
Mean Systematic Measurement OpSOF =	0.052

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

MEASUREMENT ID	Fraction of the OpDCGLs for Subsurface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-10221F-FSGS-002-SB	1.43E-02	1.38E-02	0.00E+00	1.16E-02	0.00E+00	0.040
L1-10221F-FSGS-011-SB	2.19E-02	0.00E+00	2.57E-02	1.78E-02	2.40E-04	0.066

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

MEASUREMENT ID	Fraction of the OpDCGLs for Surface Soils					OpSOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L1-10221F-FQGS-004-SS	2.25E-02	1.40E-02	7.11E-03	4.83E-03	1.67E-05	0.048

Table 19 - Basic Statistical Properties of Systematic Sample Population

ROC	Mean (pCi/g)	Median (pCi/g)	Max (pCi/g)	Min (pCi/g)	Std. Dev.	BcDCGL (pCi/g)	Avg. SOF per ROC	Avg. Dose Per ROC
Co-60	2.76E-02	2.39E-02	6.63E-02	0.00E+00	0.021	4.26	6.47E-03	1.62E-01
Cs-134	6.39E-03	3.40E-03	2.74E-02	0.00E+00	0.008	6.77	9.44E-04	2.36E-02
Cs-137	6.25E-02	4.26E-02	2.15E-01	0.00E+00	0.058	14.18	4.41E-03	1.10E-01
Ni-63	4.98E+00	4.31E+00	1.20E+01	0.00E+00	3.794	3572.1	1.39E-03	3.48E-02
Sr-90	1.25E-04	8.52E-05	4.30E-04	0.00E+00	0.000	12.09	1.03E-05	2.58E-04

The mean BcSOF for survey unit 10221F is 0.013 which equates to a dose of 0.331 mrem/yr TEDE.

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

8. QUALITY CONTROL

The on-site laboratory processed one (1) split sample, L1-10221F-FQGS-004-SS, using gamma spectroscopy analysis. The data was evaluated using acceptance criteria specified in Zion*Solutions* procedure ZS-LT-01. There was acceptable agreement between field split results. Refer to Attachment 5 for data and QC analysis results.

9. INVESTIGATIONS AND RESULTS

No investigations were performed in survey unit 10221F.

10. REMEDIATION AND RESULTS

No remediation was performed in this survey unit.

11. CHANGES FROM THE SURVEY PLAN

There were no addendums to the FSS plan.

12. DATA QUALITY ASSESSMENT

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

were consistent with the DQOs. The sampling design had adequate power as indicated by the Retrospective Power Curve.

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

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

The preliminary data review consisted of calculating basic statistical quantities (e.g., mean, median, standard deviation). All data was considered valid including negative values, zeros, values reported below the MDC, and values with uncertainties greater than two standard deviations. The mean and median values for each ROC were well below the respective Operational DCGLs. 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 120 m^2 of the survey unit (Rows 29-34) was not accessible for scanning due to standing water and ice being present in the area.

14. CONCLUSION

Survey unit 10221F has met the DQOs of the FSS plan. The ALARA criteria for soils as specified in Chapter 4 of the LTP were achieved. The EMC for soils was not needed for this survey unit and remediation was not required.

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

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

The mean B_CSOF, when the analytical results were compared to the B_CDCGLs, was 0.013, which results in a dose contribution from soil in survey unit 10221F of 0.331 mrem/yr 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 10221F is acceptable for unrestricted release.

15. REFERENCES

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

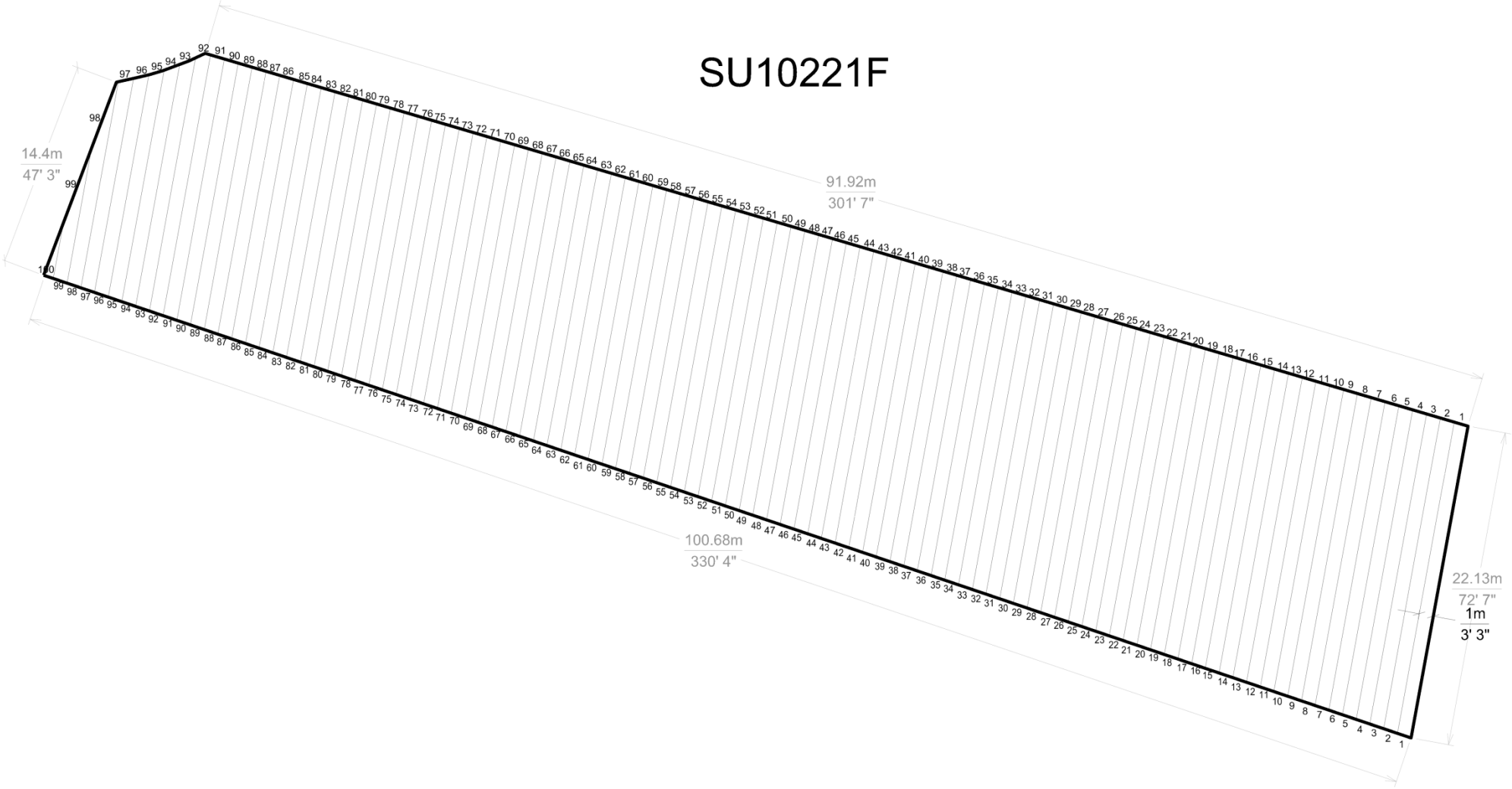
16. ATTACHMENTS

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

ATTACHMENT 1
FIGURE AND MAP

Survey Unit 10221F Final Status Survey Boundaries and Systematic Sample Points

Survey Unit 10221F Final Status Survey Scan Rows



ATTACHMENT 2
SCAN DATA

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result	Avg Background	Action Level	Scan Alarms
						(cpm)	(cpm)	(cpm)	
44-10	PR363452	304726	10221F	GS001	10/24/2018 10:12	2332	2060	2747	No
44-10	PR363452	304726	10221F	GS001	10/24/2018 10:15	2155	2060	2747	No
44-10	PR363452	304726	10221F	GS001	10/24/2018 10:17	2370	2060	2747	No
44-10	PR363452	304726	10221F	GS002	10/24/2018 10:21	2420	2060	2747	No
44-10	PR363452	304726	10221F	GS002	10/24/2018 10:23	1942	2060	2747	No
44-10	PR363452	304726	10221F	GS002	10/24/2018 10:26	2090	2060	2747	No
44-10	PR363452	304726	10221F	GS003	10/24/2018 10:32	2231	2060	2747	No
44-10	PR363452	304726	10221F	GS003	10/24/2018 10:34	1971	2060	2747	No
44-10	PR363452	304726	10221F	GS003	10/24/2018 10:36	2121	2060	2747	No
44-10	PR363452	304726	10221F	GS004	10/24/2018 12:35	2243	2060	2747	No
44-10	PR363452	304726	10221F	GS004	10/24/2018 12:37	2180	2060	2747	No
44-10	PR363452	304726	10221F	GS004	10/24/2018 12:40	2228	2060	2747	No
44-10	PR363452	304726	10221F	GS005	10/24/2018 12:43	2300	2060	2747	No
44-10	PR363452	304726	10221F	GS005	10/24/2018 12:46	2115	2060	2747	No
44-10	PR363452	304726	10221F	GS005	10/24/2018 12:48	2233	2060	2747	No
44-10	PR363452	304726	10221F	GS006	10/24/2018 12:51	2305	2060	2747	No
44-10	PR363452	304726	10221F	GS006	10/24/2018 12:54	2140	2060	2747	No
44-10	PR363452	304726	10221F	GS006	10/24/2018 12:56	2091	2060	2747	No
44-10	PR363452	304726	10221F	GS007	10/24/2018 13:00	2190	2060	2747	No
44-10	PR363452	304726	10221F	GS007	10/24/2018 13:03	2268	2060	2747	No
44-10	PR363452	304726	10221F	GS007	10/24/2018 13:05	2383	2060	2747	No
44-10	PR363452	304726	10221F	GS008	10/24/2018 13:09	2412	2060	2747	No
44-10	PR363452	304726	10221F	GS008	10/24/2018 13:13	2245	2060	2747	No
44-10	PR363452	304726	10221F	GS008	10/24/2018 13:15	2153	2060	2747	No
44-10	PR363452	304726	10221F	GS009	10/24/2018 13:19	2112	2060	2747	No
44-10	PR363452	304726	10221F	GS009	10/24/2018 13:22	2265	2060	2747	No
44-10	PR363452	304726	10221F	GS009	10/24/2018 13:24	2280	2060	2747	No
44-10	PR363452	304726	10221F	GS010	10/24/2018 13:33	2342	2060	2747	No
44-10	PR363452	304726	10221F	GS010	10/24/2018 13:36	2123	2060	2747	No
44-10	PR363452	304726	10221F	GS010	10/24/2018 13:38	2215	2060	2747	No
44-10	PR321892	304708	10221F	GS035	10/24/2018 10:12	2430	2307	3033	No
44-10	PR321892	304708	10221F	GS035	10/24/2018 10:14	2588	2307	3033	No
44-10	PR321892	304708	10221F	GS035	10/24/2018 10:16	2440	2307	3033	No
44-10	PR321892	304708	10221F	GS036	10/24/2018 10:18	2527	2307	3033	No
44-10	PR321892	304708	10221F	GS036	10/24/2018 10:20	2316	2307	3033	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result	Avg Background	Action Level	Scan Alarms
						(cpm)	(cpm)	(cpm)	
44-10	PR321892	304708	10221F	GS037	10/24/2018 10:23	2399	2307	3033	No
44-10	PR321892	304708	10221F	GS037	10/24/2018 10:25	2283	2307	3033	No
44-10	PR321892	304708	10221F	GS038	10/24/2018 10:27	2267	2307	3033	No
44-10	PR321892	304708	10221F	GS038	10/24/2018 10:29	2336	2307	3033	No
44-10	PR321892	304708	10221F	GS039	10/24/2018 10:31	2329	2307	3033	No
44-10	PR321892	304708	10221F	GS039	10/24/2018 10:33	2436	2307	3033	No
44-10	PR321892	304708	10221F	GS040	10/24/2018 10:35	2310	2307	3033	No
44-10	PR321892	304708	10221F	GS040	10/24/2018 10:37	2193	2307	3033	No
44-10	PR321892	304708	10221F	GS041	10/24/2018 12:17	2334	2307	3033	No
44-10	PR321892	304708	10221F	GS041	10/24/2018 12:20	2675	2307	3033	No
44-10	PR321892	304708	10221F	GS042	10/24/2018 12:22	2499	2307	3033	No
44-10	PR321892	304708	10221F	GS042	10/24/2018 12:24	2328	2307	3033	No
44-10	PR321892	304708	10221F	GS043	10/24/2018 12:27	2082	2307	3033	No
44-10	PR321892	304708	10221F	GS043	10/24/2018 12:30	2840	2307	3033	No
44-10	PR321892	304708	10221F	GS044	10/24/2018 12:32	2616	2307	3033	No
44-10	PR321892	304708	10221F	GS044	10/24/2018 12:34	2639	2307	3033	No
44-10	PR321892	304708	10221F	GS045	10/24/2018 12:36	2428	2307	3033	No
44-10	PR321892	304708	10221F	GS045	10/24/2018 12:38	2635	2307	3033	No
44-10	PR321892	304708	10221F	GS045	10/24/2018 12:40	2546	2307	3033	No
44-10	PR321892	304708	10221F	GS046	10/24/2018 12:42	2609	2307	3033	No
44-10	PR321892	304708	10221F	GS046	10/24/2018 12:46	2454	2307	3033	No
44-10	PR321892	304708	10221F	GS046	10/24/2018 12:49	2478	2307	3033	No
44-10	PR321892	304708	10221F	GS047	10/24/2018 12:51	2342	2307	3033	No
44-10	PR321892	304708	10221F	GS047	10/24/2018 12:53	2511	2307	3033	No
44-10	PR321892	304708	10221F	GS047	10/24/2018 12:55	2644	2307	3033	No
44-10	PR321892	304708	10221F	GS048	10/24/2018 12:57	2686	2307	3033	No
44-10	PR321892	304708	10221F	GS048	10/24/2018 12:59	2426	2307	3033	No
44-10	PR321892	304708	10221F	GS048	10/24/2018 13:02	2044	2307	3033	No
44-10	PR321892	304708	10221F	GS049	10/24/2018 13:04	2071	2307	3033	No
44-10	PR321892	304708	10221F	GS049	10/24/2018 13:06	2613	2307	3033	No
44-10	PR321892	304708	10221F	GS049	10/24/2018 13:08	2557	2307	3033	No
44-10	PR321892	304708	10221F	GS050	10/24/2018 13:10	2629	2307	3033	No
44-10	PR321892	304708	10221F	GS050	10/24/2018 13:12	2617	2307	3033	No
44-10	PR321892	304708	10221F	GS050	10/24/2018 13:14	2457	2307	3033	No
44-10	PR321892	304708	10221F	GS051	10/24/2018 13:16	2307	2307	3033	No
44-10	PR321892	304708	10221F	GS051	10/24/2018 13:18	2755	2307	3033	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result	Avg Background	Action Level	Scan Alarms
						(cpm)	(cpm)	(cpm)	
44-10	PR321892	304708	10221F	GS051	10/24/2018 13:20	2972	2307	3033	No
44-10	PR321892	304708	10221F	GS052	10/24/2018 13:22	2893	2307	3033	No
44-10	PR321892	304708	10221F	GS052	10/24/2018 13:24	2498	2307	3033	No
44-10	PR321892	304708	10221F	GS052	10/24/2018 13:27	2198	2307	3033	No
44-10	PR321892	304708	10221F	GS053	10/24/2018 13:29	2466	2307	3033	No
44-10	PR321892	304708	10221F	GS053	10/24/2018 13:31	2946	2307	3033	No
44-10	PR321892	304708	10221F	GS053	10/24/2018 13:33	2886	2307	3033	No
44-10	PR321892	304708	10221F	GS054	10/24/2018 13:37	2740	2307	3033	No
44-10	PR321892	304708	10221F	GS054	10/24/2018 13:40	2361	2307	3033	No
44-10	PR321892	304708	10221F	GS054	10/24/2018 13:42	2518	2307	3033	No
44-10	PR321892	304708	10221F	GS055	10/24/2018 13:44	2535	2307	3033	No
44-10	PR321892	304708	10221F	GS055	10/24/2018 13:46	2997	2307	3033	No
44-10	PR321892	304708	10221F	GS055	10/24/2018 13:51	2931	2307	3033	No
44-10	PR321892	304708	10221F	GS056	10/24/2018 14:00	2884	2307	3033	No
44-10	PR321892	304708	10221F	GS056	10/24/2018 14:02	2716	2307	3033	No
44-10	PR321902	304711	10221F	GS100	10/24/2018 9:48	2405	2182	2888	No
44-10	PR321902	304711	10221F	GS099	10/24/2018 9:50	2314	2182	2888	No
44-10	PR321902	304711	10221F	GS099	10/24/2018 9:52	2565	2182	2888	No
44-10	PR321902	304711	10221F	GS098	10/24/2018 9:54	2411	2182	2888	No
44-10	PR321902	304711	10221F	GS098	10/24/2018 9:56	2345	2182	2888	No
44-10	PR321902	304711	10221F	GS097	10/24/2018 9:58	2335	2182	2888	No
44-10	PR321902	304711	10221F	GS097	10/24/2018 10:00	2363	2182	2888	No
44-10	PR321902	304711	10221F	GS096	10/24/2018 10:03	2486	2182	2888	No
44-10	PR321902	304711	10221F	GS096	10/24/2018 10:06	2501	2182	2888	No
44-10	PR321902	304711	10221F	GS095	10/24/2018 10:08	2298	2182	2888	No
44-10	PR321902	304711	10221F	GS095	10/24/2018 10:11	2351	2182	2888	No
44-10	PR321902	304711	10221F	GS094	10/24/2018 10:13	2340	2182	2888	No
44-10	PR321902	304711	10221F	GS094	10/24/2018 10:16	2372	2182	2888	No
44-10	PR321902	304711	10221F	GS093	10/24/2018 10:18	2528	2182	2888	No
44-10	PR321902	304711	10221F	GS093	10/24/2018 10:20	2480	2182	2888	No
44-10	PR321902	304711	10221F	GS092	10/24/2018 10:23	2335	2182	2888	No
44-10	PR321902	304711	10221F	GS092	10/24/2018 10:25	2396	2182	2888	No
44-10	PR321902	304711	10221F	GS091	10/24/2018 10:27	2602	2182	2888	No
44-10	PR321902	304711	10221F	GS091	10/24/2018 10:30	2437	2182	2888	No
44-10	PR321902	304711	10221F	GS090	10/24/2018 12:22	2520	2182	2888	No
44-10	PR321902	304711	10221F	GS090	10/24/2018 12:24	2517	2182	2888	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result	Avg Background	Action Level	Scan Alarms
						(cpm)	(cpm)	(cpm)	
44-10	PR321902	304711	10221F	GS089	10/24/2018 12:26	2355	2182	2888	No
44-10	PR321902	304711	10221F	GS089	10/24/2018 12:28	2397	2182	2888	No
44-10	PR321902	304711	10221F	GS088	10/24/2018 12:30	2513	2182	2888	No
44-10	PR321902	304711	10221F	GS088	10/24/2018 12:32	2328	2182	2888	No
44-10	PR321902	304711	10221F	GS087	10/24/2018 12:35	2325	2182	2888	No
44-10	PR321902	304711	10221F	GS087	10/24/2018 12:37	2443	2182	2888	No
44-10	PR321902	304711	10221F	GS086	10/24/2018 12:39	2298	2182	2888	No
44-10	PR321902	304711	10221F	GS086	10/24/2018 12:42	2408	2182	2888	No
44-10	PR321902	304711	10221F	GS085	10/24/2018 12:47	2386	2182	2888	No
44-10	PR321902	304711	10221F	GS085	10/24/2018 12:49	2233	2182	2888	No
44-10	PR321902	304711	10221F	GS084	10/24/2018 12:51	2404	2182	2888	No
44-10	PR321902	304711	10221F	GS084	10/24/2018 12:53	2401	2182	2888	No
44-10	PR321902	304711	10221F	GS083	10/24/2018 12:55	2496	2182	2888	No
44-10	PR321902	304711	10221F	GS083	10/24/2018 12:58	2395	2182	2888	No
44-10	PR321902	304711	10221F	GS082	10/24/2018 13:00	2350	2182	2888	No
44-10	PR321902	304711	10221F	GS082	10/24/2018 13:02	2427	2182	2888	No
44-10	PR321902	304711	10221F	GS081	10/24/2018 13:05	2376	2182	2888	No
44-10	PR321902	304711	10221F	GS081	10/24/2018 13:08	2635	2182	2888	No
44-10	PR321902	304711	10221F	GS080	10/24/2018 13:10	2443	2182	2888	No
44-10	PR321902	304711	10221F	GS080	10/24/2018 13:12	2438	2182	2888	No
44-10	PR321902	304711	10221F	GS079	10/24/2018 13:15	2459	2182	2888	No
44-10	PR321902	304711	10221F	GS079	10/24/2018 13:17	2372	2182	2888	No
44-10	PR321902	304711	10221F	GS078	10/24/2018 13:19	2578	2182	2888	No
44-10	PR321902	304711	10221F	GS078	10/24/2018 13:21	2492	2182	2888	No
44-10	PR321902	304711	10221F	GS077	10/24/2018 13:34	2320	2182	2888	No
44-10	PR321902	304711	10221F	GS077	10/24/2018 13:37	2545	2182	2888	No
44-10	PR321902	304711	10221F	GS076	10/24/2018 13:40	2621	2182	2888	No
44-10	PR321902	304711	10221F	GS076	10/24/2018 13:43	2534	2182	2888	No
44-10	PR321902	304711	10221F	GS075	10/24/2018 13:50	2438	2182	2888	No
44-10	PR321902	304711	10221F	GS075	10/24/2018 13:53	2631	2182	2888	No
44-10	PR321902	304711	10221F	GS074	10/24/2018 13:55	2649	2182	2888	No
44-10	PR321902	304711	10221F	GS074	10/24/2018 13:58	2475	2182	2888	No
44-10	PR321902	304711	10221F	GS073	10/24/2018 14:00	2531	2182	2888	No
44-10	PR321902	304711	10221F	GS073	10/24/2018 14:02	2786	2182	2888	No
44-10	PR363452	304726	10221F	GS011	10/25/2018 8:05	2280	2071	2759	No
44-10	PR363452	304726	10221F	GS011	10/25/2018 8:08	2331	2071	2759	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	10221F	GS011	10/25/2018 8:11	2298	2071	2759	No
44-10	PR363452	304726	10221F	GS012	10/25/2018 8:16	2252	2071	2759	No
44-10	PR363452	304726	10221F	GS012	10/25/2018 8:18	2256	2071	2759	No
44-10	PR363452	304726	10221F	GS012	10/25/2018 8:21	2445	2071	2759	No
44-10	PR363452	304726	10221F	GS013	10/25/2018 8:25	2364	2071	2759	No
44-10	PR363452	304726	10221F	GS013	10/25/2018 8:28	2344	2071	2759	No
44-10	PR363452	304726	10221F	GS013	10/25/2018 8:30	2372	2071	2759	No
44-10	PR363452	304726	10221F	GS014	10/25/2018 8:34	2535	2071	2759	No
44-10	PR363452	304726	10221F	GS014	10/25/2018 8:36	2209	2071	2759	No
44-10	PR363452	304726	10221F	GS014	10/25/2018 8:39	2529	2071	2759	No
44-10	PR363452	304726	10221F	GS015	10/25/2018 8:43	2397	2071	2759	No
44-10	PR363452	304726	10221F	GS015	10/25/2018 8:46	2366	2071	2759	No
44-10	PR363452	304726	10221F	GS015	10/25/2018 8:48	2732	2071	2759	No
44-10	PR363452	304726	10221F	GS016	10/25/2018 8:54	2700	2071	2759	No
44-10	PR363452	304726	10221F	GS016	10/25/2018 8:56	2296	2071	2759	No
44-10	PR363452	304726	10221F	GS016	10/25/2018 8:58	2514	2071	2759	No
44-10	PR363452	304726	10221F	GS017	10/25/2018 9:36	2508	2071	2759	No
44-10	PR363452	304726	10221F	GS017	10/25/2018 9:39	2337	2071	2759	No
44-10	PR363452	304726	10221F	GS017	10/25/2018 9:45	2712	2071	2759	No
44-10	PR321892	304708	10221F	GS028	10/25/2018 8:09	2254	2107	2801	No
44-10	PR321892	304708	10221F	GS028	10/25/2018 8:11	2560	2107	2801	No
44-10	PR321892	304708	10221F	GS028	10/25/2018 8:13	2266	2107	2801	No
44-10	PR321892	304708	10221F	GS027	10/25/2018 8:15	2518	2107	2801	No
44-10	PR321892	304708	10221F	GS027	10/25/2018 8:17	2375	2107	2801	No
44-10	PR321892	304708	10221F	GS027	10/25/2018 8:20	2033	2107	2801	No
44-10	PR321892	304708	10221F	GS026	10/25/2018 8:22	2418	2107	2801	No
44-10	PR321892	304708	10221F	GS026	10/25/2018 8:24	2351	2107	2801	No
44-10	PR321892	304708	10221F	GS026	10/25/2018 8:26	2400	2107	2801	No
44-10	PR321892	304708	10221F	GS025	10/25/2018 8:28	2351	2107	2801	No
44-10	PR321892	304708	10221F	GS025	10/25/2018 8:30	2518	2107	2801	No
44-10	PR321892	304708	10221F	GS025	10/25/2018 8:32	2326	2107	2801	No
44-10	PR321892	304708	10221F	GS024	10/25/2018 8:34	2387	2107	2801	No
44-10	PR321892	304708	10221F	GS024	10/25/2018 8:36	2731	2107	2801	No
44-10	PR321892	304708	10221F	GS024	10/25/2018 8:38	2442	2107	2801	No
44-10	PR321892	304708	10221F	GS023	10/25/2018 8:40	2586	2107	2801	No
44-10	PR321892	304708	10221F	GS023	10/25/2018 8:43	2518	2107	2801	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result	Avg Background	Action Level	Scan Alarms
						(cpm)	(cpm)	(cpm)	
44-10	PR321892	304708	10221F	GS023	10/25/2018 8:45	2618	2107	2801	No
44-10	PR321892	304708	10221F	GS022	10/25/2018 8:47	2555	2107	2801	No
44-10	PR321892	304708	10221F	GS022	10/25/2018 8:49	2316	2107	2801	No
44-10	PR321892	304708	10221F	GS022	10/25/2018 8:51	2590	2107	2801	No
44-10	PR321892	304708	10221F	GS021	10/25/2018 8:53	2499	2107	2801	No
44-10	PR321892	304708	10221F	GS021	10/25/2018 8:55	2313	2107	2801	No
44-10	PR321892	304708	10221F	GS021	10/25/2018 8:57	2315	2107	2801	No
44-10	PR321892	304708	10221F	GS020	10/25/2018 9:32	2546	2107	2801	No
44-10	PR321892	304708	10221F	GS020	10/25/2018 9:34	2391	2107	2801	No
44-10	PR321892	304708	10221F	GS020	10/25/2018 9:36	2761	2107	2801	No
44-10	PR321892	304708	10221F	GS019	10/25/2018 9:38	2618	2107	2801	No
44-10	PR321892	304708	10221F	GS019	10/25/2018 9:40	2681	2107	2801	No
44-10	PR321892	304708	10221F	GS019	10/25/2018 9:43	2513	2107	2801	No
44-10	PR321892	304708	10221F	GS018	10/25/2018 9:45	2530	2107	2801	No
44-10	PR321892	304708	10221F	GS018	10/25/2018 9:48	2594	2107	2801	No
44-10	PR321892	304708	10221F	GS018	10/25/2018 9:51	2612	2107	2801	No
44-10	PR321902	304711	10221F	GS072	10/25/2018 8:07	3116	2743	3535	No
44-10	PR321902	304711	10221F	GS072	10/25/2018 8:10	2656	2743	3535	No
44-10	PR321902	304711	10221F	GS071	10/25/2018 8:12	2501	2743	3535	No
44-10	PR321902	304711	10221F	GS071	10/25/2018 8:14	3073	2743	3535	No
44-10	PR321902	304711	10221F	GS070	10/25/2018 8:16	3092	2743	3535	No
44-10	PR321902	304711	10221F	GS070	10/25/2018 8:18	2595	2743	3535	No
44-10	PR321902	304711	10221F	GS069	10/25/2018 8:21	2645	2743	3535	No
44-10	PR321902	304711	10221F	GS069	10/25/2018 8:23	3152	2743	3535	No
44-10	PR321902	304711	10221F	GS068	10/25/2018 8:25	3126	2743	3535	No
44-10	PR321902	304711	10221F	GS068	10/25/2018 8:27	2803	2743	3535	No
44-10	PR321902	304711	10221F	GS067	10/25/2018 8:29	2767	2743	3535	No
44-10	PR321902	304711	10221F	GS067	10/25/2018 8:31	3008	2743	3535	No
44-10	PR321902	304711	10221F	GS066	10/25/2018 8:34	3286	2743	3535	No
44-10	PR321902	304711	10221F	GS066	10/25/2018 8:37	2832	2743	3535	No
44-10	PR321902	304711	10221F	GS065	10/25/2018 8:39	2509	2743	3535	No
44-10	PR321902	304711	10221F	GS065	10/25/2018 8:41	3154	2743	3535	No
44-10	PR321902	304711	10221F	GS064	10/25/2018 8:44	3397	2743	3535	No
44-10	PR321902	304711	10221F	GS064	10/25/2018 8:46	2680	2743	3535	No
44-10	PR321902	304711	10221F	GS063	10/25/2018 8:48	2588	2743	3535	No
44-10	PR321902	304711	10221F	GS063	10/25/2018 8:50	3530	2743	3535	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result	Avg Background	Action Level	Scan Alarms
						(cpm)	(cpm)	(cpm)	
44-10	PR321902	304711	10221F	GS062	10/25/2018 8:53	3233	2743	3535	No
44-10	PR321902	304711	10221F	GS062	10/25/2018 8:55	2920	2743	3535	No
44-10	PR321902	304711	10221F	GS061	10/25/2018 9:34	2390	2743	3535	No
44-10	PR321902	304711	10221F	GS061	10/25/2018 9:36	2923	2743	3535	No
44-10	PR321902	304711	10221F	GS060	10/25/2018 9:38	3100	2743	3535	No
44-10	PR321902	304711	10221F	GS060	10/25/2018 9:40	2999	2743	3535	No
44-10	PR321902	304711	10221F	GS059	10/25/2018 9:42	3030	2743	3535	No
44-10	PR321902	304711	10221F	GS059	10/25/2018 9:45	3067	2743	3535	No
44-10	PR321902	304711	10221F	GS058	10/25/2018 9:47	3028	2743	3535	No
44-10	PR321902	304711	10221F	GS058	10/25/2018 9:50	2979	2743	3535	No
44-10	PR321902	304711	10221F	GS057	10/25/2018 9:51	2763	2743	3535	No
44-10	PR321902	304711	10221F	GS057	10/25/2018 9:54	3428	2743	3535	No
44-10	PR316938	293136	10221F	GS036	12/18/2018 9:38	2217	1994	2669	No
44-10	PR316938	293136	10221F	GS036	12/18/2018 9:41	2120	1994	2669	No
44-10	PR316938	293136	10221F	GS036	12/18/2018 9:44	2137	1994	2669	No
44-10	PR316938	293136	10221F	GS037	12/18/2018 9:47	2214	1994	2669	No
44-10	PR316938	293136	10221F	GS037	12/18/2018 9:50	2280	1994	2669	No
44-10	PR316938	293136	10221F	GS037	12/18/2018 9:53	2251	1994	2669	No
44-10	PR316938	293136	10221F	GS038	12/18/2018 9:56	2230	1994	2669	No
44-10	PR316938	293136	10221F	GS038	12/18/2018 9:59	2383	1994	2669	No
44-10	PR316938	293136	10221F	GS038	12/18/2018 10:02	2363	1994	2669	No
44-10	PR316938	293136	10221F	GS039	12/18/2018 10:05	2185	1994	2669	No
44-10	PR316938	293136	10221F	GS039	12/18/2018 10:08	2452	1994	2669	No
44-10	PR316938	293136	10221F	GS039	12/18/2018 10:11	2267	1994	2669	No
44-10	PR316938	293136	10221F	GS040	12/18/2018 10:14	2321	1994	2669	No
44-10	PR316938	293136	10221F	GS040	12/18/2018 10:17	2327	1994	2669	No
44-10	PR316938	293136	10221F	GS040	12/18/2018 10:20	2307	1994	2669	No
44-10	PR316938	293136	10221F	GS041	12/18/2018 10:23	2358	1994	2669	No
44-10	PR316938	293136	10221F	GS041	12/18/2018 10:26	2264	1994	2669	No
44-10	PR316938	293136	10221F	GS041	12/18/2018 10:29	2174	1994	2669	No
44-10	PR316938	293136	10221F	GS042	12/18/2018 12:40	2243	1994	2669	No
44-10	PR316938	293136	10221F	GS042	12/18/2018 12:43	2166	1994	2669	No
44-10	PR316938	293136	10221F	GS042	12/18/2018 12:46	2230	1994	2669	No
44-10	PR316938	293136	10221F	GS043	12/18/2018 12:49	2306	1994	2669	No
44-10	PR316938	293136	10221F	GS043	12/18/2018 12:52	2213	1994	2669	No
44-10	PR316938	293136	10221F	GS043	12/18/2018 12:55	2192	1994	2669	No

Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR316938	293136	10221F	GS044	12/18/2018 12:58	2283	1994	2669	No
44-10	PR316938	293136	10221F	GS044	12/18/2018 13:01	2195	1994	2669	No
44-10	PR316938	293136	10221F	GS044	12/18/2018 13:04	2206	1994	2669	No

ATTACHMENT 3

CONSULTATION TRIGGERS FOR RESIDENTIAL AND COMMERCIAL/INDUSTRIAL SOIL CONTAMINATION

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

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

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

ATTACHMENT 4
SIGN TEST

Attachment 12
Sign Statistical Test

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

Survey Area: No. 10200 **Description:** Radiological Restricted Area Grounds
Survey Unit: No. 10221F **Description:** South of Protected Area - Lakeshore
Classification: 1 **Type I (α) Error:** 0.05 **Number of Samples:** 17

#	Fraction of the Release Criterion						Weighted Sum (W_s)	1-W_s	Sign
	Radionuclides of Concern					Activity or SOF			
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	(as applicable)			
1	5.08E-02	0.00E+00	0.00E+00	1.09E-02	0.00E+00	SOF	0.062	0.938	+
2	8.00E-03	4.56E-03	1.17E-02	1.72E-03	2.75E-05	SOF	0.026	0.974	+
3	3.71E-02	2.59E-03	2.03E-02	7.99E-03	4.76E-05	SOF	0.068	0.932	+
4	8.58E-03	0.00E+00	1.74E-02	1.85E-03	4.08E-05	SOF	0.028	0.972	+
5	6.08E-02	0.00E+00	3.72E-02	1.31E-02	8.72E-05	SOF	0.111	0.889	+
6	3.76E-02	1.41E-03	1.30E-03	8.09E-03	3.05E-06	SOF	0.048	0.952	+
7	0.00E+00	0.00E+00	5.90E-03	0.00E+00	1.38E-05	SOF	0.006	0.994	+
8	2.49E-02	0.00E+00	1.04E-02	5.37E-03	2.44E-05	SOF	0.041	0.959	+
9	3.01E-02	1.58E-02	1.03E-02	6.47E-03	2.41E-05	SOF	0.063	0.937	+
10	2.04E-02	0.00E+00	4.66E-02	4.40E-03	1.09E-04	SOF	0.072	0.928	+
11	4.00E-02	6.35E-03	5.92E-02	8.60E-03	1.39E-04	SOF	0.114	0.886	+
12	5.41E-02	1.96E-03	1.44E-02	1.16E-02	3.39E-05	SOF	0.082	0.918	+
13	0.00E+00	4.33E-03	7.96E-03	0.00E+00	1.87E-05	SOF	0.012	0.988	+
14	2.15E-02	3.96E-03	1.10E-02	4.64E-03	2.59E-05	SOF	0.041	0.959	+
15	1.38E-02	1.18E-02	6.23E-03	2.98E-03	1.46E-05	SOF	0.035	0.965	+
16	0.00E+00	9.92E-03	1.96E-02	0.00E+00	4.61E-05	SOF	0.030	0.970	+
17	2.19E-02	0.00E+00	1.29E-02	4.72E-03	3.04E-05	SOF	0.040	0.960	+

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

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

Prepared By (RE): R. J. Mandia (Print Name) / (Signature) 2-12-19 (Date)

Peer Reviewed By (RE): T. Graham (Print Name) (Signature) 2/12/2019 (Date)

ATTACHMENT 5
QC SAMPLE ASSESSMENT

Duplicate Sample Assessment Form

Survey Area #: 10200	Survey Unit # 10221F	Survey Unit Name: South of Protected Area - Lakeshore
Sample Plan#: L1-10221F-F		

Sample Description: Comparison of split samples collected from surface soil sample location #4 and analyzed using gamma spectroscopy by on-site HpGe system. The standard sample was L1-10210A-FSGS-004SS, the comparison sample was L1-10210A-FQGS-004SS.

	STANDARD				COMPARISON			
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)
K-40	7.05E+00	5.55E-01	12.70	0.6 - 1.66	6.56E+00	4.93E-01	1.07	Y

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

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

Resolution	Agreement Range
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
>200	0.85 - 1.18

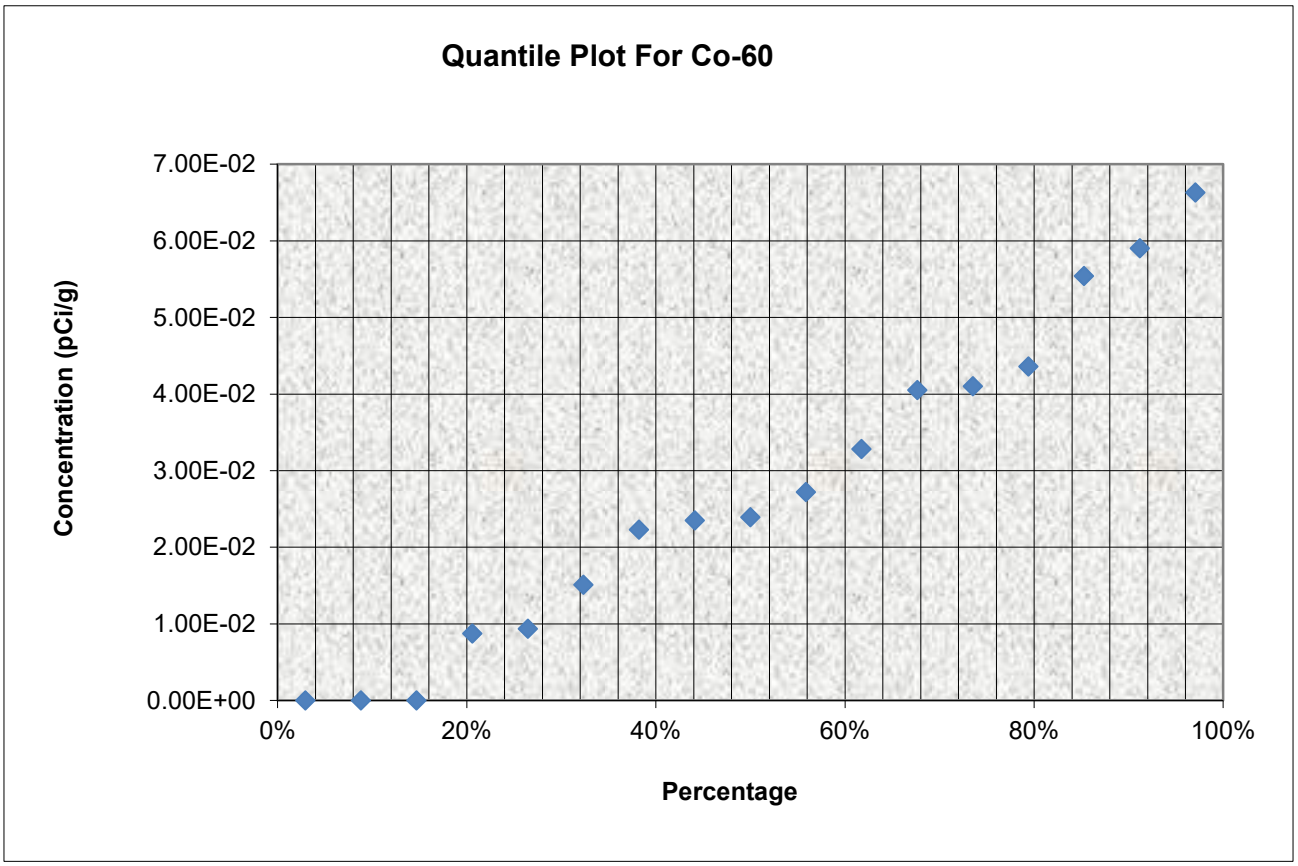
Performed by: R.S. Mandis	Date: 2-12-19	Reveiwed by: J Graham	Date: 2/12/2019

ATTACHMENT 6
GRAPHICAL PRESENTATIONS

Posting Plot

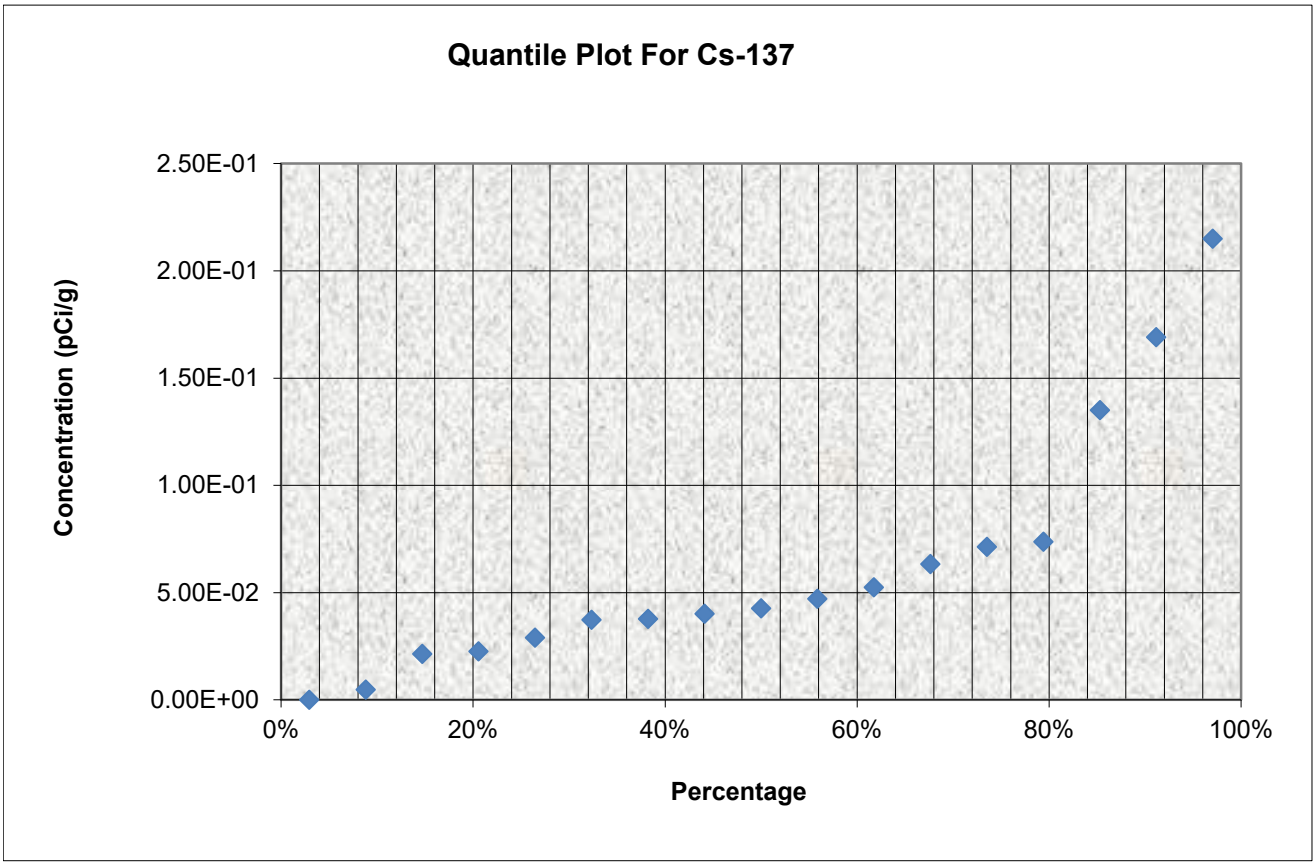
QUANTILE PLOT FOR Co-60

Survey Unit: 10221F
Survey Unit Name: South of Protected Area - Lakeshore
Mean: 2.76E-02 pCi/g



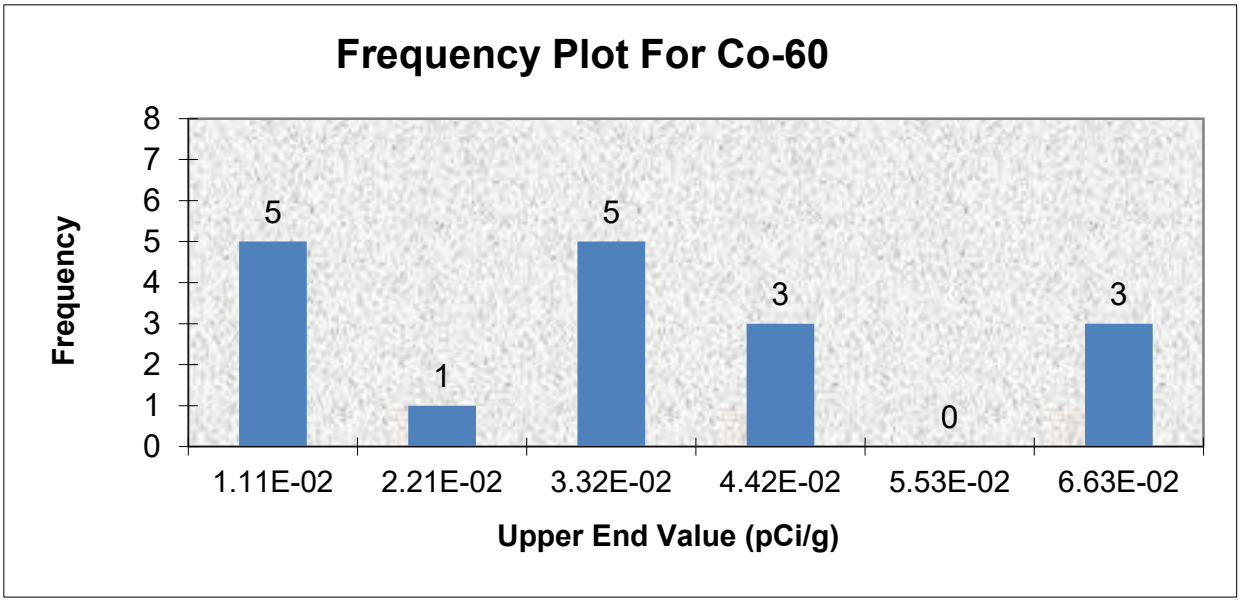
QUANTILE PLOT FOR Cs-137

Survey Unit: 10221F
Survey Unit Name: South of Protected Area - Lakeshore
Mean: 6.25E-02 pCi/g



HISTOGRAM FOR Co-60

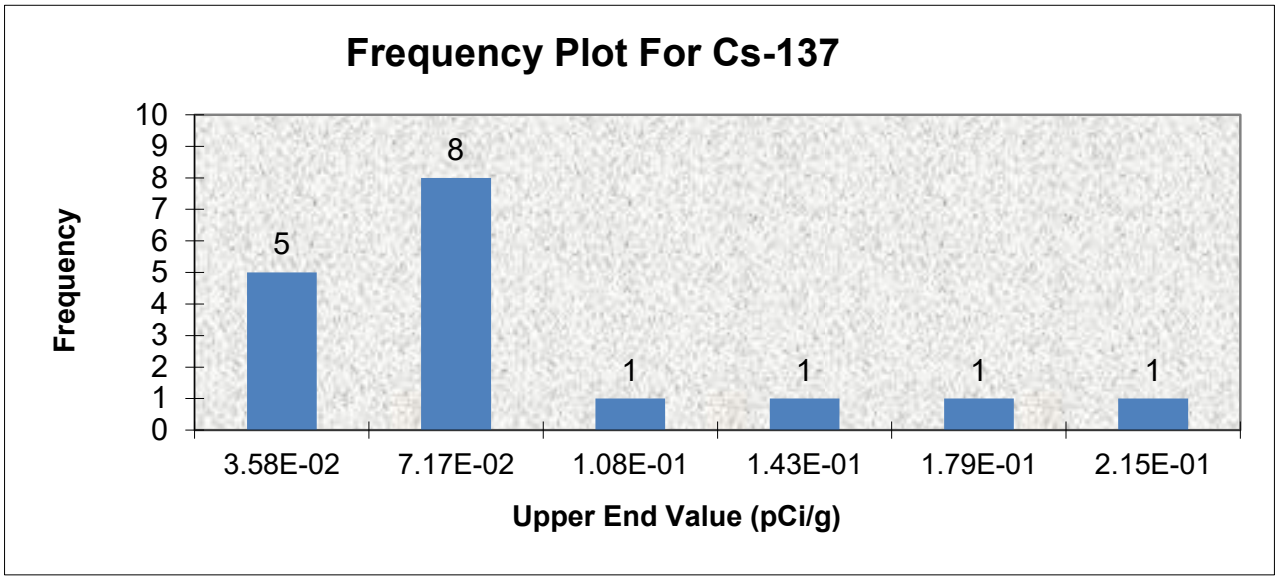
Survey Unit: 10221F
Survey Unit Name: South of Protected Area - Lakeshore
Mean: 2.76E-02 pCi/g
Median: 2.39E-02 pCi/g
ST DEV: 0.021
Skew: 0.318



Upper Value	Observation Frequency	Observation %
1.11E-02	5	29%
2.21E-02	1	6%
3.32E-02	5	29%
4.42E-02	3	18%
5.53E-02	0	0%
6.63E-02	3	18%
TOTAL	17	100%

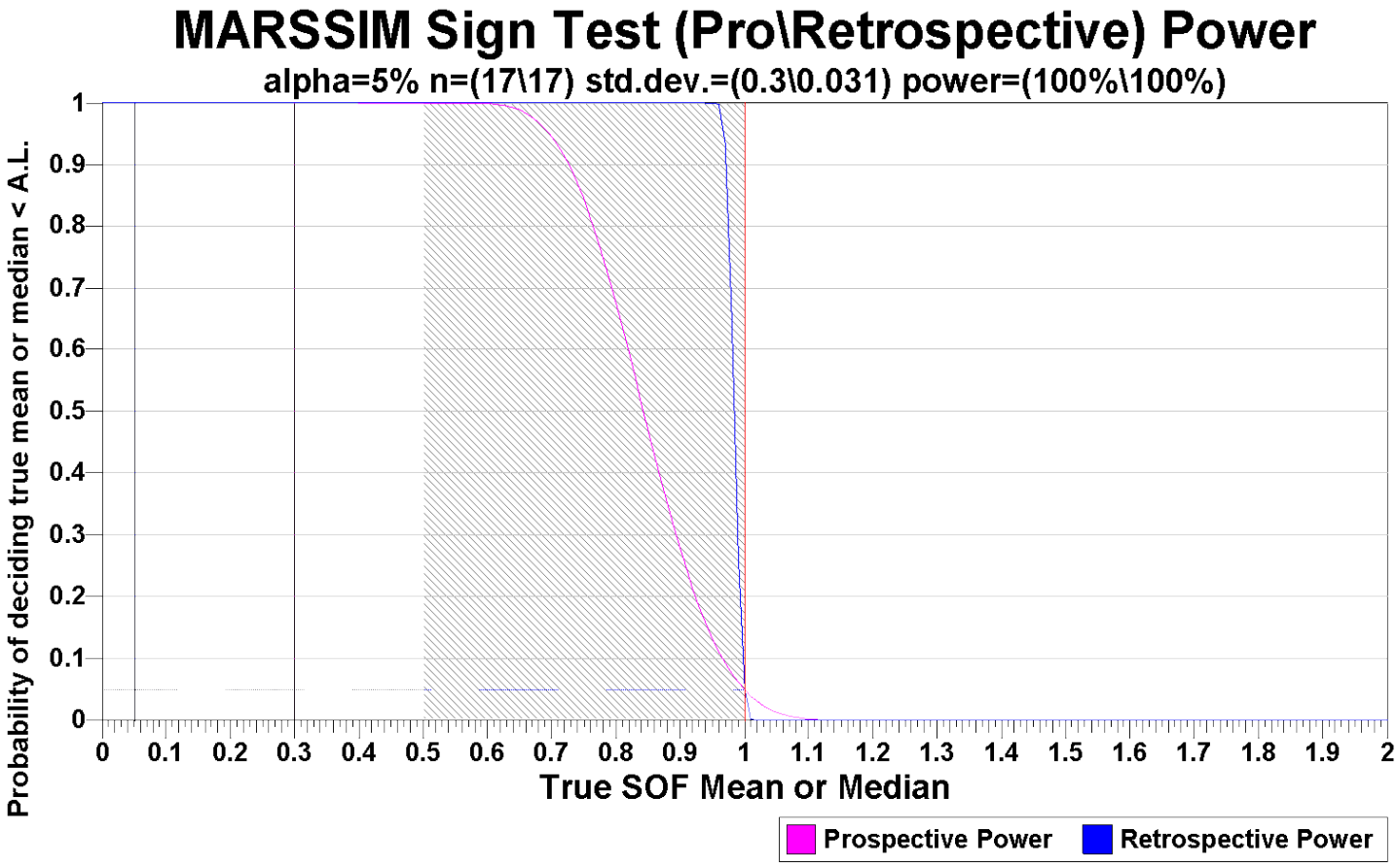
HISTOGRAM FOR Cs-137

Survey Unit: 10221F
Survey Unit Name: South of Protected Area - Lakeshore
Mean: 6.25E-02 pCi/g
Median: 4.26E-02 pCi/g
ST DEV: 0.058
Skew: 1.609



Upper Value	Observation Frequency	Observation %
3.58E-02	5	29%
7.17E-02	8	47%
1.08E-01	1	6%
1.43E-01	1	6%
1.79E-01	1	6%
2.15E-01	1	6%
TOTAL	17	100%

Prospective and Retrospective Power Curves for Survey Unit 10221F



ATTACHMENT 7
SAMPLE ANALYTICAL REPORTS

Apex-Gamma

Analysis Report for 31-Oct-18-10038

L1-10221F-FSGS-001SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10038
Sample Description	: L1-10221F-FSGS-001SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.118E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 2:30:00PM
Acquisition Started	: 10/31/2018 12:10:31PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 10/15/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61591
Fill Height	: 1117.67 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

J.P. McCall 10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 12:25:37PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

J Graham

Analysis Report for 31-Oct-18-10038

L1-10221F-FSGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.88	739 -	749	743.39	3.31E+01	11.11	3.79E+01	0.91
2	238.67	947 -	961	954.25	1.43E+02	18.37	6.74E+01	0.94
3	352.00	1397 -	1415	1407.00	1.27E+02	14.10	2.11E+01	0.72
4	583.06	2325 -	2337	2330.36	4.13E+01	8.20	9.75E+00	1.27
5	609.34	2427 -	2443	2435.40	8.02E+01	10.98	1.28E+01	0.49
6	968.66	3866 -	3878	3872.03	3.82E+01	6.58	1.81E+00	0.95
7	1460.36	5827 -	5851	5839.39	2.78E+02	17.42	6.25E+00	1.63

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.82	*	10.66	7.01E+00	5.35E-01
Tl-208	0.99	583.19	*	85.00	6.88E-02	1.43E-02
Bi-211	0.87	351.07	*	13.02	9.59E-01	1.32E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.47E-01	3.75E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.58E-01	3.85E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 31-Oct-18-10038

L1-10221F-FSGS-001SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	3.51E-01	4.80E-02
		785.96		1.06		
Ra-226	0.98	186.21	*	3.64	5.99E-01	2.07E-01
Ac-228	0.31	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		
		964.77		4.99		
		968.97	*	15.80	4.88E-01	8.69E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.81E-02	1.32E-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 31-Oct-18-10038

L1-10221F-FSGS-001SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.967	7.01E+00	5.35E-01	
	Tl-208	0.997	6.88E-02	1.43E-02	
?	Bi-211	0.871	9.59E-01	1.32E-01	
	Pb-212	1.000	2.47E-01	3.75E-02	
	Bi-214	1.000	2.58E-01	3.85E-02	
?	Pb-214	0.512	3.51E-01	4.80E-02	
?	Ra-226	0.982	5.99E-01	2.07E-01	
	Ac-228	0.311	4.88E-01	8.69E-02	
?	~~U-235~~ Ra-224	~~0.997~~	~~3.81E-02~~	~~1.32E-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

10/31-18

U-235 only 1 Peak

Analysis Report for 31-Oct-18-10038

L1-10221F-FSGS-001SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 12:25:37PM
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	7.73E-02	6.88E-02	6.88E-02
	BE-7	477.60		10.44	2.59E-01	4.72E-01	4.72E-01
+	K-40	1460.82	*	10.66	7.01E+00	5.08E-01	5.08E-01
	Co-60	1173.23		99.85	5.54E-02	5.07E-02	6.73E-02
		1332.49		99.98	-3.69E-02		5.07E-02
	Nb-94	702.65		99.81	-6.88E-03	4.35E-02	4.35E-02
		871.09		99.89	7.01E-03		4.46E-02
	Ag-108m	79.13		6.60	-2.26E-01	4.02E-02	1.19E+00
		433.94		90.50	1.19E-02		4.02E-02
		614.28		89.80	-4.05E-02		6.99E-02
		722.94		90.80	-4.38E-02		5.52E-02
	Sb-125	176.31		6.84	1.46E-01	1.34E-01	4.56E-01
		380.45		1.52	2.11E+00		2.47E+00
		427.87		29.60	-3.72E-02		1.34E-01
		463.36		10.49	1.11E-01		3.95E-01
		600.60		17.65	1.46E-02		2.21E-01
		606.71		4.98	-4.75E-02		1.56E+00
		635.95		11.22	1.50E-01		3.68E-01
		671.44		1.79	-3.44E-01		2.56E+00

Analysis Report for 31-Oct-18-10038

L1-10221F-FSGS-001SS

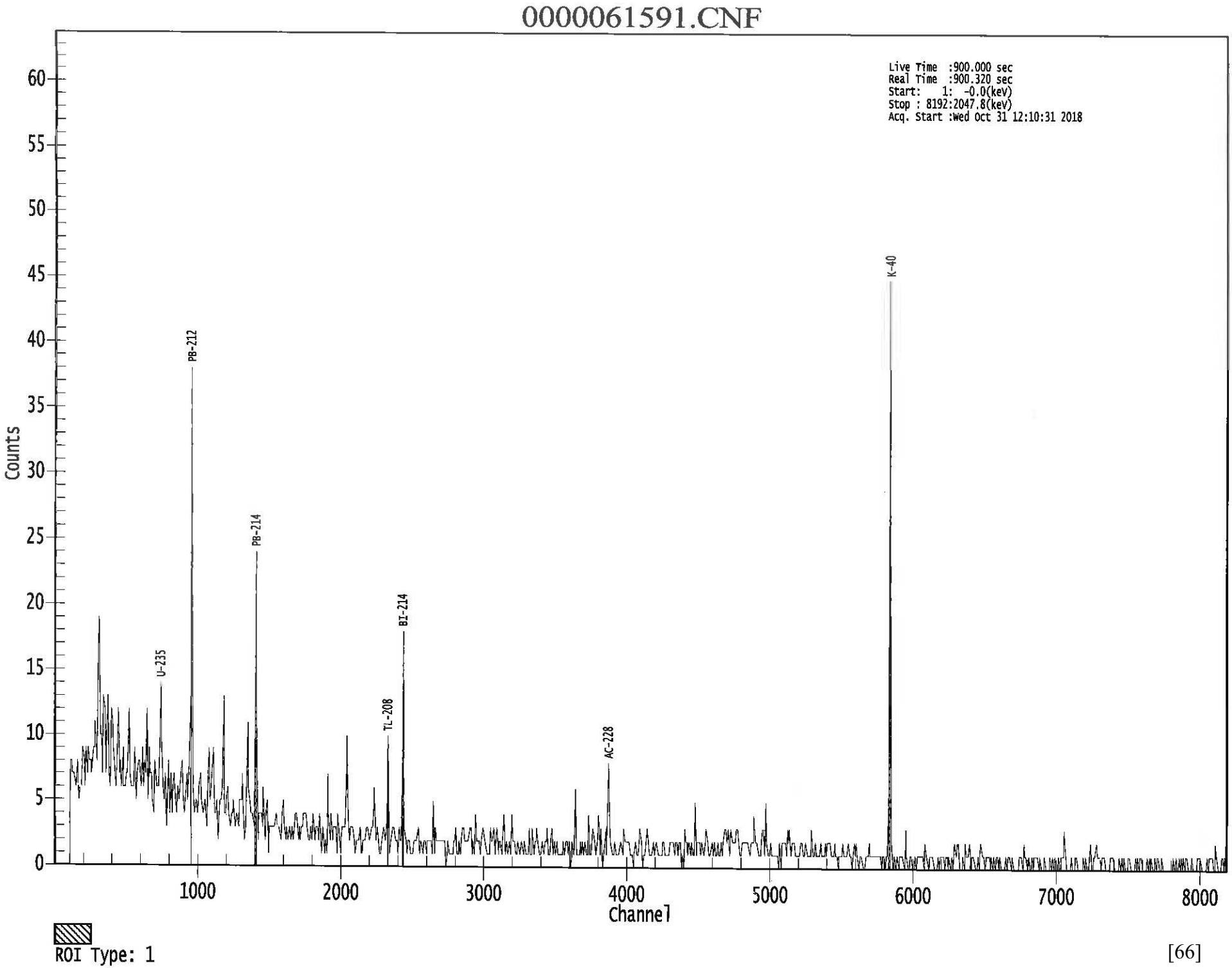
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	6.10E-01	7.67E-02	2.90E+00
	81.00	32.90	-2.40E-01		1.88E-01
	276.40	7.16	4.39E-01		5.25E-01
	302.85	18.34	1.86E-01		2.09E-01
	356.01	62.05	-1.51E-02		7.67E-02
	383.85	8.94	4.95E-02		4.33E-01
Cs-134	475.36	1.48	1.79E+00	5.15E-02	3.10E+00
	563.25	8.34	8.73E-02		5.73E-01
	569.33	15.37	-1.58E-01		2.45E-01
	604.72	97.62	-1.03E-02		6.31E-02
	795.86	85.46	-2.02E-02		5.15E-02
	801.95	8.69	-1.77E-01		4.87E-01
	1038.61	0.99	5.38E-01		5.78E+00
	1167.97	1.79	-2.55E+00		3.52E+00
	1365.19	3.02	2.29E-02		1.72E+00
Cs-137	661.66	85.10	-1.24E-02	5.91E-02	5.91E-02
Eu-152	121.78	28.67	4.65E-02	1.17E-01	1.17E-01
	244.70	7.61	2.61E-01		4.93E-01
	295.94	0.45	5.27E+00		1.05E+01
	344.28	26.60	1.01E-01		1.45E-01
	367.79	0.86	-1.84E+00		4.01E+00
	411.12	2.24	2.87E-01		1.62E+00
	443.96	2.83	-1.71E-01		1.24E+00
	488.68	0.42	-1.34E+00		1.00E+01
	563.99	0.49	-8.70E+00		8.47E+00
	586.26	0.46	-3.41E+00		1.33E+01
	678.62	0.47	5.08E+00		9.45E+00
	688.67	0.86	1.49E+00		3.62E+00
	719.35	0.28	-3.60E+00		1.74E+01
	778.90	12.96	-1.78E-01		3.40E-01
	810.45	0.32	-5.42E+00		1.38E+01
	867.37	4.26	-7.66E-01		9.68E-01
	919.33	0.43	-2.81E+00		1.06E+01
	964.08	14.65	-1.73E-01		5.59E-01
	1085.87	10.24	-5.09E-01		4.96E-01
	1089.74	1.73	2.03E+00		3.21E+00
	1112.07	13.69	4.46E-02		4.03E-01
	1212.95	1.43	-6.99E-01		5.09E+00
	1249.94	0.19	1.19E+01		3.53E+01
	1299.14	1.63	-3.22E-01		4.00E+00
	1408.01	21.07	-1.09E-02		2.04E-01
	1457.64	0.50	1.53E+02		4.52E+01
	1528.10	0.28	-7.64E+00		1.54E+01
Eu-154	123.07	40.40	-5.18E-02	7.84E-02	7.84E-02
	247.93	6.89	4.44E-02		4.44E-01
	591.76	4.95	7.17E-01		8.94E-01
	692.42	1.78	-1.57E+00		1.99E+00
	723.30	20.06	-5.76E-02		2.54E-01
	756.80	4.52	-1.60E+00		8.75E-01
	873.18	12.08	7.92E-02		3.95E-01
	996.29	10.48	3.51E-01		6.07E-01

Analysis Report for 31-Oct-18-10038

L1-10221F-FSGS-001SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	1.79E-01	7.84E-02	2.80E-01
		1274.43		34.80	-1.87E-03		1.50E-01
		1596.48		1.80	1.61E+00		2.90E+00
	Eu-155	45.30		1.31	3.09E-01	1.95E-01	1.06E+01
		60.01		1.22	-5.95E-01		1.28E+01
		86.55		30.70	1.91E-01		2.01E-01
		105.31		21.10	-2.31E-02		1.95E-01
+	Ra-226	186.21	*	3.64	5.99E-01	6.36E-01	6.36E-01
	Pa-231	27.36		10.30	4.06E-01	1.28E+00	1.28E+00
		283.69		1.70	-5.62E-01		1.90E+00
		300.07		2.47	-3.92E+00		1.52E+00
		302.65		2.20	1.87E+00		1.76E+00
		330.06		1.40	4.04E-01		2.86E+00
+	U-235	143.76		10.96	-8.22E-02	4.05E-02	3.18E-01
		163.33		5.08	1.30E-01		6.58E-01
		185.71	*	57.20	3.81E-02		4.05E-02
		202.11		1.08	4.53E-01		3.09E+00
		205.31		5.01	-2.63E-01		6.24E-01
	Am-241	59.54		35.90	-1.46E-01	4.43E-01	4.43E-01

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


0000061591.CNF
Live Time :900.000 sec
Real Time :900.320 sec
Start: 1: -0.0(kev)
Stop : 8192:2047.8(kev)
Acq. Start :Wed Oct 31 12:10:31 2018
Counts
Channel
U-235
PB-212
PB-214
TL-208
BI-214
AC-228
K-40
ROI Type: 1

[66]

Apex-Gamma

Analysis Report for 31-Oct-18-10039

L1-10221F-FSGS-002SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10039
Sample Description	: L1-10221F-FSGS-002SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.232E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 2:33:00PM
Acquisition Started	: 10/31/2018 12:10:39PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61592
Fill Height	: 1232.03 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 12:25:56PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

JGraham

Analysis Report for 31-Oct-18-10039

L1-10221F-FSGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.70	949 -	961	955.26	1.42E+02	16.72	5.11E+01	1.06
2	295.21	1171 -	1188	1181.08	5.87E+01	13.06	3.33E+01	1.14
3	338.09	1345 -	1357	1352.41	3.67E+01	10.05	2.43E+01	0.44
4	351.90	1400 -	1414	1407.59	1.07E+02	13.08	2.25E+01	1.15
5	582.99	2325 -	2336	2331.28	5.05E+01	9.58	1.65E+01	0.76
6	609.21	2429 -	2444	2436.10	5.39E+01	11.26	2.41E+01	1.15
7	910.94	3636 -	3650	3642.81	3.68E+01	7.58	7.19E+00	1.27
8	969.08	3870 -	3881	3875.39	2.27E+01	5.66	3.33E+00	0.85
9	1460.59	5831 -	5852	5842.74	1.89E+02	14.80	8.12E+00	2.07

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	4.25E+00	3.80E-01
Tl-208	0.99	583.19	*	85.00	7.67E-02	1.53E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.33E-01	3.33E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.57E-01	3.42E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 31-Oct-18-10039

L1-10221F-FSGS-002SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.57E-01	6.08E-02
		351.93	*	35.60	2.73E-01	4.01E-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	2.89E-01	8.26E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.48E-01	5.22E-02
		964.77		4.99		
		968.97	*	15.80	2.60E-01	6.60E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 31-Oct-18-10039

L1-10221F-FSGS-002SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.992	4.25E+00	3.80E-01	
	Tl-208	0.994	7.67E-02	1.53E-02	
X	Bi-211	0.896			
	Pb-212	0.999	2.33E-01	3.33E-02	
	Bi-214	0.999	1.57E-01	3.42E-02	
	Pb-214	1.000	2.69E-01	3.35E-02	
	Ac-228	0.995	2.60E-01	3.67E-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 31-Oct-18-10039

L1-10221F-FSGS-002SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 12:25:56PM
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	4.18E-02	5.83E-02	5.83E-02
	BE-7	477.60		10.44	-8.57E-02	4.67E-01	4.67E-01
+	K-40	1460.82	*	10.66	4.25E+00	4.84E-01	4.84E-01
	Co-60	1173.23		99.85	7.00E-03	4.37E-02	5.44E-02
		1332.49		99.98	8.73E-03		4.37E-02
	Nb-94	702.65		99.81	-3.56E-02	3.48E-02	3.48E-02
		871.09		99.89	7.03E-04		4.45E-02
	Ag-108m	79.13		6.60	3.49E-01	4.49E-02	1.58E+00
		433.94		90.50	1.32E-02		4.49E-02
		614.28		89.80	-2.92E-02		7.31E-02
		722.94		90.80	2.84E-03		5.45E-02
	Sb-125	176.31		6.84	-8.44E-02	1.21E-01	4.78E-01
		380.45		1.52	-7.16E-01		2.33E+00
		427.87		29.60	1.07E-02		1.21E-01
		463.36		10.49	3.12E-01		3.86E-01
		600.60		17.65	-1.87E-03		2.18E-01
		606.71		4.98	1.68E+00		1.38E+00
		635.95		11.22	4.35E-01		4.07E-01
		671.44		1.79	8.40E-01		2.49E+00

Analysis Report for 31-Oct-18-10039

L1-10221F-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	1.82E+00	8.11E-02	3.75E+00
	81.00	32.90	-6.58E-01		2.35E-01
	276.40	7.16	-2.67E-01		5.15E-01
	302.85	18.34	8.41E-02		2.12E-01
	356.01	62.05	-4.32E-02		8.11E-02
	383.85	8.94	-7.06E-02		4.15E-01
Cs-134	475.36	1.48	1.15E+00	4.74E-02	3.04E+00
	563.25	8.34	3.73E-01		5.05E-01
	569.33	15.37	-1.02E-01		2.46E-01
	604.72	97.62	7.90E-03		6.42E-02
	795.86	85.46	-4.21E-02		4.74E-02
	801.95	8.69	-3.49E-01		5.46E-01
	1038.61	0.99	-1.56E+00		4.69E+00
	1167.97	1.79	-2.54E-01		3.15E+00
	1365.19	3.02	8.59E-01		1.76E+00
Cs-137	661.66	85.10	4.26E-02	5.96E-02	5.96E-02
Eu-152	121.78	28.67	-4.56E-02	1.27E-01	1.27E-01
	244.70	7.61	1.20E-01		5.26E-01
	295.94	0.45	1.95E+00		1.04E+01
	344.28	26.60	-2.62E-02		1.36E-01
	367.79	0.86	-1.72E-01		3.64E+00
	411.12	2.24	8.55E-01		1.65E+00
	443.96	2.83	-6.96E-01		1.28E+00
	488.68	0.42	-2.51E+00		9.57E+00
	563.99	0.49	7.65E+00		8.54E+00
	586.26	0.46	1.33E+01		1.37E+01
	678.62	0.47	-3.03E-01		8.28E+00
	688.67	0.86	2.48E+00		4.59E+00
	719.35	0.28	5.03E+00		1.46E+01
	778.90	12.96	-3.62E-01		3.19E-01
	810.45	0.32	1.34E+00		1.55E+01
	867.37	4.26	-8.29E-01		1.12E+00
	919.33	0.43	-8.46E+00		1.19E+01
	964.08	14.65	-2.51E-01		4.75E-01
	1085.87	10.24	4.75E-02		4.85E-01
	1089.74	1.73	-3.05E-02		3.10E+00
	1112.07	13.69	-6.94E-01		3.68E-01
	1212.95	1.43	-7.84E-01		4.30E+00
	1249.94	0.19	2.61E+01		2.94E+01
	1299.14	1.63	-5.61E+00		3.22E+00
	1408.01	21.07	1.33E-02		2.38E-01
	1457.64	0.50	9.43E+01		3.43E+01
	1528.10	0.28	-3.04E+00		1.20E+01
Eu-154	123.07	40.40	-1.32E-02	9.06E-02	9.06E-02
	247.93	6.89	-1.60E-01		4.73E-01
	591.76	4.95	4.78E-01		8.13E-01
	692.42	1.78	2.31E-01		2.15E+00
	723.30	20.06	-7.65E-02		2.44E-01
	756.80	4.52	-1.12E-02		1.02E+00
	873.18	12.08	3.25E-01		4.08E-01
	996.29	10.48	1.66E-01		4.48E-01

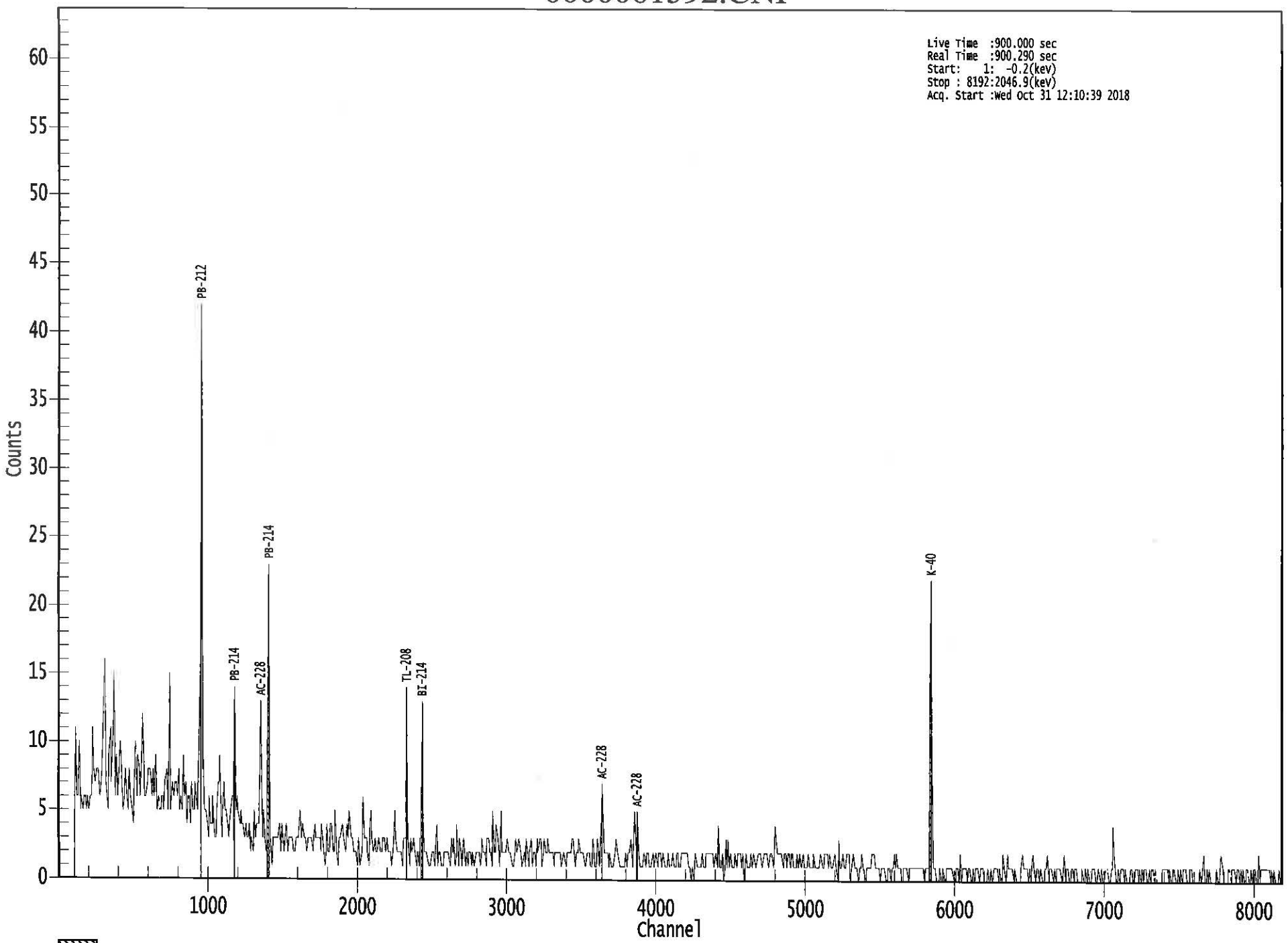
Analysis Report for 31-Oct-18-10039

L1-10221F-FSGS-002SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	4.01E-02	9.06E-02	2.67E-01
	1274.43	34.80	7.03E-02		1.68E-01
	1596.48	1.80	-1.88E+00		2.22E+00
Eu-155	45.30	1.31	7.93E+00	2.08E-01	2.01E+01
	60.01	1.22	-1.37E+01		2.11E+01
	86.55	30.70	1.57E-01		2.29E-01
	105.31	21.10	7.09E-03		2.08E-01
Ra-226	186.21	3.64	2.35E-01	1.08E+00	1.08E+00
Pa-231	27.36	10.30	1.86E+00	1.68E+00	2.30E+00
	283.69	1.70	-2.09E+00		1.89E+00
	300.07	2.47	3.55E-01		1.68E+00
	302.65	2.20	5.11E-01		1.77E+00
	330.06	1.40	2.09E-01		2.75E+00
U-235	143.76	10.96	-8.08E-02	6.84E-02	3.40E-01
	163.33	5.08	-1.53E-01		6.62E-01
	185.71	57.20	2.59E-02		6.84E-02
	202.11	1.08	-1.88E+00		3.17E+00
	205.31	5.01	-2.08E-01		6.95E-01
Am-241	59.54	35.90	-1.35E-01	7.64E-01	7.64E-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

0000061592.CNF



[74]

Apex-Gamma

Analysis Report for 31-Oct-18-10040

L1-10221F-FSGS-003SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10040
Sample Description	: L1-10221F-FSGS-003SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.092E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 2:36:00PM
Acquisition Started	: 10/31/2018 12:44:03PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61593
Fill Height	: 1091.50 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

J.P. Nichols 10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 12:59:06PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 11/1/18 1300

J. Graham

Analysis Report for 31-Oct-18-10040

L1-10221F-FSGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.62	472 -	481	477.41	1.39E+02	19.50	1.03E+02	1.04
2	295.11	587 -	594	590.29	5.39E+01	11.34	3.71E+01	1.03
3	352.05	700 -	708	704.05	8.34E+01	13.68	4.86E+01	1.13
4	477.74	951 -	958	955.21	3.41E+01	8.95	2.29E+01	1.11
5	583.15	1161 -	1171	1165.90	5.76E+01	9.96	1.74E+01	1.46
6	609.35	1213 -	1223	1218.27	7.80E+01	10.66	1.50E+01	1.63
7	661.73	1317 -	1328	1323.00	4.73E+01	10.24	2.27E+01	1.07
8	910.95	1818 -	1826	1821.35	3.70E+01	8.06	1.30E+01	1.36
9	969.28	1933 -	1941	1938.02	1.89E+01	7.25	1.41E+01	0.98
10	1460.64	2914 -	2927	2921.34	2.80E+02	17.15	5.27E+00	1.75
11	1763.77	3525 -	3532	3528.38	1.31E+01	3.85	8.57E-01	0.69

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	3.76E-01	1.02E-01
K-40	0.99	1460.82	*	10.66	5.95E+00	4.47E-01
Cs-137	0.99	661.66	*	85.10	7.37E-02	1.66E-02
Tl-208	1.00	583.19	*	85.00	8.25E-02	1.51E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.12E-01	3.45E-02

Analysis Report for 31-Oct-18-10040

L1-10221F-FSGS-003SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb-212	1.00	300.09		3.30		
Bi-214	0.98	609.32	*	45.49	2.15E-01	3.21E-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	2.25E-01	6.66E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.22E-01	4.99E-02
		351.93	*	35.60	2.01E-01	3.68E-02
		785.96		1.06		
Ac-228	0.99	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.36E-01	5.24E-02
		964.77		4.99		
		968.97	*	15.80	2.05E-01	7.92E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 31-Oct-18-10040

L1-10221F-FSGS-003SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.997	3.76E-01	1.02E-01	
	K-40	0.995	5.95E+00	4.47E-01	
	Cs-137	0.999	7.37E-02	1.66E-02	
	Tl-208	1.000	8.25E-02	1.51E-02	
X	Bi-211	0.857			
	Pb-212	1.000	2.12E-01	3.45E-02	
	Bi-214	0.988	2.17E-01	2.89E-02	
	Pb-214	0.998	2.08E-01	2.96E-02	
	Ac-228	0.994	2.26E-01	4.37E-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 31-Oct-18-10040

L1-10221F-FSGS-003SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 12:59:05PM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	9.28E-02	6.54E-02	6.54E-02
+	BE-7	477.60	*	10.44	3.76E-01	2.86E-01	2.86E-01
+	K-40	1460.82	*	10.66	5.95E+00	3.36E-01	3.36E-01
	Co-60	1173.23		99.85	4.05E-02	4.27E-02	6.33E-02
		1332.49		99.98	8.48E-03		4.27E-02
	Nb-94	702.65		99.81	-1.17E-02	3.79E-02	4.15E-02
		871.09		99.89	-7.03E-03		3.79E-02
	Ag-108m	79.13		6.60	1.50E+00	3.78E-02	1.28E+00
		433.94		90.50	-1.70E-02		3.78E-02
		614.28		89.80	-1.65E-02		5.67E-02
		722.94		90.80	1.67E-02		5.32E-02
	Sb-125	176.31		6.84	-1.01E-01	1.16E-01	4.96E-01
		380.45		1.52	4.22E-01		2.48E+00
		427.87		29.60	5.25E-02		1.16E-01
		463.36		10.49	-1.82E-02		3.78E-01
		600.60		17.65	6.02E-02		2.38E-01
		606.71		4.98	-2.53E-01		1.33E+00
		635.95		11.22	2.01E-01		3.84E-01
		671.44		1.79	-1.27E+00		2.16E+00

Analysis Report for 31-Oct-18-10040

L1-10221F-FSGS-003SS

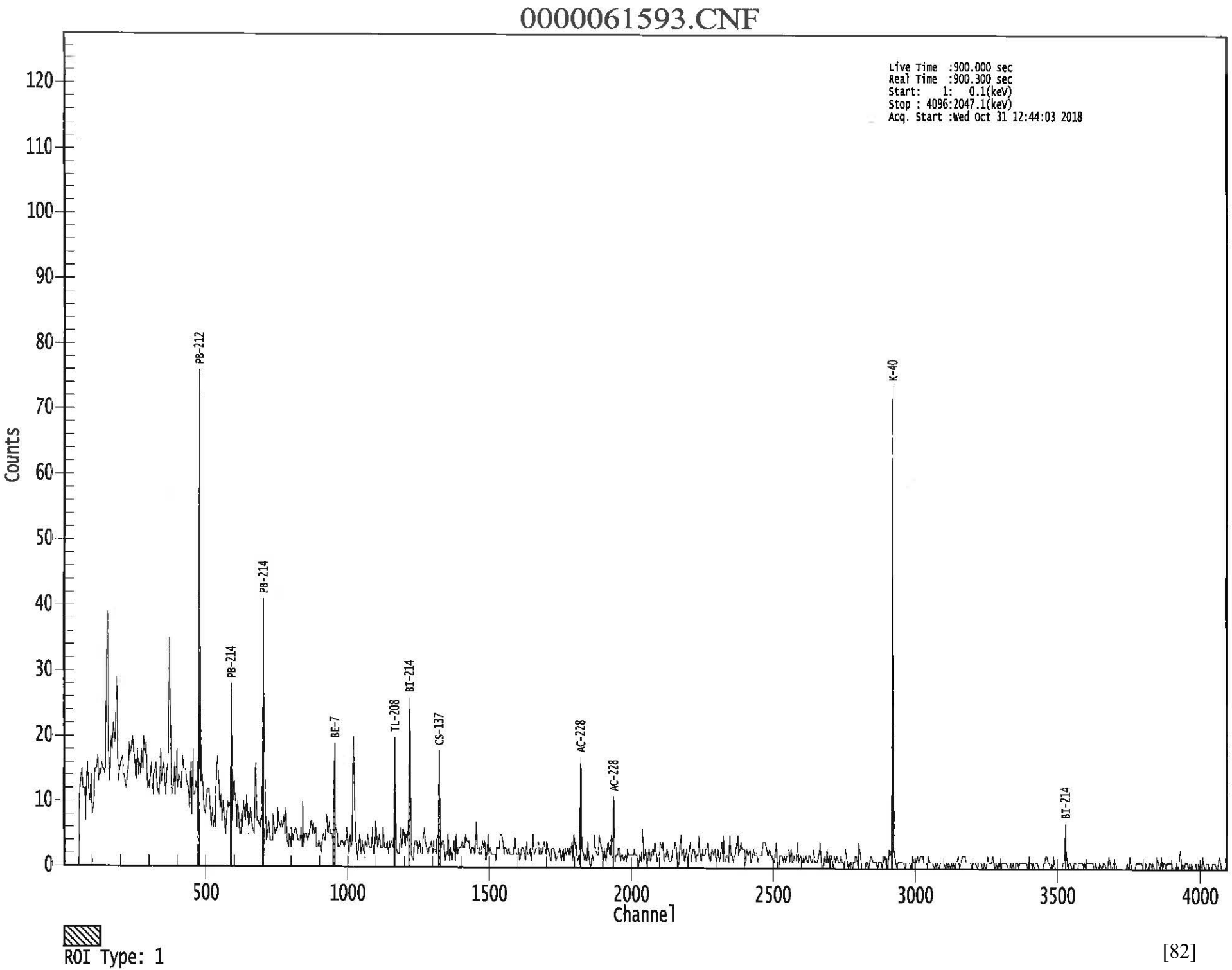
	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	1.40E+00	7.87E-02	2.90E+00
		81.00		32.90	-3.49E-01		1.79E-01
		276.40		7.16	-6.41E-02		5.15E-01
		302.85		18.34	7.41E-02		2.08E-01
		356.01		62.05	-5.88E-02		7.87E-02
		383.85		8.94	-2.10E-01		3.87E-01
	Cs-134	475.36		1.48	9.98E-03	5.15E-02	3.43E+00
		563.25		8.34	-1.04E-01		4.25E-01
		569.33		15.37	0.00E+00		2.42E-01
		604.72		97.62	-2.50E-02		5.71E-02
		795.86		85.46	4.49E-03		5.15E-02
		801.95		8.69	-9.46E-02		4.43E-01
		1038.61		0.99	1.18E+00		5.31E+00
		1167.97		1.79	2.69E-01		3.31E+00
		1365.19		3.02	5.39E-01		1.58E+00
+	Cs-137	661.66	*	85.10	7.37E-02	4.46E-02	4.46E-02
	Eu-152	121.78		28.67	-2.62E-02	1.13E-01	1.13E-01
		244.70		7.61	-5.30E-02		5.02E-01
		295.94		0.45	8.00E-01		9.16E+00
		344.28		26.60	-1.47E-01		1.27E-01
		367.79		0.86	5.12E-01		3.89E+00
		411.12		2.24	6.25E-01		1.57E+00
		443.96		2.83	-1.77E-01		1.24E+00
		488.68		0.42	7.09E-01		8.76E+00
		563.99		0.49	-2.65E+00		7.29E+00
		586.26		0.46	-2.59E+00		1.27E+01
		678.62		0.47	2.68E+00		7.95E+00
		688.67		0.86	1.51E+00		4.34E+00
		719.35		0.28	-7.42E+00		1.42E+01
		778.90		12.96	-9.87E-02		3.18E-01
		810.45		0.32	-3.09E+00		1.18E+01
		867.37		4.26	-1.01E-01		9.08E-01
		919.33		0.43	-2.88E+00		9.21E+00
		964.08		14.65	-1.25E-03		4.01E-01
		1085.87		10.24	-2.52E-01		4.39E-01
		1089.74		1.73	1.93E+00		2.93E+00
		1112.07		13.69	-3.54E-01		3.55E-01
		1212.95		1.43	-3.82E-01		3.61E+00
		1249.94		0.19	-1.68E+01		2.72E+01
		1299.14		1.63	1.64E+00		3.25E+00
		1408.01		21.07	-7.92E-02		1.31E-01
		1457.64		0.50	-1.35E+00		3.83E+01
		1528.10		0.28	-2.08E-01		1.50E+01
	Eu-154	123.07		40.40	3.35E-02	8.34E-02	8.34E-02
		247.93		6.89	-1.88E-01		4.88E-01
		591.76		4.95	-1.31E-01		7.78E-01
		692.42		1.78	8.61E-01		2.28E+00
		723.30		20.06	8.54E-02		2.44E-01
		756.80		4.52	-2.68E-01		7.82E-01
		873.18		12.08	2.15E-01		3.29E-01
		996.29		10.48	-1.31E-02		4.32E-01

Analysis Report for 31-Oct-18-10040

L1-10221F-FSGS-003SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-2.02E-02	8.34E-02	2.43E-01
	1274.43	34.80	-1.09E-02		1.44E-01
	1596.48	1.80	1.01E-01		2.11E+00
Eu-155	45.30	1.31	-6.55E+00	1.74E-01	1.11E+01
	60.01	1.22	9.49E-01		1.29E+01
	86.55	30.70	-4.66E-02		1.74E-01
	105.31	21.10	7.92E-02		1.82E-01
Ra-226	186.21	3.64	1.27E+00	1.21E+00	1.21E+00
Pa-231	27.36	10.30	7.25E-01	1.13E+00	1.13E+00
	283.69	1.70	1.96E-01		1.81E+00
	300.07	2.47	-6.65E-01		1.44E+00
	302.65	2.20	6.17E-01		1.73E+00
	330.06	1.40	4.18E-01		2.55E+00
U-235	143.76	10.96	-1.63E-02	7.66E-02	2.84E-01
	163.33	5.08	3.36E-01		7.22E-01
	185.71	57.20	6.64E-02		7.66E-02
	202.11	1.08	6.83E-01		3.27E+00
	205.31	5.01	-4.16E-01		6.75E-01
Am-241	59.54	35.90	1.19E-01	4.63E-01	4.63E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
\> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level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Live Time :900.000 sec
Real Time :900.300 sec
Start: 1: 0.1(keV)
Stop : 4096:2047.1(keV)
Acq. Start :Wed Oct 31 12:44:03 2018
Counts
Channel
PB-212
PB-214
PB-214
BE-7
TL-208
BI-214
CS-137
AC-228
AC-228
K-40
BI-214
ROI Type: 1

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Apex-Gamma

Analysis Report for 31-Oct-18-10041

L1-10221F-FSGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10041
Sample Description	: L1-10221F-FSGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.029E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 2:39:00PM
Acquisition Started	: 10/31/2018 12:44:09PM
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	: 0.14 %
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	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61594
Fill Height	: 1028.62 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 12:59:13PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

J Graham

Analysis Report for 31-Oct-18-10041

L1-10221F-FSGS-004SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	74.81	297 -	314	299.99	2.27E+01	6.39	3.21E+01	0.44
m	2	77.08	297 -	314	309.06	2.74E+01	6.97	3.36E+01	0.45
	3	238.69	947 -	960	954.86	1.24E+02	17.23	6.28E+01	0.99
	4	295.10	1173 -	1188	1180.32	6.97E+01	11.55	2.13E+01	0.55
	5	351.76	1402 -	1413	1406.76	7.85E+01	11.57	2.15E+01	0.56
	6	582.98	2325 -	2338	2331.15	4.20E+01	8.98	1.40E+01	1.07
	7	609.15	2428 -	2442	2435.76	6.56E+01	9.97	1.14E+01	0.84
	8	911.04	3637 -	3649	3643.13	2.95E+01	6.82	6.50E+00	0.92
	9	1460.49	5832 -	5853	5841.78	2.40E+02	15.79	2.52E+00	1.75

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	7.05E+00	5.55E-01
Tl-208	0.99	583.19	*	85.00	8.09E-02	1.80E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.51E-01	4.03E-02
		300.09		3.30		
Pb212-XR	1.00	74.82	*	10.28	5.66E-01	1.70E-01
		77.11	*	17.10	3.63E-01	9.97E-02
		87.35		3.97		

Analysis Report for 31-Oct-18-10041

L1-10221F-FSGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	1.00	89.78		1.46		
Bi-214	0.99	609.32	*	45.49	2.43E-01	3.98E-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	3.77E-01	6.94E-02
		351.93	*	35.60	2.51E-01	4.20E-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	2.56E-01	6.02E-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 31-Oct-18-10041

L1-10221F-FSGS-004SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.982	7.05E+00	5.55E-01	
	Tl-208	0.993	8.09E-02	1.80E-02	
X	Bi-211	0.927			
	Pb-212	0.999	2.51E-01	4.03E-02	
	Pb212-XR	1.000	4.15E-01	8.59E-02	
	Bi-214	0.998	2.43E-01	3.98E-02	
	Pb-214	0.997	2.85E-01	3.59E-02	
X	Pb214-XR	1.000			
	Ac-228	0.999	2.56E-01	6.02E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 31-Oct-18-10041

L1-10221F-FSGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 12:59:13PM
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	6.22E-02	7.66E-02	7.66E-02
	BE-7	477.60		10.44	3.11E-01	5.04E-01	5.04E-01
+	K-40	1460.82	*	10.66	7.05E+00	3.81E-01	3.81E-01
	Co-60	1173.23		99.85	9.36E-03	5.48E-02	7.56E-02
		1332.49		99.98	8.29E-03		5.48E-02
	Nb-94	702.65		99.81	3.32E-02	4.91E-02	5.28E-02
		871.09		99.89	3.68E-02		4.91E-02
	Ag-108m	79.13		6.60	9.68E-02	4.33E-02	1.85E+00
		433.94		90.50	-8.21E-03		4.33E-02
		614.28		89.80	-2.32E-02		7.21E-02
		722.94		90.80	-3.26E-02		6.88E-02
	Sb-125	176.31		6.84	1.64E-01	1.34E-01	6.44E-01
		380.45		1.52	-1.60E+00		2.82E+00
		427.87		29.60	-1.01E-01		1.34E-01
		463.36		10.49	1.28E-01		4.85E-01
		600.60		17.65	-6.36E-02		3.05E-01
		606.71		4.98	2.23E+00		1.71E+00
		635.95		11.22	-3.50E-02		4.33E-01
		671.44		1.79	-1.80E+00		2.52E+00

Analysis Report for 31-Oct-18-10041

L1-10221F-FSGS-004SS

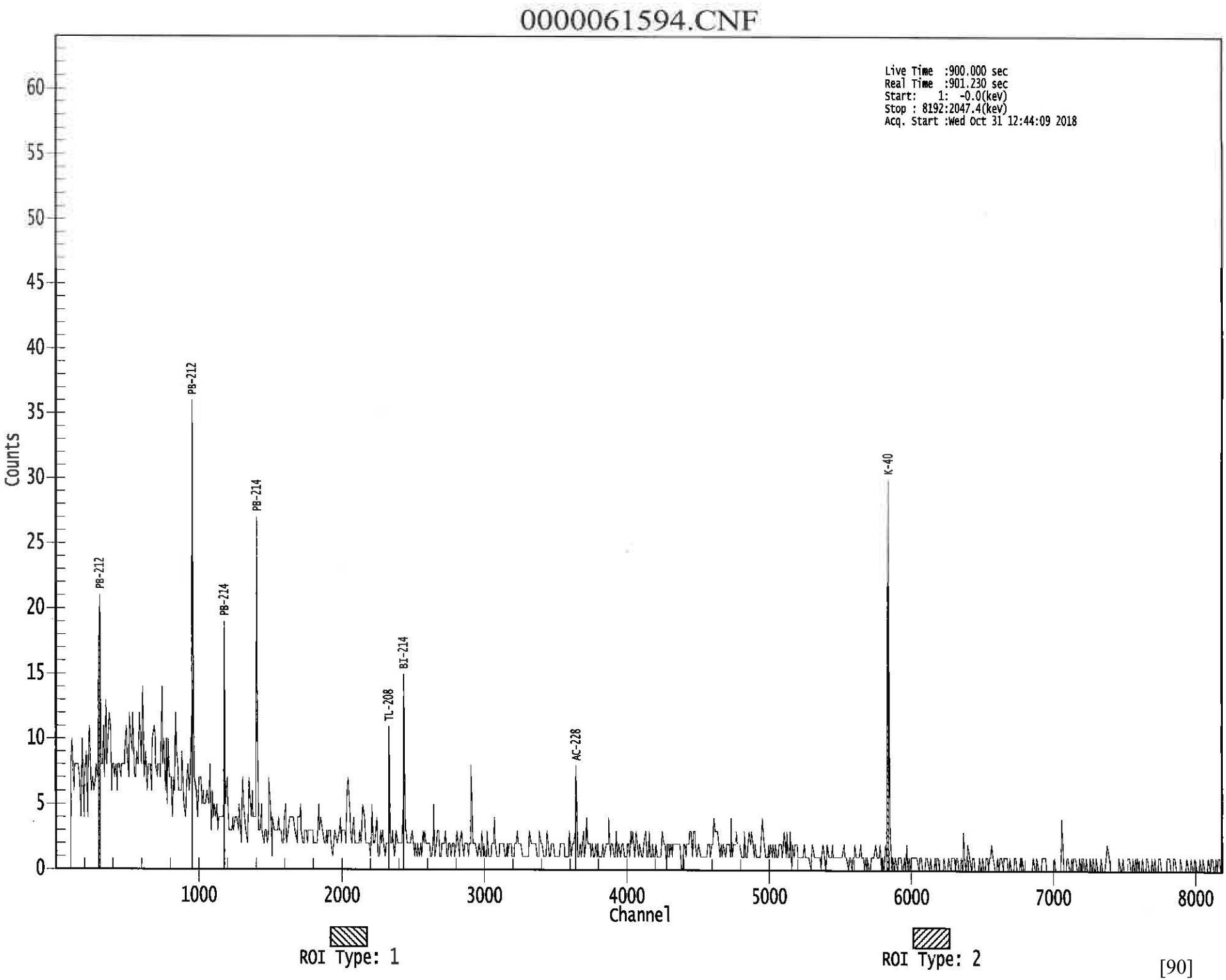
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	3.41E-01	8.37E-02	4.42E+00
	81.00	32.90	-1.76E-01		3.03E-01
	276.40	7.16	9.02E-02		6.25E-01
	302.85	18.34	-4.42E-02		2.11E-01
	356.01	62.05	-5.55E-02		8.37E-02
	383.85	8.94	1.15E-01		5.22E-01
Cs-134	475.36	1.48	-3.49E-01	5.56E-02	3.16E+00
	563.25	8.34	-2.40E-01		5.35E-01
	569.33	15.37	1.45E-01		2.72E-01
	604.72	97.62	-2.79E-02		8.19E-02
	795.86	85.46	-5.25E-02		5.56E-02
	801.95	8.69	2.76E-01		6.12E-01
	1038.61	0.99	-8.97E-01		6.06E+00
	1167.97	1.79	-1.26E+00		4.22E+00
	1365.19	3.02	-7.02E-01		1.93E+00
Cs-137	661.66	85.10	6.32E-02	6.57E-02	6.57E-02
Eu-152	121.78	28.67	5.83E-02	1.80E-01	1.83E-01
	244.70	7.61	4.49E-01		6.44E-01
	295.94	0.45	9.02E+00		1.21E+01
	344.28	26.60	1.48E-01		1.80E-01
	367.79	0.86	-3.18E+00		4.48E+00
	411.12	2.24	1.10E-01		2.04E+00
	443.96	2.83	7.58E-01		1.70E+00
	488.68	0.42	6.63E+00		1.03E+01
	563.99	0.49	-1.79E+00		9.35E+00
	586.26	0.46	-2.73E-01		1.57E+01
	678.62	0.47	7.12E+00		1.17E+01
	688.67	0.86	-3.52E-01		5.55E+00
	719.35	0.28	-1.08E-01		1.73E+01
	778.90	12.96	-6.96E-03		3.76E-01
	810.45	0.32	6.78E+00		1.75E+01
	867.37	4.26	-4.93E-01		1.26E+00
	919.33	0.43	1.39E-01		1.22E+01
	964.08	14.65	8.48E-02		4.97E-01
	1085.87	10.24	-1.94E-02		7.09E-01
	1089.74	1.73	2.98E+00		4.34E+00
	1112.07	13.69	4.70E-04		5.48E-01
	1212.95	1.43	-2.47E+00		6.14E+00
	1249.94	0.19	1.07E+01		3.59E+01
	1299.14	1.63	2.04E+00		4.47E+00
	1408.01	21.07	-1.60E-01		2.49E-01
	1457.64	0.50	1.55E+02		4.88E+01
	1528.10	0.28	6.90E+00		1.68E+01
Eu-154	123.07	40.40	3.32E-02	1.26E-01	1.26E-01
	247.93	6.89	-5.44E-02		6.20E-01
	591.76	4.95	-1.97E-01		8.82E-01
	692.42	1.78	-1.89E+00		2.69E+00
	723.30	20.06	1.07E-01		3.23E-01
	756.80	4.52	-4.28E-01		1.01E+00
	873.18	12.08	-1.61E-01		3.96E-01
	996.29	10.48	3.85E-01		5.78E-01

Analysis Report for 31-Oct-18-10041

L1-10221F-FSGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-8.66E-02	1.26E-01	3.31E-01
	1274.43	34.80	-9.53E-03		2.10E-01
	1596.48	1.80	2.99E+00		4.13E+00
Eu-155	45.30	1.31	3.04E+01	2.85E-01	3.58E+01
	60.01	1.22	0.00E+00		3.16E+01
	86.55	30.70	-4.57E-02		2.93E-01
	105.31	21.10	5.06E-02		2.85E-01
Ra-226	186.21	3.64	5.00E-01	1.30E+00	1.30E+00
Pa-231	27.36	10.30	2.92E+00	1.65E+00	3.69E+00
	283.69	1.70	8.93E-01		2.40E+00
	300.07	2.47	6.17E-01		1.65E+00
	302.65	2.20	-1.90E-01		1.76E+00
	330.06	1.40	1.09E+00		3.28E+00
U-235	143.76	10.96	-1.72E-01	8.11E-02	4.48E-01
	163.33	5.08	4.19E-01		8.56E-01
	185.71	57.20	-1.57E-02		8.11E-02
	202.11	1.08	-1.32E+00		3.74E+00
	205.31	5.01	-8.80E-01		7.91E-01
Am-241	59.54	35.90	8.68E-02	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


0000061594.CNF
Live Time :900.000 sec
Real Time :901.230 sec
Start: 1: -0.0(keV)
Stop : 8192:2047.4(keV)
Acq. Start :Wed Oct 31 12:44:09 2018
Counts
Channel
PB-212
PB-212
PB-214
PB-214
TL-208
BI-214
AC-228
K-40
ROI Type: 1
ROI Type: 2

[90]

Apex-Gamma

Analysis Report for 31-Oct-18-10042

L1-10221F-FQGS-004SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10042
Sample Description	: L1-10221F-FQGS-004SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.186E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 2:39:00PM
Acquisition Started	: 10/31/2018 12:44:16PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 10/15/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61595
Fill Height	: 1185.86 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 12:59:25PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

JBroham

Analysis Report for 31-Oct-18-10042

L1-10221F-FQGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.23	305 -	315	309.46	2.64E+01	15.97	9.46E+01	0.71
2	238.72	948 -	961	954.48	1.23E+02	17.10	6.03E+01	1.25
3	295.14	1174 -	1186	1179.84	5.46E+01	10.90	2.44E+01	0.34
4	352.05	1399 -	1414	1407.22	9.91E+01	13.74	2.99E+01	1.00
5	582.99	2324 -	2336	2330.08	4.01E+01	8.96	1.49E+01	1.11
6	609.08	2427 -	2441	2434.36	6.78E+01	10.01	1.13E+01	1.08
7	911.26	3636 -	3651	3642.49	4.03E+01	8.33	9.70E+00	0.72
8	1460.39	5828 -	5852	5839.49	2.67E+02	16.34	0.00E+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	0.97	1460.82	*	10.66	6.56E+00	4.93E-01
Tl-208	0.99	583.19	*	85.00	6.52E-02	1.51E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.08E-01	3.35E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		
		77.11	*	17.10	1.93E-01	1.18E-01
		87.35		3.97		
		89.78		1.46		

Analysis Report for 31-Oct-18-10042

L1-10221F-FQGS-004SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	609.32	*	45.49	2.12E-01	3.39E-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	2.50E-01	5.37E-02
		351.93	*	35.60	2.68E-01	4.29E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	3.40E-01	2.09E-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	2.95E-01	6.22E-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 31-Oct-18-10042

L1-10221F-FQGS-004SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.970	6.56E+00	4.93E-01	
	Tl-208	0.994	6.52E-02	1.51E-02	
X	Bi-211	0.857			
	Pb-212	0.999	2.08E-01	3.35E-02	
?	Pb212-XR	0.999	1.93E-01	1.18E-01	
	Bi-214	0.996	2.12E-01	3.39E-02	
	Pb-214	0.998	2.61E-01	3.35E-02	
?	Pb214-XR	0.999	3.40E-01	2.09E-01	
	Ac-228	1.000	2.95E-01	6.22E-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 31-Oct-18-10042
L1-10221F-FQGS-004SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 12:59:25PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	1.03E-01	6.55E-02	6.55E-02
	BE-7	477.60		10.44	1.23E-01	4.22E-01	4.22E-01
+	K-40	1460.82	*	10.66	6.56E+00	7.07E-02	7.07E-02
	Co-60	1173.23		99.85	1.49E-02	4.41E-02	6.65E-02
		1332.49		99.98	2.45E-02		4.41E-02
	Nb-94	702.65		99.81	-1.18E-02	4.64E-02	4.67E-02
		871.09		99.89	-2.89E-03		4.64E-02
	Ag-108m	79.13		6.60	1.06E-01	3.82E-02	1.18E+00
		433.94		90.50	3.54E-03		3.82E-02
		614.28		89.80	-5.18E-02		5.71E-02
		722.94		90.80	4.03E-02		5.38E-02
	Sb-125	176.31		6.84	-2.49E-01	1.13E-01	4.44E-01
		380.45		1.52	2.99E-01		2.41E+00
		427.87		29.60	-2.67E-02		1.13E-01
		463.36		10.49	1.12E-01		4.14E-01
		600.60		17.65	1.61E-01		2.64E-01
		606.71		4.98	2.02E+00		1.48E+00
		635.95		11.22	-1.52E-01		3.13E-01
		671.44		1.79	1.62E+00		2.61E+00

Analysis Report for 31-Oct-18-10042

L1-10221F-FQGS-004SS

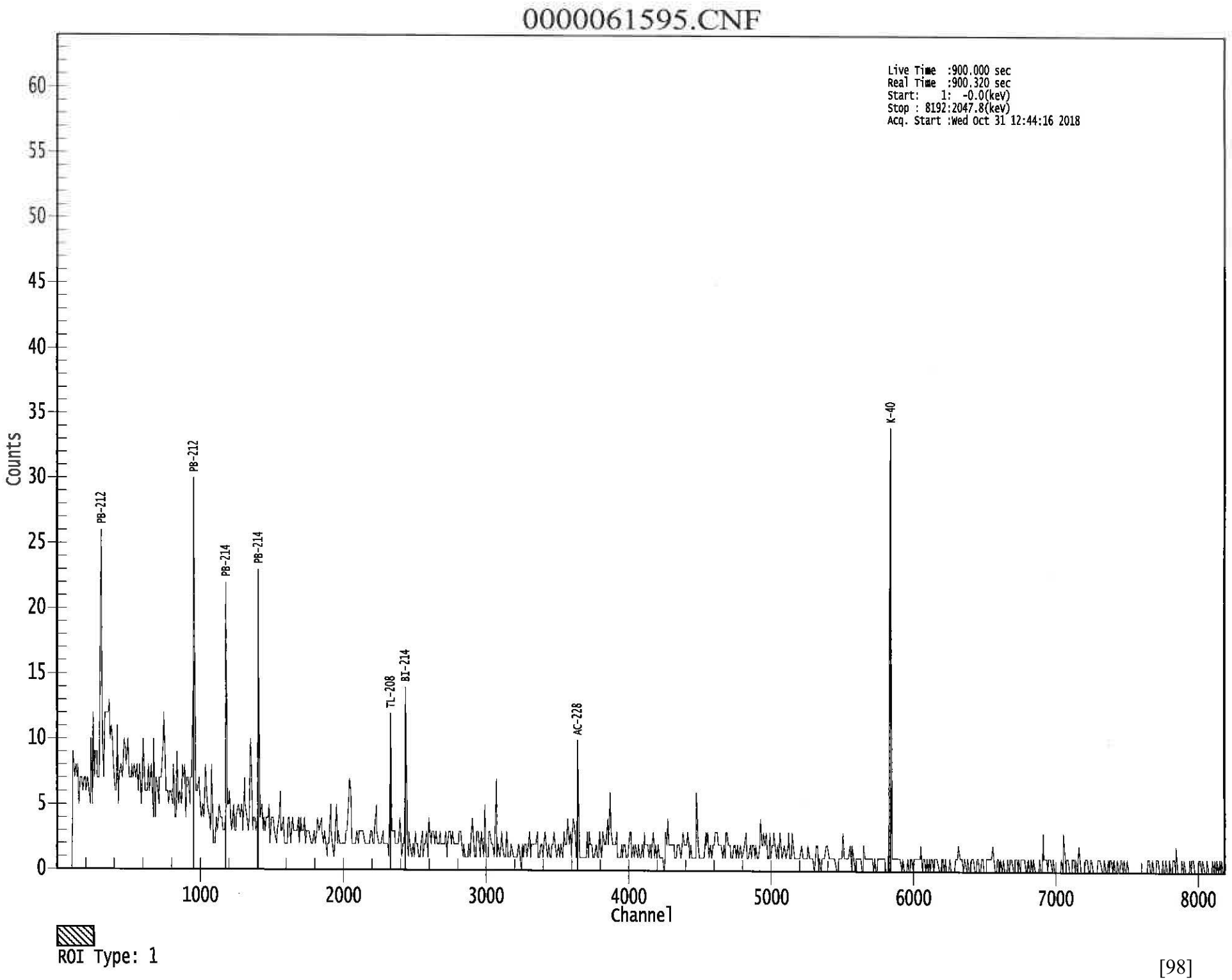
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	2.65E-01	7.73E-02	2.86E+00
	81.00	32.90	-9.27E-02		1.78E-01
	276.40	7.16	-2.29E-01		3.88E-01
	302.85	18.34	1.05E-01		1.98E-01
	356.01	62.05	-1.32E-02		7.73E-02
	383.85	8.94	-2.70E-01		3.90E-01
Cs-134	475.36	1.48	7.65E-01	5.33E-02	2.74E+00
	563.25	8.34	-6.94E-01		4.60E-01
	569.33	15.37	7.39E-02		2.47E-01
	604.72	97.62	-5.30E-03		6.65E-02
	795.86	85.46	2.43E-02		5.33E-02
	801.95	8.69	-6.73E-01		4.52E-01
	1038.61	0.99	1.30E+00		6.02E+00
	1167.97	1.79	8.15E-01		3.66E+00
	1365.19	3.02	-5.59E-01		1.21E+00
Cs-137	661.66	85.10	2.58E-02	5.48E-02	5.48E-02
Eu-152	121.78	28.67	1.98E-02	1.23E-01	1.23E-01
	244.70	7.61	-1.88E-02		4.97E-01
	295.94	0.45	8.26E+00		1.01E+01
	344.28	26.60	-3.91E-02		1.31E-01
	367.79	0.86	1.25E+00		4.09E+00
	411.12	2.24	-2.54E-01		1.87E+00
	443.96	2.83	-6.87E-01		1.31E+00
	488.68	0.42	4.53E+00		9.88E+00
	563.99	0.49	-5.40E+00		7.53E+00
	586.26	0.46	-7.43E-01		1.38E+01
	678.62	0.47	1.75E-01		9.22E+00
	688.67	0.86	2.89E-01		5.43E+00
	719.35	0.28	-1.43E+01		1.23E+01
	778.90	12.96	-8.43E-03		3.44E-01
	810.45	0.32	1.75E+00		1.37E+01
	867.37	4.26	1.24E+00		1.23E+00
	919.33	0.43	4.33E+00		1.10E+01
	964.08	14.65	2.23E-01		5.02E-01
	1085.87	10.24	5.49E-02		5.17E-01
	1089.74	1.73	-9.41E-01		3.19E+00
	1112.07	13.69	-1.44E-01		3.49E-01
	1212.95	1.43	-6.10E+00		4.61E+00
	1249.94	0.19	1.99E+01		3.61E+01
	1299.14	1.63	-2.44E+00		2.55E+00
	1408.01	21.07	-4.10E-02		2.09E-01
	1457.64	0.50	1.34E+02		4.23E+01
	1528.10	0.28	4.82E+00		1.31E+01
Eu-154	123.07	40.40	1.31E-02	8.60E-02	8.60E-02
	247.93	6.89	4.13E-01		5.37E-01
	591.76	4.95	-4.13E-01		7.73E-01
	692.42	1.78	-2.24E+00		2.64E+00
	723.30	20.06	1.49E-01		2.44E-01
	756.80	4.52	-1.18E-01		1.02E+00
	873.18	12.08	2.24E-01		4.14E-01
	996.29	10.48	-3.32E-01		4.96E-01

Analysis Report for 31-Oct-18-10042

L1-10221F-FQGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	3.03E-03	8.60E-02	3.02E-01
	1274.43	34.80	-2.07E-01		1.66E-01
	1596.48	1.80	-2.54E-01		2.29E+00
Eu-155	45.30	1.31	-2.85E+00	1.87E-01	1.11E+01
	60.01	1.22	-3.70E+00		1.19E+01
	86.55	30.70	3.58E-02		1.96E-01
	105.31	21.10	-2.20E-02		1.87E-01
Ra-226	186.21	3.64	1.23E+00	1.10E+00	1.10E+00
Pa-231	27.36	10.30	1.26E+00	1.29E+00	1.29E+00
	283.69	1.70	3.45E-01		1.84E+00
	300.07	2.47	-1.67E-01		1.49E+00
	302.65	2.20	1.89E-01		1.63E+00
	330.06	1.40	1.04E+00		2.64E+00
U-235	143.76	10.96	9.63E-02	6.79E-02	3.14E-01
	163.33	5.08	8.56E-02		6.12E-01
	185.71	57.20	4.08E-02		6.79E-02
	202.11	1.08	-6.53E-01		2.78E+00
	205.31	5.01	-5.82E-01		5.96E-01
Am-241	59.54	35.90	4.54E-03	4.11E-01	4.11E-01

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


0000061595.CNF
Live Time :900.000 sec
Real Time :900.320 sec
Start: 1: -0.0(keV)
Stop : 8192:2047.8(keV)
Acq. Start :Wed Oct 31 12:44:16 2018
Counts
Channel
PB-212
PB-212
PB-214
PB-214
TL-208
BI-214
AC-228
K-40
ROI Type: 1

Apex-Gamma

Analysis Report for 31-Oct-18-10043
L1-10221F-FSGS-005SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10043
Sample Description	: L1-10221F-FSGS-005SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 9.452E+02 grams
Facility	: Default
Sample Taken On	: 10/25/2018 2:42:00PM
Acquisition Started	: 10/31/2018 12:44:23PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61596
Fill Height	: 945.16 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

J.C. Mitchell 10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 12:59:29PM

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

DATA VALIDATED 11/1/18 1300
T Graham / C Dyl

Analysis Report for 31-Oct-18-10043

L1-10221F-FSGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.12	307 -	314	309.77	3.29E+01	10.84	3.91E+01	0.66
2	238.69	949 -	961	955.22	1.61E+02	18.27	6.54E+01	1.01
3	295.23	1176 -	1187	1181.15	5.41E+01	11.14	2.79E+01	1.14
4	338.42	1348 -	1358	1353.71	1.90E+01	8.99	2.60E+01	1.14
5	351.95	1398 -	1414	1407.80	1.01E+02	14.38	3.38E+01	0.85
6	477.51	1904 -	1915	1909.61	2.94E+01	8.12	1.46E+01	0.70
7	583.27	2326 -	2338	2332.39	4.27E+01	7.70	6.33E+00	1.15
8	609.34	2430 -	2445	2436.64	7.47E+01	11.46	1.83E+01	1.19
9	661.62	2636 -	2654	2645.65	7.31E+01	10.66	1.19E+01	1.14
10	1460.57	5830 -	5855	5842.65	3.08E+02	18.31	6.50E+00	1.96

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
BE-7	0.99	477.60	*	10.44	3.84E-01	1.10E-01
K-40	0.99	1460.82	*	10.66	7.83E+00	5.77E-01
Cs-137	1.00	661.66	*	85.10	1.35E-01	2.13E-02
Tl-208	0.99	583.19	*	85.00	7.25E-02	1.38E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.92E-01	4.08E-02
		300.09		3.30		

Analysis Report for 31-Oct-18-10043

L1-10221F-FSGS-005SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	1.00	74.82		10.28		
		77.11	*	17.10	3.46E-01	1.19E-01
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	2.44E-01	4.02E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.62E-01	5.80E-02
		351.93	*	35.60	2.89E-01	4.71E-02
		785.96		1.06		
Pb214-XR	1.00	74.82		5.80		
		77.11	*	9.70	6.09E-01	2.12E-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	1.66E-01	7.99E-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 31-Oct-18-10043

L1-10221F-FSGS-005SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	BE-7	0.998	3.84E-01	1.10E-01	
	K-40	0.990	7.83E+00	5.77E-01	
	Cs-137	1.000	1.35E-01	2.13E-02	
	Tl-208	0.999	7.25E-02	1.38E-02	
X	Bi-211	0.883			
	Pb-212	1.000	2.92E-01	4.08E-02	
?	Pb212-XR	1.000	3.46E-01	1.19E-01	
	Bi-214	1.000	2.44E-01	4.02E-02	
	Pb-214	1.000	2.78E-01	3.66E-02	
?	Pb214-XR	1.000	6.09E-01	2.12E-01	
	Ac-228	1.000	1.66E-01	7.99E-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 31-Oct-18-10043

L1-10221F-FSGS-005SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 12:59:29PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	1.84E-02	6.57E-02	6.57E-02
+	BE-7	477.60	*	10.44	3.84E-01	3.05E-01	3.05E-01
+	K-40	1460.82	*	10.66	7.83E+00	5.27E-01	5.27E-01
	Co-60	1173.23		99.85	6.63E-02	6.94E-02	7.28E-02
		1332.49		99.98	4.67E-02		6.94E-02
	Nb-94	702.65		99.81	3.67E-02	5.33E-02	5.33E-02
		871.09		99.89	-2.61E-02		5.93E-02
	Ag-108m	79.13		6.60	-4.02E-02	4.80E-02	1.57E+00
		433.94		90.50	-1.73E-02		4.80E-02
		614.28		89.80	-3.11E-02		8.67E-02
		722.94		90.80	1.49E-02		6.45E-02
	Sb-125	176.31		6.84	-1.87E-02	1.32E-01	5.58E-01
		380.45		1.52	9.28E-01		2.85E+00
		427.87		29.60	-3.28E-02		1.32E-01
		463.36		10.49	1.64E-01		4.98E-01
		600.60		17.65	1.84E-01		3.08E-01
		606.71		4.98	2.43E+00		1.67E+00
		635.95		11.22	-4.14E-01		3.81E-01
		671.44		1.79	-2.67E-01		3.03E+00

Analysis Report for 31-Oct-18-10043

L1-10221F-FSGS-005SS

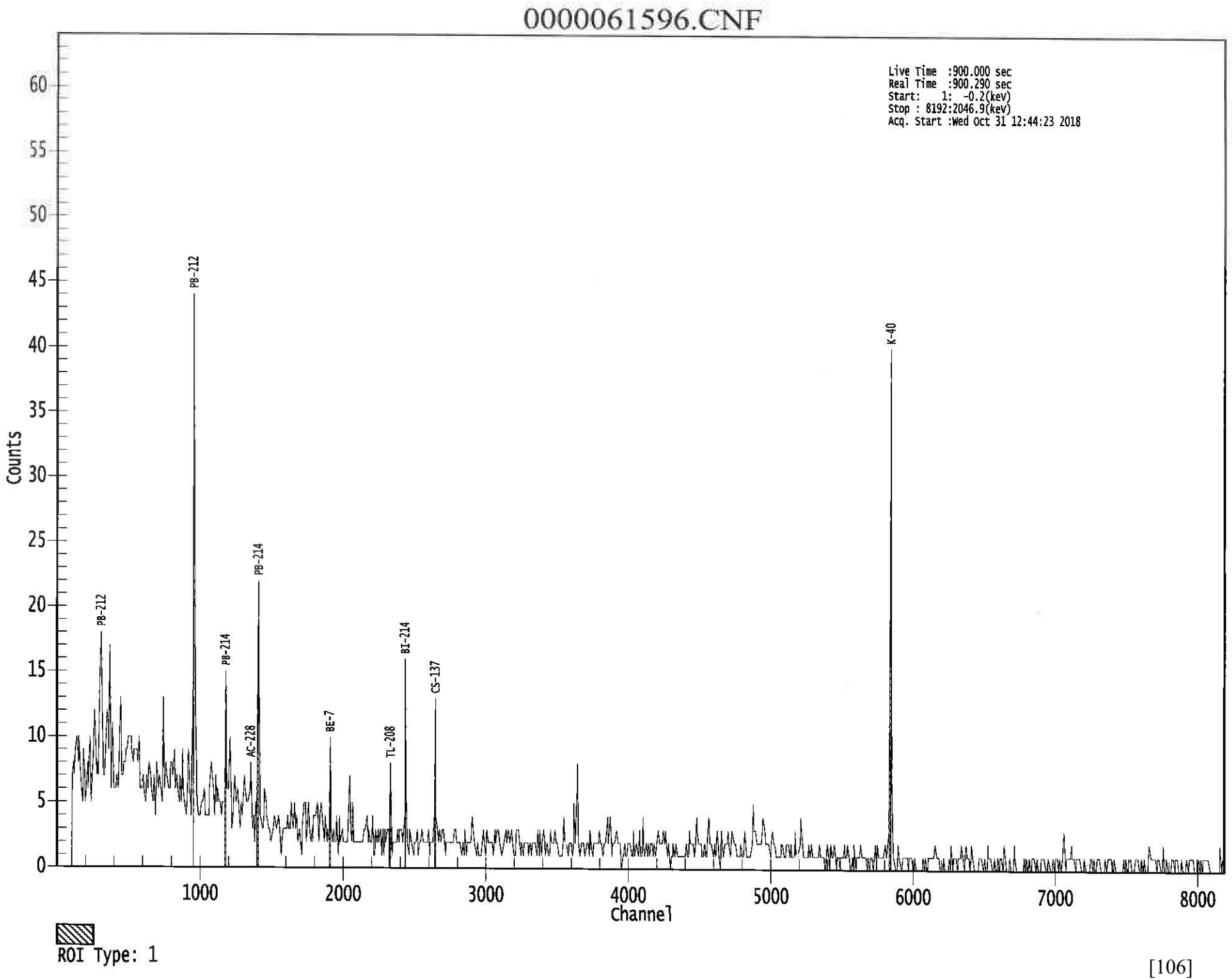
	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61	2.65	-8.61E-01	9.58E-02	3.78E+00
		81.00	32.90	-1.69E-01		2.51E-01
		276.40	7.16	3.74E-01		6.30E-01
		302.85	18.34	1.46E-01		2.48E-01
		356.01	62.05	-2.88E-02		9.58E-02
		383.85	8.94	-3.71E-01		4.73E-01
	Cs-134	475.36	1.48	3.14E+00	6.56E-02	3.92E+00
		563.25	8.34	-7.50E-02		4.73E-01
		569.33	15.37	7.35E-03		2.75E-01
		604.72	97.62	-4.45E-02		7.71E-02
		795.86	85.46	-3.28E-02		6.56E-02
		801.95	8.69	-2.26E-01		6.73E-01
		1038.61	0.99	-7.90E+00		5.62E+00
		1167.97	1.79	1.11E+00		4.06E+00
		1365.19	3.02	-4.35E-01		1.84E+00
+	Cs-137	661.66	* 85.10	1.35E-01	4.53E-02	4.53E-02
	Eu-152	121.78	28.67	-3.08E-02	1.52E-01	1.55E-01
		244.70	7.61	4.14E-01		6.13E-01
		295.94	0.45	8.85E+00		1.16E+01
		344.28	26.60	-1.77E-02		1.52E-01
		367.79	0.86	-1.88E+00		5.09E+00
		411.12	2.24	9.75E-01		1.99E+00
		443.96	2.83	9.64E-01		1.59E+00
		488.68	0.42	-1.84E+00		1.03E+01
		563.99	0.49	4.20E+00		8.51E+00
		586.26	0.46	1.55E+01		1.38E+01
		678.62	0.47	-2.68E+00		1.10E+01
		688.67	0.86	4.88E-01		6.11E+00
		719.35	0.28	-1.28E+01		1.72E+01
		778.90	12.96	-5.49E-01		3.37E-01
		810.45	0.32	2.23E+00		1.69E+01
		867.37	4.26	3.36E-01		1.44E+00
		919.33	0.43	3.80E+00		1.38E+01
		964.08	14.65	-9.93E-04		5.07E-01
		1085.87	10.24	-2.06E-01		5.46E-01
		1089.74	1.73	-2.90E-01		3.24E+00
		1112.07	13.69	-3.37E-01		5.37E-01
		1212.95	1.43	2.95E-01		4.63E+00
		1249.94	0.19	-1.47E+01		4.11E+01
		1299.14	1.63	3.00E-01		4.12E+00
		1408.01	21.07	-1.24E-01		2.44E-01
		1457.64	0.50	1.75E+02		4.82E+01
		1528.10	0.28	-7.07E-01		1.46E+01
	Eu-154	123.07	40.40	-1.08E-02	1.10E-01	1.10E-01
		247.93	6.89	-4.79E-01		5.42E-01
		591.76	4.95	4.20E-01		1.02E+00
		692.42	1.78	-2.29E+00		2.86E+00
		723.30	20.06	-1.11E-01		2.83E-01
		756.80	4.52	3.25E-01		1.15E+00
		873.18	12.08	3.74E-01		4.98E-01
		996.29	10.48	9.30E-02		5.62E-01

Analysis Report for 31-Oct-18-10043

L1-10221F-FSGS-005SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	1.11E-01	1.10E-01	3.64E-01
	1274.43	34.80	8.90E-02		1.90E-01
	1596.48	1.80	-5.26E-01		3.16E+00
Eu-155	45.30	1.31	-3.99E+00	2.25E-01	2.20E+01
	60.01	1.22	-5.29E+00		2.34E+01
	86.55	30.70	-7.37E-02		2.54E-01
	105.31	21.10	-8.56E-02		2.25E-01
Ra-226	186.21	3.64	1.99E-01	1.16E+00	1.16E+00
Pa-231	27.36	10.30	3.45E+00	1.91E+00	2.69E+00
	283.69	1.70	-1.36E+00		2.37E+00
	300.07	2.47	-2.49E-01		1.91E+00
	302.65	2.20	1.05E+00		2.06E+00
	330.06	1.40	5.83E-01		3.23E+00
U-235	143.76	10.96	-1.06E-01	7.34E-02	3.79E-01
	163.33	5.08	-2.56E-01		7.42E-01
	185.71	57.20	-8.93E-03		7.34E-02
	202.11	1.08	6.03E-01		3.78E+00
	205.31	5.01	-4.31E-01		7.60E-01
Am-241	59.54	35.90	-1.13E-01	8.18E-01	8.18E-01

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


0000061596.CNF
Live Time :900.000 sec
Real Time :900.290 sec
Start: 1: -0.2(kev)
Stop : 8192:2046.9(kev)
Acq. Start :Wed Oct 31 12:44:23 2018
Counts
Channel
PB-212
PB-214
AC-228
PB-214
BE-7
TL-208
BI-214
CS-137
K-40
ROI Type: 1

[106]

Apex-Gamma

Analysis Report for 31-Oct-18-10044

L1-10221F-FSGS-006SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10044
Sample Description	: L1-10221F-FSGS-006SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.168E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 2:45:00PM
Acquisition Started	: 10/31/2018 1:03:20PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61597
Fill Height	: 1168.40 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 1:18:23PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 11/1/18 1300

JGraham

Analysis Report for 31-Oct-18-10044

L1-10221F-FSGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.62	472 -	481	477.43	1.45E+02	20.41	1.18E+02	1.14
2	295.23	588 -	604	590.51	5.93E+01	21.03	1.15E+02	1.07
3	351.83	698 -	708	703.60	1.45E+02	16.51	5.36E+01	1.10
4	582.92	1159 -	1171	1165.45	8.41E+01	10.51	9.90E+00	1.49
5	609.06	1211 -	1222	1217.70	1.18E+02	13.61	2.69E+01	1.57
6	911.00	1816 -	1826	1821.46	3.84E+01	8.84	1.66E+01	1.26
7	1460.56	2913 -	2927	2921.17	3.80E+02	19.88	5.47E+00	2.14

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	7.83E+00	5.33E-01
Tl-208	0.98	583.19	*	85.00	1.17E-01	1.63E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.17E-01	3.52E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	3.17E-01	4.12E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 31-Oct-18-10044

L1-10221F-FSGS-006SS

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	2.38E-01	8.64E-02
		351.93	*	35.60	3.42E-01	4.75E-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	2.38E-01	5.58E-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 31-Oct-18-10044

L1-10221F-FSGS-006SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.989	7.83E+00	5.33E-01	
	Tl-208	0.989	1.17E-01	1.63E-02	
X	Bi-211	0.912			
	Pb-212	1.000	2.17E-01	3.52E-02	
	Bi-214	0.996	3.17E-01	4.12E-02	
	Pb-214	0.999	3.18E-01	4.17E-02	
	Ac-228	0.998	2.38E-01	5.58E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 31-Oct-18-10044

L1-10221F-FSGS-006SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 1:18:23PM
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	8.67E-02	6.23E-02	6.23E-02
	BE-7	477.60		10.44	-1.64E-01	3.35E-01	3.35E-01
+	K-40	1460.82	*	10.66	7.83E+00	3.35E-01	3.35E-01
	Co-60	1173.23		99.85	4.10E-02	5.62E-02	6.70E-02
		1332.49		99.98	2.19E-02		5.62E-02
	Nb-94	702.65		99.81	9.09E-03	4.24E-02	4.57E-02
		871.09		99.89	7.10E-03		4.24E-02
	Ag-108m	79.13		6.60	8.89E-01	3.72E-02	1.25E+00
		433.94		90.50	1.07E-02		3.72E-02
		614.28		89.80	-6.84E-02		5.84E-02
		722.94		90.80	-1.76E-03		4.59E-02
	Sb-125	176.31		6.84	1.07E-01	1.18E-01	5.21E-01
		380.45		1.52	-2.93E-01		2.22E+00
		427.87		29.60	6.45E-03		1.18E-01
		463.36		10.49	3.10E-01		3.89E-01
		600.60		17.65	-1.24E-01		2.18E-01
		606.71		4.98	-2.19E-01		1.55E+00
		635.95		11.22	2.35E-02		3.52E-01
		671.44		1.79	-5.18E-02		2.13E+00

Analysis Report for 31-Oct-18-10044

L1-10221F-FSGS-006SS

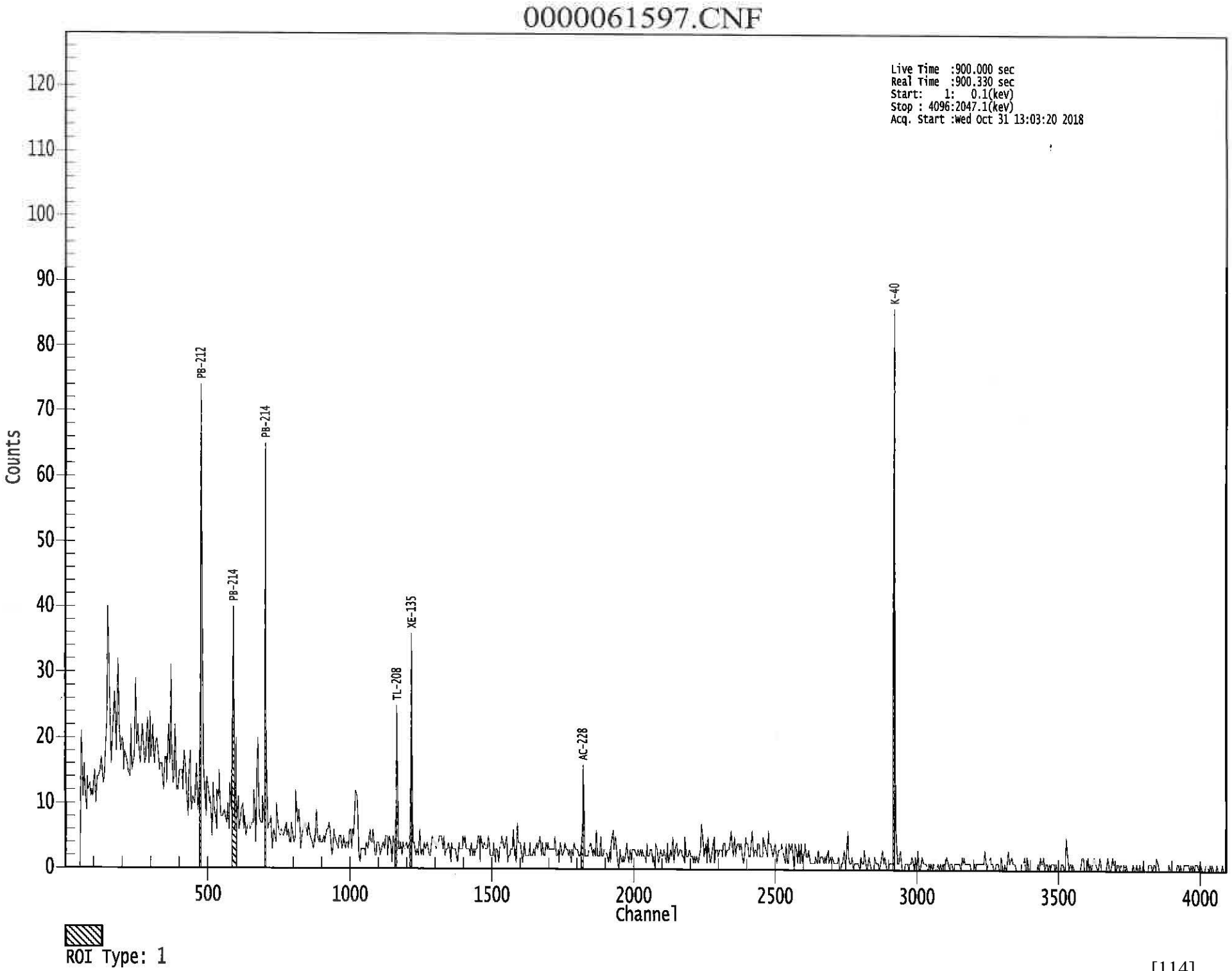
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	1.12E+00	8.66E-02	2.89E+00
	81.00	32.90	-3.17E-01		1.88E-01
	276.40	7.16	-5.34E-02		4.73E-01
	302.85	18.34	1.51E-02		1.90E-01
	356.01	62.05	-3.87E-02		8.66E-02
	383.85	8.94	-1.93E-01		3.77E-01
Cs-134	475.36	1.48	4.49E-01	5.50E-02	2.41E+00
	563.25	8.34	9.43E-02		4.90E-01
	569.33	15.37	8.98E-02		2.45E-01
	604.72	97.62	-1.96E-02		7.13E-02
	795.86	85.46	2.45E-03		5.50E-02
	801.95	8.69	-3.15E-01		4.72E-01
	1038.61	0.99	-2.17E+00		4.40E+00
	1167.97	1.79	1.00E+00		3.67E+00
	1365.19	3.02	-6.57E-01		1.08E+00
Cs-137	661.66	85.10	4.72E-03	5.48E-02	5.48E-02
Eu-152	121.78	28.67	3.59E-02	1.24E-01	1.24E-01
	244.70	7.61	-1.18E-01		5.03E-01
	295.94	0.45	-5.47E+00		9.99E+00
	344.28	26.60	-7.98E-02		1.41E-01
	367.79	0.86	2.99E-01		3.86E+00
	411.12	2.24	8.15E-01		1.76E+00
	443.96	2.83	4.70E-01		1.29E+00
	488.68	0.42	9.45E-01		8.96E+00
	563.99	0.49	-5.72E-01		8.11E+00
	586.26	0.46	-7.54E-01		1.31E+01
	678.62	0.47	-2.51E+00		7.99E+00
	688.67	0.86	1.66E+00		4.64E+00
	719.35	0.28	-5.86E+00		1.34E+01
	778.90	12.96	-1.43E-01		2.98E-01
	810.45	0.32	2.26E+00		1.17E+01
	867.37	4.26	-8.71E-02		9.75E-01
	919.33	0.43	-2.94E+00		1.06E+01
	964.08	14.65	1.53E-01		4.10E-01
	1085.87	10.24	-4.22E-02		5.03E-01
	1089.74	1.73	-1.14E-01		2.39E+00
	1112.07	13.69	-2.42E-01		2.94E-01
	1212.95	1.43	4.45E-02		4.39E+00
	1249.94	0.19	-2.73E+01		2.59E+01
	1299.14	1.63	6.81E-01		3.51E+00
	1408.01	21.07	-5.29E-02		2.30E-01
	1457.64	0.50	6.55E-01		4.26E+01
	1528.10	0.28	7.57E-01		1.01E+01
Eu-154	123.07	40.40	-1.04E-02	8.61E-02	8.61E-02
	247.93	6.89	-1.27E-01		4.86E-01
	591.76	4.95	5.05E-03		7.67E-01
	692.42	1.78	-7.44E-01		2.19E+00
	723.30	20.06	4.44E-02		2.14E-01
	756.80	4.52	-1.07E-02		8.69E-01
	873.18	12.08	-1.07E-01		3.45E-01
	996.29	10.48	-1.40E-01		4.03E-01

Analysis Report for 31-Oct-18-10044

L1-10221F-FSGS-006SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	2.05E-02	8.61E-02	2.93E-01
	1274.43	34.80	5.22E-02		1.62E-01
	1596.48	1.80	1.87E-02		2.04E+00
Eu-155	45.30	1.31	2.63E+00	1.81E-01	1.10E+01
	60.01	1.22	-2.30E+00		1.27E+01
	86.55	30.70	3.27E-02		1.90E-01
	105.31	21.10	-6.28E-02		1.81E-01
Ra-226	186.21	3.64	2.56E-01	1.10E+00	1.10E+00
Pa-231	27.36	10.30	1.30E+00	1.29E+00	1.29E+00
	283.69	1.70	-6.88E-01		1.86E+00
	300.07	2.47	-9.63E-03		1.39E+00
	302.65	2.20	1.26E-01		1.58E+00
	330.06	1.40	6.38E-01		2.55E+00
U-235	143.76	10.96	6.67E-02	7.09E-02	3.08E-01
	163.33	5.08	1.96E-01		7.54E-01
	185.71	57.20	3.84E-02		7.09E-02
	202.11	1.08	-1.09E+00		3.17E+00
	205.31	5.01	-1.93E-01		6.99E-01
Am-241	59.54	35.90	-1.72E-01	4.37E-01	4.37E-01

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


0000061597.CNF
Live Time :900.000 sec
Real Time :900.330 sec
Start: 1: 0.1(kev)
Stop : 4096:2047.1(kev)
Acq. Start :Wed Oct 31 13:03:20 2018
PB-212
PB-214
PB-214
TL-208
XE-135
AC-228
K-40
Counts
Channel
ROI Type: 1

[114]

Apex-Gamma

Analysis Report for 31-Oct-18-10045
L1-10221F-FSGS-007SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10045
Sample Description	: L1-10221F-FSGS-007SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.519E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 2:48:00PM
Acquisition Started	: 10/31/2018 1:03:27PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61598
Fill Height	: 1519.09 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

JC Mitchell 10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 1:18:31PM

DATA VALIDATED 11/1/18 1300

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

JGraham

Analysis Report for 31-Oct-18-10045

L1-10221F-FSGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.61	950 -	960	954.54	1.76E+02	18.48	6.62E+01	1.11
2	295.26	1176 -	1187	1180.93	5.82E+01	11.97	3.38E+01	0.82
3	351.80	1397 -	1413	1406.93	1.31E+02	14.46	2.52E+01	0.94
4	583.21	2324 -	2340	2332.05	7.36E+01	11.37	1.74E+01	0.89
5	609.25	2431 -	2443	2436.17	7.52E+01	11.27	1.98E+01	1.50
6	910.91	3636 -	3651	3642.62	4.86E+01	7.63	3.40E+00	0.80
7	968.78	3868 -	3881	3874.11	3.36E+01	6.99	5.40E+00	0.50
8	1120.24	4475 -	4486	4480.05	1.73E+01	5.45	4.72E+00	0.56
9	1460.68	5831 -	5851	5842.57	1.86E+02	15.50	1.52E+01	1.65

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	4.64E+00	4.37E-01
Tl-208	1.00	583.19	*	85.00	1.23E-01	2.04E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	3.15E-01	4.17E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.42E-01	3.91E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 31-Oct-18-10045

L1-10221F-FSGS-007SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	934.06		3.11		
		1120.29	*	14.92	2.56E-01	8.15E-02
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.78E-01	6.13E-02
		351.93	*	35.60	3.67E-01	5.01E-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	3.63E-01	5.91E-02
		964.77		4.99		
		968.97	*	15.80	4.27E-01	9.08E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 31-Oct-18-10045

L1-10221F-FSGS-007SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	4.64E+00	4.37E-01	
	Tl-208	1.000	1.23E-01	2.04E-02	
X	Bi-211	0.918			
	Pb-212	1.000	3.15E-01	4.17E-02	
	Bi-214	1.000	2.45E-01	3.52E-02	
	Pb-214	0.998	3.31E-01	3.88E-02	
	Ac-228	0.995	3.82E-01	4.96E-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 31-Oct-18-10045
L1-10221F-FSGS-007SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 1:18:31PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.72E-02	6.52E-02	6.52E-02
	BE-7	477.60		10.44	2.82E-01	5.01E-01	5.01E-01
+	K-40	1460.82	*	10.66	4.64E+00	6.97E-01	6.97E-01
	Co-60	1173.23		99.85	-1.05E-02	5.18E-02	6.15E-02
		1332.49		99.98	-1.38E-02		5.18E-02
	Nb-94	702.65		99.81	-2.59E-02	4.00E-02	4.34E-02
		871.09		99.89	-1.40E-02		4.00E-02
	Ag-108m	79.13		6.60	1.84E+00	4.84E-02	2.15E+00
		433.94		90.50	2.91E-02		4.84E-02
		614.28		89.80	-1.50E-02		7.72E-02
		722.94		90.80	-1.69E-02		5.88E-02
	Sb-125	176.31		6.84	-2.85E-01	1.43E-01	6.05E-01
		380.45		1.52	8.32E-01		2.92E+00
		427.87		29.60	-9.84E-03		1.43E-01
		463.36		10.49	2.32E-01		4.46E-01
		600.60		17.65	-2.27E-02		2.33E-01
		606.71		4.98	3.08E+00		1.70E+00
		635.95		11.22	-1.15E-01		3.99E-01
		671.44		1.79	1.77E-01		2.48E+00

Analysis Report for 31-Oct-18-10045

L1-10221F-FSGS-007SS

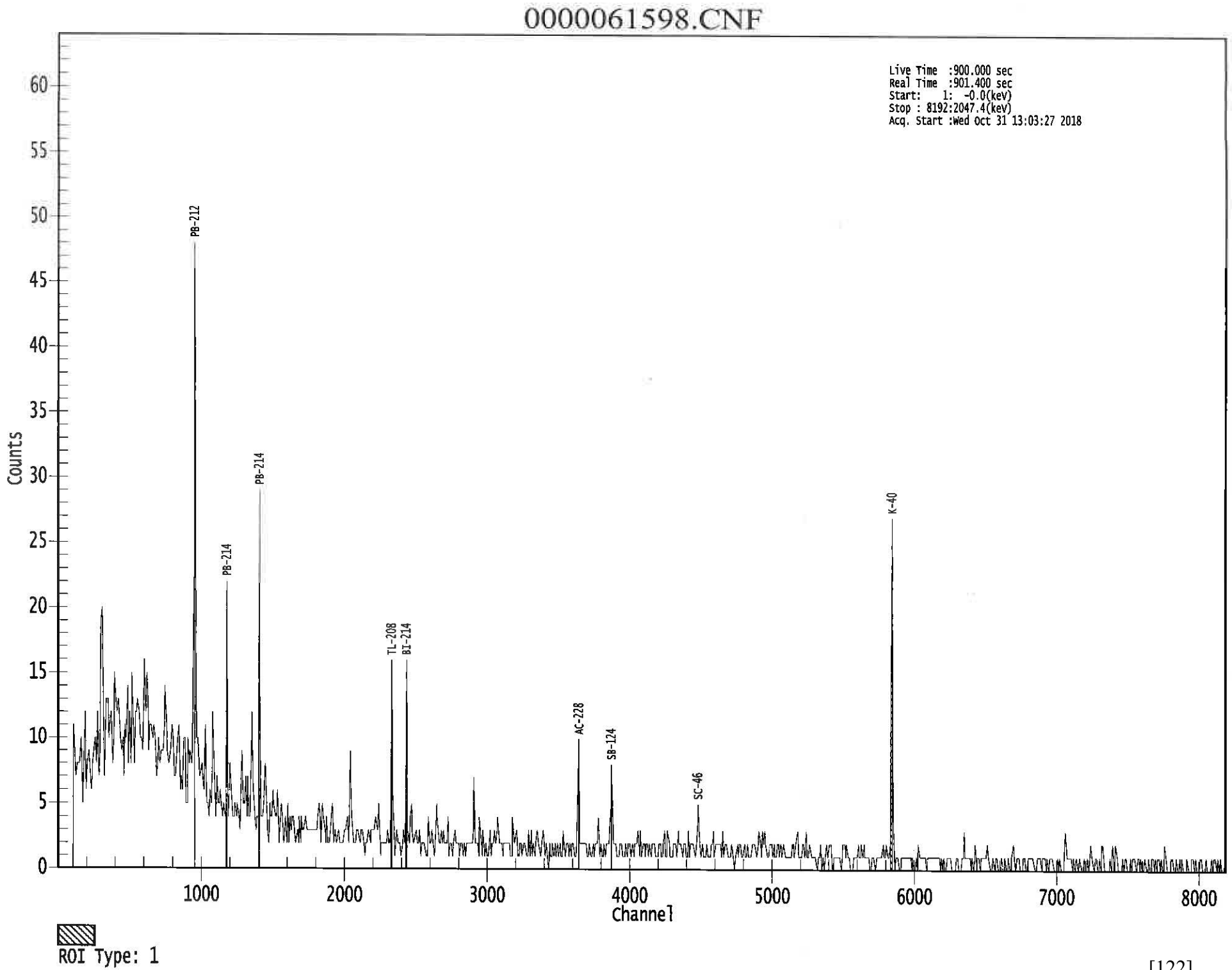
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-5.75E-01	8.30E-02	5.00E+00
	81.00	32.90	-5.59E-01		3.31E-01
	276.40	7.16	1.05E-01		6.02E-01
	302.85	18.34	-2.44E-02		2.26E-01
	356.01	62.05	-4.85E-02		8.30E-02
	383.85	8.94	2.46E-01		4.65E-01
Cs-134	475.36	1.48	1.25E+00	5.24E-02	3.23E+00
	563.25	8.34	-9.58E-02		5.09E-01
	569.33	15.37	-2.15E-01		2.67E-01
	604.72	97.62	-5.88E-02		7.66E-02
	795.86	85.46	-5.84E-02		5.24E-02
	801.95	8.69	8.45E-02		5.86E-01
	1038.61	0.99	2.11E-01		4.97E+00
	1167.97	1.79	2.71E+00		3.61E+00
	1365.19	3.02	-4.85E-01		1.31E+00
Cs-137	661.66	85.10	2.14E-02	5.47E-02	5.47E-02
Eu-152	121.78	28.67	-5.02E-02	1.49E-01	1.69E-01
	244.70	7.61	2.48E-01		6.37E-01
	295.94	0.45	6.70E+00		1.19E+01
	344.28	26.60	-1.65E-02		1.49E-01
	367.79	0.86	3.86E-03		4.86E+00
	411.12	2.24	1.15E+00		1.85E+00
	443.96	2.83	9.41E-02		1.47E+00
	488.68	0.42	1.24E-01		9.95E+00
	563.99	0.49	-4.82E-01		8.50E+00
	586.26	0.46	-4.41E+00		1.59E+01
	678.62	0.47	4.66E+00		9.60E+00
	688.67	0.86	-2.98E+00		4.41E+00
	719.35	0.28	7.35E-01		1.76E+01
	778.90	12.96	6.41E-02		3.59E-01
	810.45	0.32	-4.57E+00		1.46E+01
	867.37	4.26	-2.47E-01		8.51E-01
	919.33	0.43	2.70E+00		1.20E+01
	964.08	14.65	-1.36E-01		5.47E-01
	1085.87	10.24	3.83E-02		5.79E-01
	1089.74	1.73	2.17E+00		3.61E+00
	1112.07	13.69	1.12E-01		4.25E-01
	1212.95	1.43	-8.34E-01		3.98E+00
	1249.94	0.19	1.31E+01		3.56E+01
	1299.14	1.63	-1.73E+00		3.74E+00
	1408.01	21.07	1.54E-02		2.56E-01
	1457.64	0.50	1.03E+02		3.86E+01
	1528.10	0.28	-5.59E+00		1.52E+01
Eu-154	123.07	40.40	-1.79E-02	1.19E-01	1.19E-01
	247.93	6.89	3.03E-01		6.35E-01
	591.76	4.95	-3.47E-01		7.66E-01
	692.42	1.78	6.66E-01		2.62E+00
	723.30	20.06	1.25E-01		2.79E-01
	756.80	4.52	5.89E-01		1.20E+00
	873.18	12.08	7.74E-03		3.51E-01
	996.29	10.48	-1.91E-01		4.65E-01

Analysis Report for 31-Oct-18-10045

L1-10221F-FSGS-007SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	3.96E-02	1.19E-01	2.78E-01
	1274.43	34.80	1.40E-02		1.65E-01
	1596.48	1.80	3.98E-02		2.33E+00
Eu-155	45.30	1.31	-6.71E+00	2.84E-01	3.19E+01
	60.01	1.22	-6.14E-01		3.24E+01
	86.55	30.70	-1.09E-02		2.84E-01
	105.31	21.10	4.26E-02		3.13E-01
Ra-226	186.21	3.64	6.24E-01	1.31E+00	1.31E+00
Pa-231	27.36	10.30	6.39E+00	1.70E+00	4.07E+00
	283.69	1.70	4.91E-01		2.36E+00
	300.07	2.47	8.96E-01		1.70E+00
	302.65	2.20	-1.60E-01		1.88E+00
	330.06	1.40	4.86E-01		3.08E+00
U-235	143.76	10.96	1.30E-01	8.33E-02	4.40E-01
	163.33	5.08	-3.12E-01		8.77E-01
	185.71	57.20	7.16E-02		8.33E-02
	202.11	1.08	-6.03E-01		3.87E+00
	205.31	5.01	-3.70E-01		8.06E-01
Am-241	59.54	35.90	-3.58E-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


0000061598.CNF
Live Time :900.000 sec
Real Time :901.400 sec
Start: 1: -0.0(kev)
Stop : 8192:2047.4(kev)
Acq. Start :Wed Oct 31 13:03:27 2018
Counts
Channel
PB-212
PB-214
PB-214
TL-208
BI-214
AC-228
SB-124
SC-46
K-40
ROI Type: 1

[122]

Apex-Gamma

Analysis Report for 31-Oct-18-10046

L1-10221F-FSGS-008SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10046
Sample Description	: L1-10221F-FSGS-008SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.174E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 2:51:00PM
Acquisition Started	: 10/31/2018 1:03:34PM
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	: 10/15/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61599
Fill Height	: 1173.89 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

J. Parker 10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 1:18:47PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

J Graham

Analysis Report for 31-Oct-18-10046

L1-10221F-FSGS-008SS

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
	1	77.25	306 -	313	309.55	2.80E+01	11.96	5.60E+01	0.70
M	2	238.75	948 -	974	954.56	1.41E+02	12.30	2.93E+01	0.97
m	3	242.22	948 -	974	968.43	3.53E+01	7.12	3.15E+01	0.97
	4	295.36	1177 -	1186	1180.73	5.95E+01	9.84	1.65E+01	1.05
	5	352.02	1400 -	1414	1407.07	9.62E+01	13.70	3.18E+01	0.94
	6	510.99	2037 -	2048	2042.33	3.80E+01	8.70	1.50E+01	0.54
	7	582.78	2324 -	2337	2329.25	5.01E+01	7.97	4.95E+00	0.89
	8	609.38	2427 -	2442	2435.56	6.81E+01	9.26	5.94E+00	0.84
	9	910.65	3634 -	3647	3640.06	3.19E+01	8.10	1.21E+01	1.01
	10	1460.47	5829 -	5850	5839.80	2.52E+02	16.46	5.24E+00	1.94

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	1.00	511.00	*	100.00	5.21E-02	1.24E-02
K-40	0.98	1460.82	*	10.66	6.22E+00	4.88E-01
Tl-208	0.97	583.19	*	85.00	8.18E-02	1.39E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.39E-01	2.85E-02
		300.09		3.30		
Pb212-XR	0.99	74.82		10.28		

Analysis Report for 31-Oct-18-10046

L1-10221F-FSGS-008SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.99	77.11	*	17.10	2.05E-01	9.00E-02
		87.35		3.97		
		89.78		1.46		
Bi-214	1.00	609.32	*	45.49	2.14E-01	3.19E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	3.64E-01	7.90E-02
		295.22	*	18.42	2.73E-01	5.02E-02
		351.93	*	35.60	2.61E-01	4.26E-02
		785.96		1.06		
Pb214-XR	0.99	74.82		5.80		
		77.11	*	9.70	3.61E-01	1.60E-01
		87.35		2.24		
		89.78		0.82		
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.34E-01	6.04E-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 31-Oct-18-10046

L1-10221F-FSGS-008SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	1.000	5.21E-02	1.24E-02	
	K-40	0.980	6.22E+00	4.88E-01	
	Tl-208	0.974	8.18E-02	1.39E-02	
X	Bi-211	0.867			
	Pb-212	0.998	2.39E-01	2.85E-02	
?	Pb212-XR	0.998	2.05E-01	9.00E-02	
	Bi-214	1.000	2.14E-01	3.19E-02	
	Pb-214	0.998	2.81E-01	3.01E-02	
?	Pb214-XR	0.998	3.61E-01	1.60E-01	
	Ac-228	0.985	2.34E-01	6.04E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 31-Oct-18-10046

L1-10221F-FSGS-008SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 1:18:47PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
+	An Pk	511.00	*	100.00	5.21E-02	3.24E-02	3.24E-02
	BE-7	477.60		10.44	2.38E-01	4.20E-01	4.20E-01
+	K-40	1460.82	*	10.66	6.22E+00	4.37E-01	4.37E-01
	Co-60	1173.23		99.85	-5.64E-03	5.61E-02	5.61E-02
		1332.49		99.98	2.72E-02		5.71E-02
	Nb-94	702.65		99.81	-2.59E-02	4.33E-02	4.33E-02
		871.09		99.89	6.43E-03		4.84E-02
	Ag-108m	79.13		6.60	-3.28E-01	4.04E-02	1.13E+00
		433.94		90.50	-1.66E-03		4.04E-02
		614.28		89.80	-5.23E-02		6.06E-02
		722.94		90.80	3.05E-02		5.97E-02
	Sb-125	176.31		6.84	-2.14E-01	1.27E-01	4.08E-01
		380.45		1.52	-2.29E+00		2.15E+00
		427.87		29.60	1.78E-02		1.27E-01
		463.36		10.49	2.64E-01		3.76E-01
		600.60		17.65	-2.13E-01		2.17E-01
		606.71		4.98	1.92E+00		1.39E+00
		635.95		11.22	-1.90E-01		3.28E-01
		671.44		1.79	-8.81E-01		2.04E+00

Analysis Report for 31-Oct-18-10046

L1-10221F-FSGS-008SS

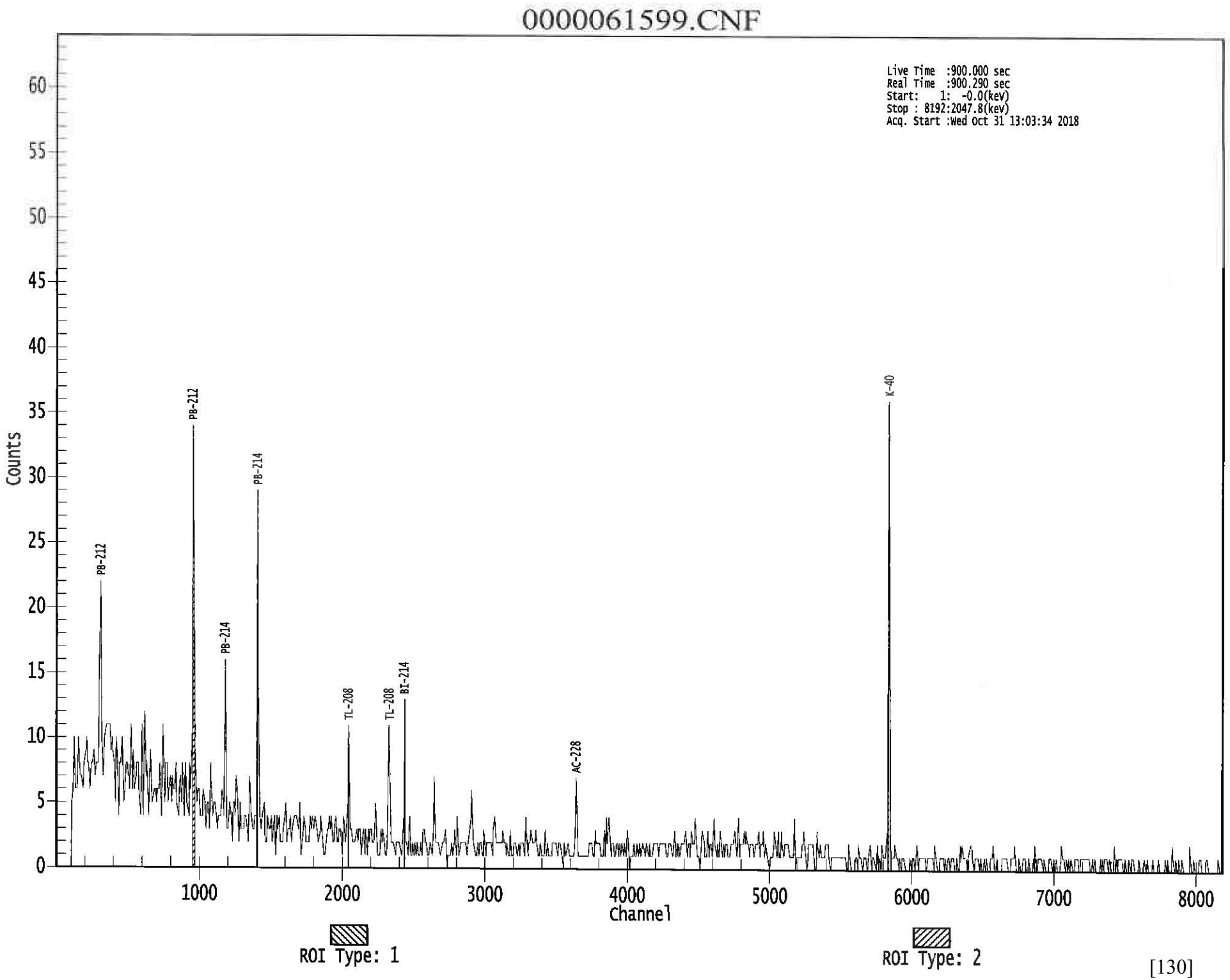
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-6.22E-01	7.76E-02	2.76E+00
	81.00	32.90	-1.62E-01		1.76E-01
	276.40	7.16	-3.69E-02		4.78E-01
	302.85	18.34	7.71E-02		1.76E-01
	356.01	62.05	-5.35E-02		7.76E-02
	383.85	8.94	3.17E-02		4.00E-01
Cs-134	475.36	1.48	4.84E-01	4.47E-02	2.59E+00
	563.25	8.34	-2.95E-01		3.89E-01
	569.33	15.37	-5.26E-02		2.22E-01
	604.72	97.62	-8.39E-03		5.74E-02
	795.86	85.46	-3.15E-02		4.47E-02
	801.95	8.69	-1.14E-02		4.30E-01
	1038.61	0.99	5.32E-01		4.89E+00
	1167.97	1.79	3.78E-01		3.44E+00
	1365.19	3.02	1.58E+00		1.98E+00
Cs-137	661.66	85.10	3.77E-02	6.57E-02	6.57E-02
Eu-152	121.78	28.67	-5.23E-02	1.08E-01	1.08E-01
	244.70	7.61	4.00E-03		5.13E-01
	295.94	0.45	7.30E+00		1.00E+01
	344.28	26.60	-5.14E-03		1.29E-01
	367.79	0.86	-1.19E+00		3.85E+00
	411.12	2.24	-4.61E-01		1.61E+00
	443.96	2.83	-6.10E-01		1.31E+00
	488.68	0.42	1.18E+00		9.03E+00
	563.99	0.49	-1.10E+01		5.76E+00
	586.26	0.46	-2.33E+00		1.29E+01
	678.62	0.47	3.68E+00		8.31E+00
	688.67	0.86	1.64E+00		4.12E+00
	719.35	0.28	3.69E+00		1.49E+01
	778.90	12.96	-1.72E-01		3.39E-01
	810.45	0.32	-8.45E+00		1.26E+01
	867.37	4.26	1.86E-01		1.05E+00
	919.33	0.43	-1.51E+00		9.29E+00
	964.08	14.65	2.73E-01		4.95E-01
	1085.87	10.24	7.31E-02		5.80E-01
	1089.74	1.73	-1.52E+00		3.27E+00
	1112.07	13.69	-3.20E-01		4.34E-01
	1212.95	1.43	-6.13E+00		4.78E+00
	1249.94	0.19	-1.18E+01		2.67E+01
	1299.14	1.63	1.22E+00		3.69E+00
	1408.01	21.07	3.11E-02		2.00E-01
	1457.64	0.50	1.31E+02		4.23E+01
	1528.10	0.28	9.68E+00		1.75E+01
Eu-154	123.07	40.40	-2.96E-02	8.01E-02	8.01E-02
	247.93	6.89	1.95E-01		4.84E-01
	591.76	4.95	-7.81E-02		7.63E-01
	692.42	1.78	-4.15E-01		2.28E+00
	723.30	20.06	1.45E-01		2.74E-01
	756.80	4.52	8.11E-01		9.36E-01
	873.18	12.08	-2.63E-01		4.02E-01
	996.29	10.48	-2.52E-03		4.79E-01

Analysis Report for 31-Oct-18-10046

L1-10221F-FSGS-008SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-1.30E-01	8.01E-02	2.42E-01
	1274.43	34.80	-7.07E-02		1.70E-01
	1596.48	1.80	-3.22E+00		2.45E+00
Eu-155	45.30	1.31	-1.41E+00	1.78E-01	1.17E+01
	60.01	1.22	-6.85E+00		1.10E+01
	86.55	30.70	8.32E-02		1.78E-01
	105.31	21.10	7.88E-03		1.87E-01
Ra-226	186.21	3.64	7.74E-01	9.43E-01	9.43E-01
Pa-231	27.36	10.30	7.17E-01	1.10E+00	1.10E+00
	283.69	1.70	-4.62E-01		1.77E+00
	300.07	2.47	-6.82E-01		1.32E+00
	302.65	2.20	6.49E-01		1.47E+00
	330.06	1.40	1.43E+00		2.55E+00
U-235	143.76	10.96	6.07E-02	5.89E-02	2.87E-01
	163.33	5.08	9.26E-02		6.29E-01
	185.71	57.20	4.17E-02		5.89E-02
	202.11	1.08	-6.59E-02		3.04E+00
	205.31	5.01	-2.26E-01		6.32E-01
Am-241	59.54	35.90	-4.21E-02	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


0000061599.CNF
Live Time :900.000 sec
Real Time :900.290 sec
Start: 1: -0.0(keV)
Stop : 8192:2047.8(keV)
Acq. Start :Wed Oct 31 13:03:34 2018
Counts
Channel
PB-212
PB-212
PB-214
PB-214
TL-208
TL-208
BI-214
AC-228
K-40
ROI Type: 1
ROI Type: 2

[130]

Apex-Gamma

Analysis Report for 31-Oct-18-10047

L1-10221F-FSGS-009SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10047
Sample Description	: L1-10221F-FSGS-009SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.406E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 2:54:00PM
Acquisition Started	: 10/31/2018 1:03:41PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61600
Fill Height	: 1406.15 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

J.F. Wright 10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 1:18:46PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

J Graham / C

Analysis Report for 31-Oct-18-10047

L1-10221F-FSGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	92.65	367 -	379	371.82	4.22E+01	11.75	3.58E+01	0.30
2	185.91	737 -	748	744.36	3.65E+01	11.74	4.05E+01	0.52
3	238.60	948 -	960	954.88	1.14E+02	16.06	5.46E+01	0.94
4	295.38	1173 -	1187	1181.72	4.29E+01	10.94	2.61E+01	0.60
5	351.88	1397 -	1415	1407.50	1.23E+02	13.97	2.14E+01	1.46
6	583.03	2323 -	2338	2331.44	5.30E+01	9.77	1.40E+01	0.96
7	609.24	2428 -	2444	2436.21	6.82E+01	10.69	1.48E+01	1.27
8	911.15	3636 -	3650	3643.64	3.19E+01	8.34	1.31E+01	0.37
9	1460.61	5831 -	5855	5842.80	2.43E+02	16.31	5.79E+00	2.07

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	5.22E+00	4.17E-01
Tl-208	0.99	583.19	*	85.00	7.74E-02	1.50E-02
Bi-211	0.90	351.07	*	13.02	8.30E-01	1.16E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.82E-01	2.95E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.92E-01	3.21E-02
		768.36		4.89		

Analysis Report for 31-Oct-18-10047

L1-10221F-FSGS-009SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	1.82E-01	4.85E-02
		351.93	*	35.60	3.04E-01	4.23E-02
		785.96		1.06		
Ra-226	0.98	186.21	*	3.64	6.22E-01	2.06E-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	2.06E-01	5.46E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		
Ac228-XR	0.95	89.96		1.90		
		93.35	*	3.10	1.35E+00	4.35E-01
Th-234	0.99	92.38		2.13		
		92.80	*	2.10	2.36E+00	7.33E-01
		112.81		0.21		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.96E-02	1.31E-02
		202.11		1.08		
		205.31		5.01		
U235-XR	0.95	89.96		3.47		
		93.35	*	5.60	7.46E-01	2.21E-01
		105.60		1.32		

Analysis Report for 31-Oct-18-10047

L1-10221F-FSGS-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	0.993	5.22E+00	4.17E-01	
	Tl-208	0.996	7.74E-02	1.50E-02	
	Bi-211	0.901	3.34E-01	1.76E-01	
	Pb-212	1.000	1.82E-01	2.95E-02	
	Bi-214	1.000	1.92E-01	3.21E-02	
	Pb-214	0.999	1.82E-01	4.85E-02	
?	Ra-226	0.986	6.22E-01	2.06E-01	
	Ac-228	1.000	2.06E-01	5.46E-02	
?	Ac228-XR	0.952	1.35E+00	4.35E-01	
?	Th-234	0.998	2.36E+00	7.33E-01	
?	~~U-235~~ Ra-226	~~0.996~~	3.96E-02	1.31E-02	
?	~~U235-XR~~ Th-234	~~0.959~~	7.46E-01	2.21E-01	

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

Errors quoted at 1.000sigma

JW 10-31-18

U-235 only 1 peak

U235-XR only 1 peak

Analysis Report for 31-Oct-18-10047

L1-10221F-FSGS-009SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 1:18:45PM
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	3.23E-02	5.55E-02	5.55E-02
	BE-7	477.60		10.44	4.11E-02	3.73E-01	3.73E-01
+	K-40	1460.82	*	10.66	5.22E+00	4.09E-01	4.09E-01
	Co-60	1173.23		99.85	3.28E-02	4.02E-02	6.40E-02
		1332.49		99.98	-5.44E-02		4.02E-02
	Nb-94	702.65		99.81	3.06E-02	4.28E-02	4.28E-02
		871.09		99.89	3.52E-02		4.99E-02
	Ag-108m	79.13		6.60	-7.33E-01	3.98E-02	1.44E+00
		433.94		90.50	9.36E-04		3.98E-02
		614.28		89.80	-5.17E-03		6.85E-02
		722.94		90.80	4.84E-02		5.35E-02
	Sb-125	176.31		6.84	4.55E-02	1.14E-01	4.72E-01
		380.45		1.52	1.05E+00		2.35E+00
		427.87		29.60	-6.82E-02		1.14E-01
		463.36		10.49	1.18E-01		3.42E-01
		600.60		17.65	2.44E-02		2.50E-01
		606.71		4.98	1.91E+00		1.37E+00
		635.95		11.22	1.70E-01		3.99E-01
		671.44		1.79	1.03E+00		2.45E+00

Analysis Report for 31-Oct-18-10047

L1-10221F-FSGS-009SS

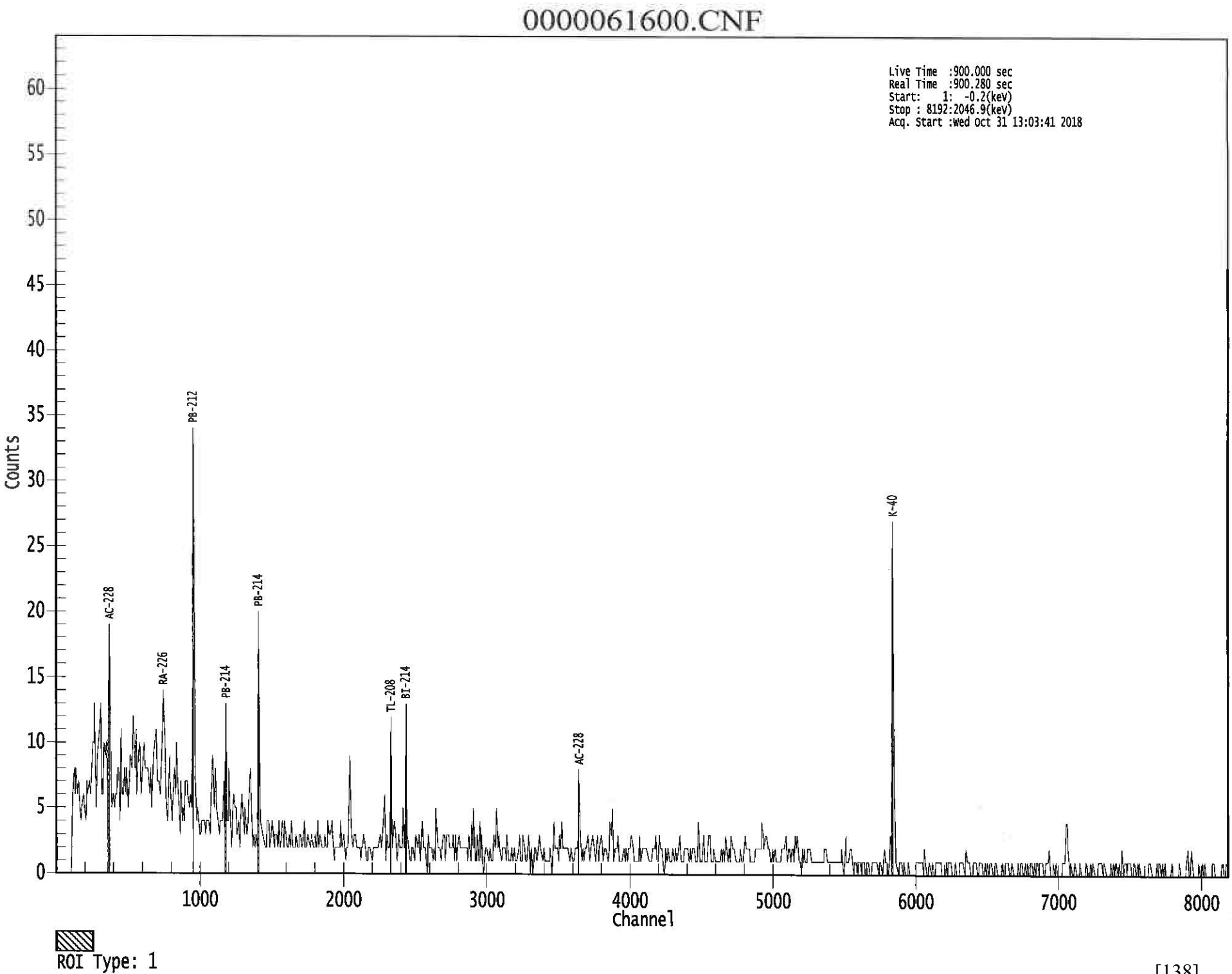
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-3.04E+00	7.86E-02	3.45E+00
	81.00	32.90	-3.81E-01		2.48E-01
	276.40	7.16	1.60E-01		5.14E-01
	302.85	18.34	4.12E-02		1.90E-01
	356.01	62.05	-4.30E-03		7.86E-02
	383.85	8.94	3.28E-02		3.86E-01
Cs-134	475.36	1.48	-5.17E-01	4.45E-02	2.36E+00
	563.25	8.34	-1.82E-01		4.20E-01
	569.33	15.37	4.38E-02		2.68E-01
	604.72	97.62	-5.06E-03		6.56E-02
	795.86	85.46	2.74E-02		4.45E-02
	801.95	8.69	8.86E-03		4.67E-01
	1038.61	0.99	4.58E-01		5.04E+00
	1167.97	1.79	9.31E-01		3.53E+00
	1365.19	3.02	6.11E-01		1.60E+00
Cs-137	661.66	85.10	3.73E-02	5.62E-02	5.62E-02
Eu-152	121.78	28.67	-6.43E-04	1.15E-01	1.28E-01
	244.70	7.61	1.85E-01		4.90E-01
	295.94	0.45	2.72E+00		9.36E+00
	344.28	26.60	-7.70E-02		1.15E-01
	367.79	0.86	7.92E-02		3.78E+00
	411.12	2.24	-1.17E+00		1.56E+00
	443.96	2.83	-6.47E-01		1.16E+00
	488.68	0.42	-5.88E+00		7.54E+00
	563.99	0.49	-5.80E+00		6.99E+00
	586.26	0.46	-3.65E-01		1.33E+01
	678.62	0.47	1.79E+00		9.09E+00
	688.67	0.86	1.89E+00		4.91E+00
	719.35	0.28	-4.06E+00		1.30E+01
	778.90	12.96	-2.90E-01		2.94E-01
	810.45	0.32	7.33E+00		1.34E+01
	867.37	4.26	-8.28E-01		1.09E+00
	919.33	0.43	-2.40E+01		1.11E+01
	964.08	14.65	9.16E-02		4.19E-01
	1085.87	10.24	-3.99E-02		4.73E-01
	1089.74	1.73	-1.03E+00		2.86E+00
	1112.07	13.69	-4.84E-01		3.59E-01
	1212.95	1.43	6.03E-01		3.92E+00
	1249.94	0.19	-1.73E+00		2.96E+01
	1299.14	1.63	2.74E-01		3.41E+00
	1408.01	21.07	4.73E-02		1.83E-01
	1457.64	0.50	1.13E+02		3.63E+01
	1528.10	0.28	5.04E+00		1.23E+01
Eu-154	123.07	40.40	-2.25E-02	9.19E-02	9.19E-02
	247.93	6.89	-1.70E-01		4.31E-01
	591.76	4.95	2.89E-02		8.12E-01
	692.42	1.78	5.87E-01		2.28E+00
	723.30	20.06	2.14E-01		2.42E-01
	756.80	4.52	1.52E-01		9.93E-01
	873.18	12.08	-3.69E-02		4.14E-01
	996.29	10.48	9.72E-02		5.07E-01

Analysis Report for 31-Oct-18-10047

L1-10221F-FSGS-009SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	-7.57E-02	9.19E-02	2.56E-01
		1274.43		34.80	-2.32E-02		1.74E-01
		1596.48		1.80	-3.28E+00		2.24E+00
	Eu-155	45.30		1.31	3.80E+00	2.02E-01	1.89E+01
		60.01		1.22	-2.13E+01		2.04E+01
		86.55		30.70	2.50E-02		2.29E-01
		105.31		21.10	-1.02E-02		2.02E-01
+	Ra-226	186.21	*	3.64	6.22E-01	6.30E-01	6.30E-01
	Pa-231	27.36		10.30	9.03E-01	1.51E+00	1.87E+00
		283.69		1.70	-1.82E-01		1.86E+00
		300.07		2.47	-4.75E-02		1.51E+00
		302.65		2.20	-1.87E-01		1.56E+00
		330.06		1.40	1.05E+00		2.52E+00
+	U-235	143.76		10.96	-1.88E-01	4.01E-02	3.41E-01
		163.33		5.08	1.08E-01		6.54E-01
		185.71	*	57.20	3.96E-02		4.01E-02
		202.11		1.08	-2.03E+00		2.99E+00
		205.31		5.01	-3.51E-01		6.73E-01
	Am-241	59.54		35.90	-1.48E-01	7.39E-01	7.39E-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


0000061600.CNF
Live Time :900.000 sec
Real Time :900.280 sec
Start: 1: -0.2(keV)
Stop : 8192:2046.9(keV)
Acq. Start :Wed Oct 31 13:03:41 2018
Counts
Channel
AC-228
RA-226
PB-212
PB-214
PB-214
TL-208
BI-214
AC-228
K-40
ROI Type: 1

Apex-Gamma

Analysis Report for 31-Oct-18-10048

L1-10221F-FSGS-010SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10048
Sample Description	: L1-10221F-FSGS-010SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 8.982E+02 grams
Facility	: Default
Sample Taken On	: 10/25/2018 2:57:00PM
Acquisition Started	: 10/31/2018 1:22:33PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61601
Fill Height	: 898.20 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 1:37:36PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 4096

DATA VALIDATED 11/1/18 1300

J Graham

Analysis Report for 31-Oct-18-10048

L1-10221F-FSGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.61	474 -	481	477.39	1.56E+02	18.93	9.71E+01	1.20
2	351.78	700 -	708	703.51	7.67E+01	11.99	3.13E+01	1.11
3	583.04	1161 -	1171	1165.68	4.62E+01	10.33	2.48E+01	1.17
4	609.34	1214 -	1223	1218.26	6.33E+01	9.34	1.07E+01	1.34
5	661.48	1317 -	1328	1322.48	9.84E+01	12.16	1.96E+01	1.66
6	911.05	1816 -	1827	1821.55	4.76E+01	8.13	7.40E+00	1.02
7	1460.66	2913 -	2928	2921.37	2.63E+02	16.22	0.00E+00	2.30

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	6.21E+00	4.68E-01
Cs-137	0.99	661.66	*	85.10	1.69E-01	2.32E-02
Tl-208	0.99	583.19	*	85.00	7.29E-02	1.69E-02
Bi-211	0.92	351.07	*	13.02	5.54E-01	9.75E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.61E-01	3.81E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	1.92E-01	3.06E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 31-Oct-18-10048

L1-10221F-FSGS-010SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.03E-01	3.56E-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	3.35E-01	5.90E-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 31-Oct-18-10048

L1-10221F-FSGS-010SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.996	6.21E+00	4.68E-01	
	Cs-137	0.995	1.69E-01	2.32E-02	
	Tl-208	0.997	7.29E-02	1.69E-02	
?	Bi-211	0.922	5.54E-01	9.75E-02	
	Pb-212	1.000	2.61E-01	3.81E-02	
	Bi-214	1.000	1.92E-01	3.06E-02	
?	Pb-214	0.998	2.03E-01	3.56E-02	
	Ac-228	0.999	3.35E-01	5.90E-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 31-Oct-18-10048

L1-10221F-FSGS-010SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 1:37:36PM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.78E-02	6.59E-02	6.59E-02
	BE-7	477.60		10.44	2.80E-01	4.80E-01	4.80E-01
+	K-40	1460.82	*	10.66	6.21E+00	6.79E-02	6.79E-02
	Co-60	1173.23		99.85	-5.27E-03	5.37E-02	5.37E-02
		1332.49		99.98	2.23E-02		6.31E-02
	Nb-94	702.65		99.81	-2.99E-02	3.95E-02	3.95E-02
		871.09		99.89	2.01E-02		4.98E-02
	Ag-108m	79.13		6.60	2.67E-01	4.01E-02	1.18E+00
		433.94		90.50	-1.50E-02		4.01E-02
		614.28		89.80	-2.50E-02		5.80E-02
		722.94		90.80	1.35E-03		5.55E-02
	Sb-125	176.31		6.84	2.53E-01	1.19E-01	5.92E-01
		380.45		1.52	7.74E-01		2.45E+00
		427.87		29.60	-4.75E-02		1.19E-01
		463.36		10.49	6.45E-03		3.84E-01
		600.60		17.65	9.78E-02		2.37E-01
		606.71		4.98	-7.18E-01		1.32E+00
		635.95		11.22	1.91E-01		3.98E-01
		671.44		1.79	-7.24E-02		2.41E+00

Analysis Report for 31-Oct-18-10048

L1-10221F-FSGS-010SS

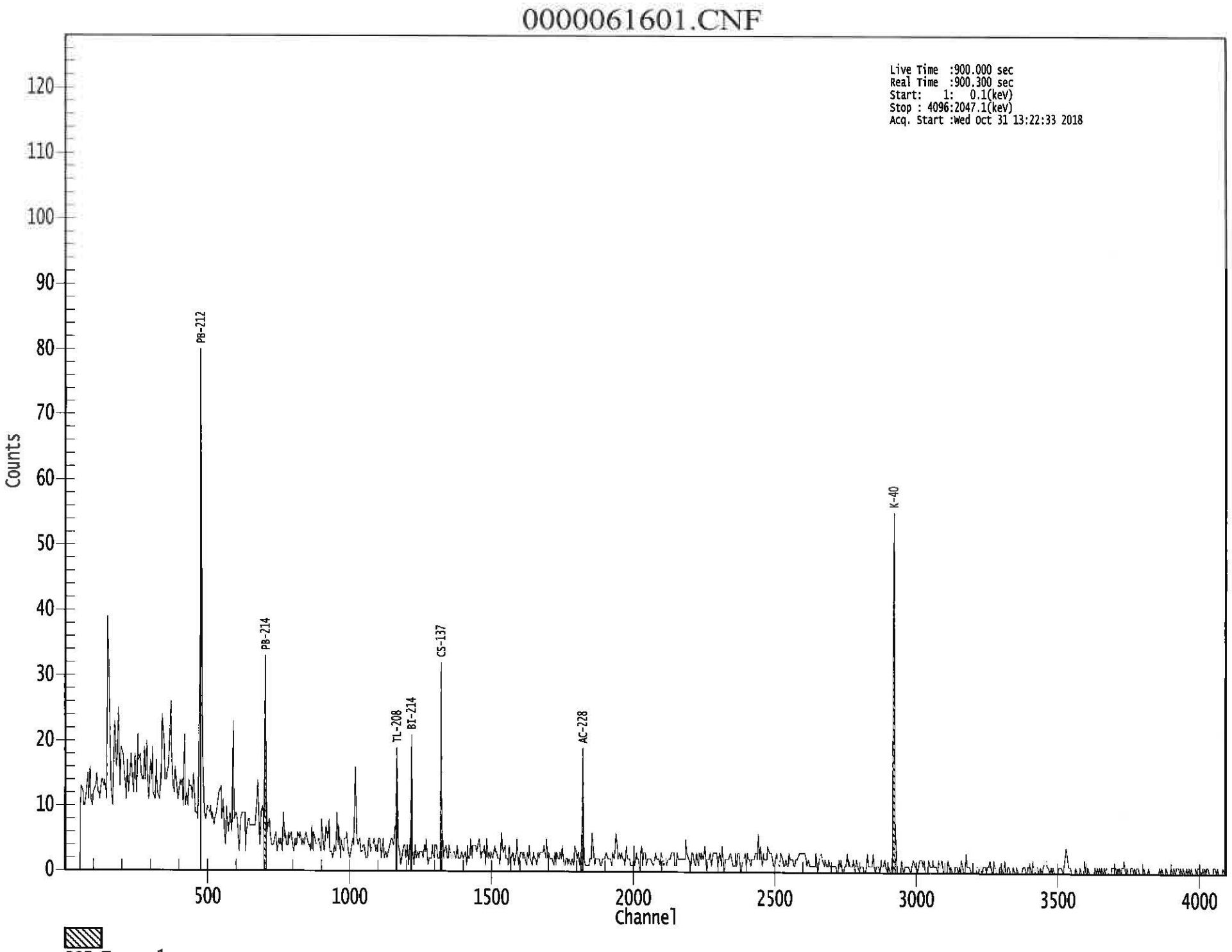
	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	7.88E-01	8.04E-02	2.75E+00
		81.00		32.90	-1.95E-01		1.79E-01
		276.40		7.16	6.17E-02		4.99E-01
		302.85		18.34	3.36E-02		1.85E-01
		356.01		62.05	-1.08E-02		8.04E-02
		383.85		8.94	5.90E-02		4.28E-01
	Cs-134	475.36		1.48	1.89E+00	5.04E-02	3.12E+00
		563.25		8.34	-7.82E-02		4.39E-01
		569.33		15.37	3.09E-02		2.55E-01
		604.72		97.62	-3.48E-02		5.84E-02
		795.86		85.46	-4.55E-03		5.04E-02
		801.95		8.69	-5.30E-02		4.98E-01
		1038.61		0.99	-8.90E-02		4.57E+00
		1167.97		1.79	1.08E+00		2.93E+00
		1365.19		3.02	4.62E-01		1.37E+00
+	Cs-137	661.66	*	85.10	1.69E-01	4.59E-02	4.59E-02
	Eu-152	121.78		28.67	1.66E-02	1.20E-01	1.20E-01
		244.70		7.61	1.81E-02		5.10E-01
		295.94		0.45	7.29E+00		9.99E+00
		344.28		26.60	-1.23E-01		1.42E-01
		367.79		0.86	-2.26E-01		3.88E+00
		411.12		2.24	2.36E-01		1.76E+00
		443.96		2.83	-1.13E-01		1.42E+00
		488.68		0.42	-6.25E-02		9.71E+00
		563.99		0.49	-3.41E+00		6.91E+00
		586.26		0.46	-1.97E+00		1.31E+01
		678.62		0.47	-3.32E+00		9.05E+00
		688.67		0.86	1.39E+00		4.78E+00
		719.35		0.28	-1.09E+00		1.62E+01
		778.90		12.96	7.27E-02		3.20E-01
		810.45		0.32	-3.73E+00		1.38E+01
		867.37		4.26	1.59E-01		1.11E+00
		919.33		0.43	-1.06E+01		8.34E+00
		964.08		14.65	-7.23E-02		3.76E-01
		1085.87		10.24	-2.90E-01		4.86E-01
		1089.74		1.73	-5.70E-02		3.24E+00
		1112.07		13.69	-1.33E-01		3.44E-01
		1212.95		1.43	8.59E-01		4.43E+00
		1249.94		0.19	1.61E+01		3.19E+01
		1299.14		1.63	1.73E+00		4.26E+00
		1408.01		21.07	-3.92E-02		1.91E-01
		1457.64		0.50	-8.25E+00		4.03E+01
		1528.10		0.28	-8.55E+00		1.60E+01
	Eu-154	123.07		40.40	2.86E-03	8.24E-02	8.24E-02
		247.93		6.89	7.18E-02		4.92E-01
		591.76		4.95	-4.09E-01		6.81E-01
		692.42		1.78	-4.29E-01		2.11E+00
		723.30		20.06	-2.76E-02		2.51E-01
		756.80		4.52	4.82E-01		1.06E+00
		873.18		12.08	1.87E-01		3.99E-01
		996.29		10.48	-1.03E-01		3.84E-01

Analysis Report for 31-Oct-18-10048

L1-10221F-FSGS-010SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	2.24E-01	8.24E-02	2.95E-01
	1274.43	34.80	5.05E-02		1.69E-01
	1596.48	1.80	5.78E-01		2.04E+00
Eu-155	45.30	1.31	-3.04E-01	1.78E-01	1.21E+01
	60.01	1.22	-2.14E+00		1.25E+01
	86.55	30.70	3.98E-02		1.78E-01
	105.31	21.10	-9.26E-03		1.89E-01
Ra-226	186.21	3.64	1.63E-01	1.13E+00	1.13E+00
Pa-231	27.36	10.30	8.48E-01	1.18E+00	1.18E+00
	283.69	1.70	8.45E-01		2.07E+00
	300.07	2.47	-1.81E+00		1.44E+00
	302.65	2.20	2.80E-01		1.54E+00
	330.06	1.40	7.54E-01		2.90E+00
U-235	143.76	10.96	2.51E-01	7.39E-02	3.20E-01
	163.33	5.08	-2.99E-01		7.38E-01
	185.71	57.20	3.72E-02		7.39E-02
	202.11	1.08	-8.35E-01		3.35E+00
	205.31	5.01	-4.70E-01		7.57E-01
Am-241	59.54	35.90	-7.03E-02	4.41E-01	4.41E-01

\+ = Nuclide identified during the nuclide identification
* = Energy line found in the spectrum
\> = MDA value not calculated
@ = Half-life too short to be able to perform the decay correction
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level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Live Time :900.000 sec
Real Time :900.300 sec
Start: 1: 0.1(keV)
Stop : 4096:2047.1(keV)
Acq. Start :Wed Oct 31 13:22:33 2018
Counts
Channel
PB-212
PB-214
TL-208
BI-214
CS-137
AC-228
K-40
ROI Type: 1

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Apex-Gamma

Analysis Report for 31-Oct-18-10049

L1-10221F-FSGS-011SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10049
Sample Description	: L1-10221F-FSGS-011SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.141E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 3:00:00PM
Acquisition Started	: 10/31/2018 1:22:39PM
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	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61602
Fill Height	: 1140.55 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 1:37:44PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

J Graham

Analysis Report for 31-Oct-18-10049

L1-10221F-FSGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.60	947 -	960	954.48	1.11E+02	17.14	6.58E+01	0.85
2	351.89	1402 -	1413	1407.29	6.97E+01	10.97	2.03E+01	0.92
3	583.09	2327 -	2337	2331.59	3.03E+01	7.97	1.38E+01	0.99
4	609.13	2430 -	2443	2435.68	4.92E+01	8.57	7.82E+00	0.56
5	661.59	2637 -	2654	2645.44	1.07E+02	13.05	1.86E+01	1.29
6	910.89	3638 -	3648	3642.54	3.20E+01	6.47	3.98E+00	0.62
7	1460.50	5831 -	5853	5841.83	2.38E+02	16.06	5.46E+00	1.40

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	6.61E+00	5.31E-01
Cs-137	0.99	661.66	*	85.10	2.15E-01	2.92E-02
Tl-208	0.99	583.19	*	85.00	5.56E-02	1.50E-02
Bi-211	0.89	351.07	*	13.02	5.82E-01	1.03E-01
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.15E-01	3.75E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.74E-01	3.21E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 31-Oct-18-10049

L1-10221F-FSGS-011SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.13E-01	3.76E-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	2.64E-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 31-Oct-18-10049

L1-10221F-FSGS-011SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.984	6.61E+00	5.31E-01	
	Cs-137	0.999	2.15E-01	2.92E-02	
	Tl-208	0.999	5.56E-02	1.50E-02	
?	Bi-211	0.898	5.82E-01	1.03E-01	
	Pb-212	1.000	2.15E-01	3.75E-02	
	Bi-214	0.998	1.74E-01	3.21E-02	
?	Pb-214	1.000	2.13E-01	3.76E-02	
	Ac-228	0.995	2.64E-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 31-Oct-18-10049

L1-10221F-FSGS-011SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 1:37:44PM
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	7.94E-02	7.11E-02	7.11E-02
	BE-7	477.60		10.44	4.72E-01	5.39E-01	5.39E-01
+	K-40	1460.82	*	10.66	6.61E+00	5.08E-01	5.08E-01
	Co-60	1173.23		99.85	4.36E-02	5.20E-02	7.94E-02
		1332.49		99.98	-4.85E-03		5.20E-02
	Nb-94	702.65		99.81	2.85E-03	4.16E-02	5.49E-02
		871.09		99.89	7.53E-04		4.16E-02
	Ag-108m	79.13		6.60	1.94E-01	5.15E-02	2.04E+00
		433.94		90.50	-3.50E-03		5.15E-02
		614.28		89.80	4.85E-04		6.75E-02
		722.94		90.80	-4.87E-03		6.16E-02
	Sb-125	176.31		6.84	-6.00E-01	1.46E-01	5.90E-01
		380.45		1.52	-3.81E-01		3.08E+00
		427.87		29.60	-3.19E-03		1.46E-01
		463.36		10.49	8.22E-02		5.20E-01
		600.60		17.65	4.62E-02		2.56E-01
		606.71		4.98	1.21E+00		1.35E+00
		635.95		11.22	5.28E-02		4.58E-01
		671.44		1.79	4.86E-01		2.35E+00

Analysis Report for 31-Oct-18-10049

L1-10221F-FSGS-011SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Ba-133	79.61		2.65	-8.49E-01	8.05E-02	4.89E+00
		81.00		32.90	-1.70E-01		3.46E-01
		276.40		7.16	-1.84E-01		6.01E-01
		302.85		18.34	1.77E-01		2.58E-01
		356.01		62.05	-4.33E-02		8.05E-02
		383.85		8.94	-3.03E-02		5.20E-01
	Cs-134	475.36		1.48	3.91E-01	6.44E-02	3.32E+00
		563.25		8.34	-2.84E-01		4.84E-01
		569.33		15.37	2.14E-01		3.14E-01
		604.72		97.62	-6.40E-02		6.44E-02
		795.86		85.46	1.10E-02		6.64E-02
		801.95		8.69	-2.52E-02		6.05E-01
		1038.61		0.99	3.79E+00		5.22E+00
		1167.97		1.79	-4.27E-01		4.07E+00
		1365.19		3.02	-6.33E-01		1.76E+00
+	Cs-137	661.66	*	85.10	2.15E-01	5.96E-02	5.96E-02
	Eu-152	121.78		28.67	-1.60E-02	1.68E-01	1.71E-01
		244.70		7.61	-5.32E-02		5.54E-01
		295.94		0.45	5.84E-01		1.12E+01
		344.28		26.60	1.27E-02		1.68E-01
		367.79		0.86	-2.03E-01		4.43E+00
		411.12		2.24	1.87E+00		2.16E+00
		443.96		2.83	7.26E-01		1.46E+00
		488.68		0.42	-1.85E+00		1.11E+01
		563.99		0.49	2.11E-01		8.78E+00
		586.26		0.46	1.09E+01		1.42E+01
		678.62		0.47	1.66E+00		9.70E+00
		688.67		0.86	1.33E+00		5.58E+00
		719.35		0.28	-6.74E-01		1.74E+01
		778.90		12.96	-1.94E-01		3.74E-01
		810.45		0.32	4.37E+00		1.55E+01
		867.37		4.26	3.71E-01		1.22E+00
		919.33		0.43	8.53E+00		1.39E+01
		964.08		14.65	4.96E-01		5.57E-01
		1085.87		10.24	-4.33E-01		4.58E-01
		1089.74		1.73	-1.46E+00		3.16E+00
		1112.07		13.69	2.68E-01		4.96E-01
		1212.95		1.43	-6.95E-01		4.42E+00
		1249.94		0.19	-1.67E+01		3.41E+01
		1299.14		1.63	6.27E-03		4.07E+00
		1408.01		21.07	-1.80E-01		2.67E-01
		1457.64		0.50	1.39E+02		4.61E+01
		1528.10		0.28	-1.48E+00		1.70E+01
	Eu-154	123.07		40.40	1.49E-02	1.19E-01	1.19E-01
		247.93		6.89	-5.15E-02		5.55E-01
		591.76		4.95	-1.92E-01		9.01E-01
		692.42		1.78	1.26E-01		2.61E+00
		723.30		20.06	-1.16E-01		2.79E-01
		756.80		4.52	-1.60E-01		1.07E+00
		873.18		12.08	-2.56E-01		3.21E-01
		996.29		10.48	1.06E-01		4.78E-01

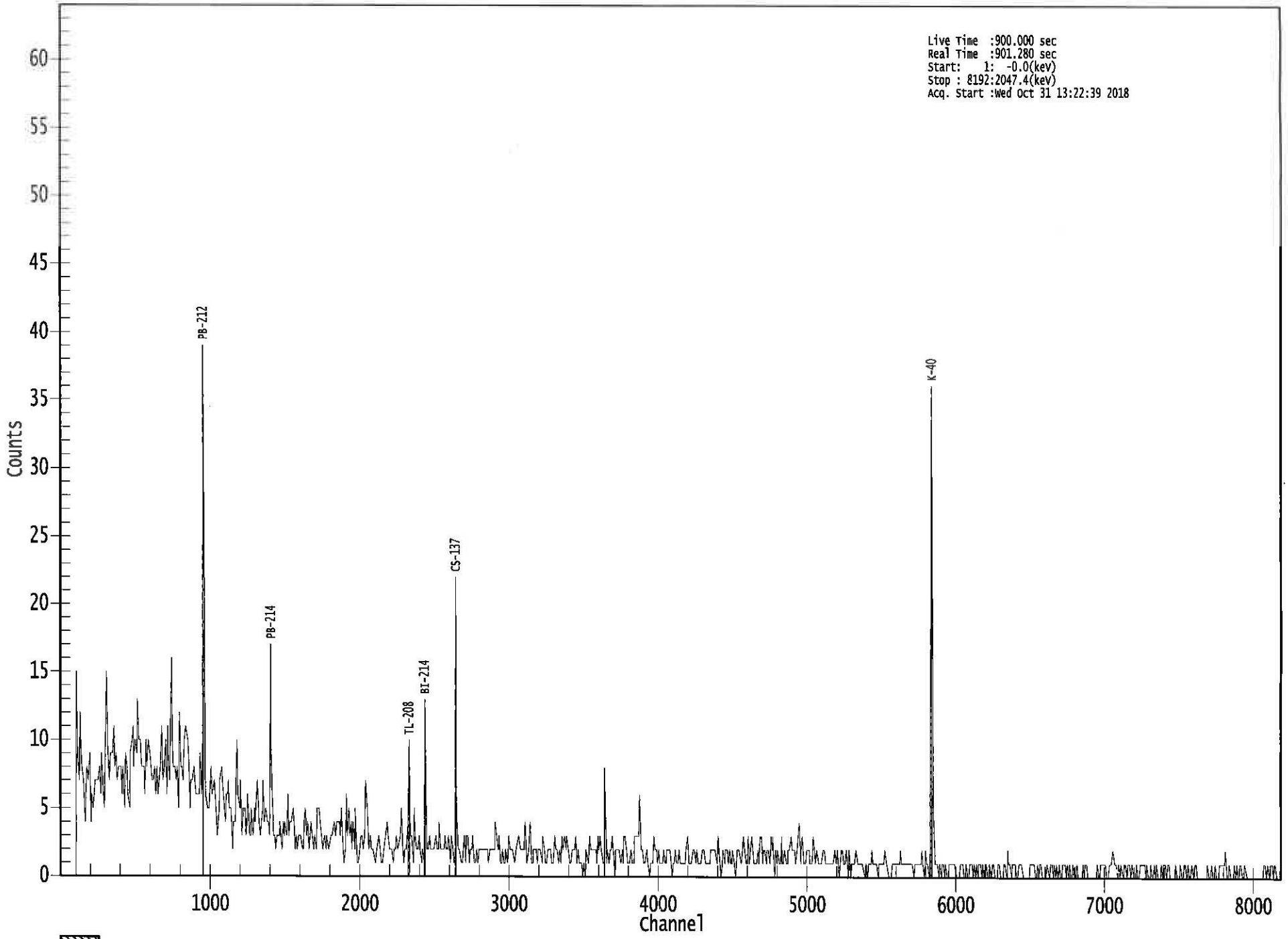
Analysis Report for 31-Oct-18-10049

L1-10221F-FSGS-011SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-1.62E-02	1.19E-01	2.80E-01
	1274.43	34.80	-5.95E-02		1.65E-01
	1596.48	1.80	8.87E-01		2.41E+00
Eu-155	45.30	1.31	6.12E-01	2.61E-01	3.11E+01
	60.01	1.22	-2.16E-01		3.16E+01
	86.55	30.70	-6.86E-02		2.84E-01
	105.31	21.10	-1.08E-01		2.61E-01
Ra-226	186.21	3.64	1.02E+00	1.25E+00	1.25E+00
Pa-231	27.36	10.30	2.90E+00	1.77E+00	3.56E+00
	283.69	1.70	-3.03E-01		2.50E+00
	300.07	2.47	-1.60E+00		1.77E+00
	302.65	2.20	7.30E-01		2.12E+00
	330.06	1.40	9.94E-01		3.25E+00
U-235	143.76	10.96	-1.35E-01	8.00E-02	4.06E-01
	163.33	5.08	3.31E-01		7.93E-01
	185.71	57.20	5.77E-02		8.00E-02
	202.11	1.08	-1.20E+00		3.79E+00
	205.31	5.01	-2.41E-01		8.41E-01
Am-241	59.54	35.90	1.57E-02	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

0000061602.CNF



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Apex-Gamma

Analysis Report for 31-Oct-18-10050

L1-10221F-FSGS-012SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10050
Sample Description	: L1-10221F-FSGS-012SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.131E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 3:03:00PM
Acquisition Started	: 10/31/2018 1:22:46PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.4 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 10/15/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61603
Fill Height	: 1131.03 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 1:38:05PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

J Graham

Analysis Report for 31-Oct-18-10050
L1-10221F-FSGS-012SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	77.51	306 -	317	310.55	5.54E+01	15.01	6.66E+01	0.67
2	185.88	739 -	749	743.37	3.93E+01	11.49	3.87E+01	0.92
3	238.80	948 -	961	954.77	1.34E+02	17.54	6.31E+01	1.15
4	295.17	1175 -	1188	1179.98	6.67E+01	12.05	2.83E+01	0.85
5	352.12	1400 -	1415	1407.51	1.00E+02	12.39	1.78E+01	0.73
6	583.06	2325 -	2335	2330.36	2.88E+01	8.10	1.52E+01	0.78
7	609.29	2428 -	2442	2435.22	7.23E+01	9.74	7.67E+00	1.56
8	910.65	3633 -	3646	3640.08	3.53E+01	7.69	8.69E+00	0.73
9	1460.34	5827 -	5851	5839.28	2.82E+02	16.79	0.00E+00	1.46

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.96	1460.82	*	10.66	7.08E+00	5.22E-01
Tl-208	0.99	583.19	*	85.00	4.77E-02	1.37E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.31E-01	3.55E-02
		300.09		3.30		
Pb212-XR	0.98	74.82		10.28		
		77.11	*	17.10	4.06E-01	1.18E-01
		87.35		3.97		

Analysis Report for 31-Oct-18-10050

L1-10221F-FSGS-012SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Pb212-XR	0.98	89.78		1.46		
Bi-214	1.00	609.32	*	45.49	2.31E-01	3.41E-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	3.11E-01	6.14E-02
		351.93	*	35.60	2.76E-01	4.06E-02
		785.96		1.06		
Pb214-XR	0.98	74.82		5.80		
		77.11	*	9.70	7.15E-01	2.10E-01
		87.35		2.24		
		89.78		0.82		
Ra-226	0.98	186.21	*	3.64	7.08E-01	2.15E-01
Ac-228	0.98	129.07		2.42		
		209.25		3.89		
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.64E-01	5.86E-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	4.51E-02	1.37E-02
		202.11		1.08		
		205.31		5.01		

Analysis Report for 31-Oct-18-10050

L1-10221F-FSGS-012SS

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

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.963	7.08E+00	5.22E-01	
	Tl-208	0.997	4.77E-02	1.37E-02	
	Pb-212	0.996	2.31E-01	3.55E-02	
?	Pb212-XR	0.987	4.06E-01	1.18E-01	
	Bi-214	1.000	2.31E-01	3.41E-02	
	Pb-214	0.997	2.87E-01	3.39E-02	
?	Pb214-XR	0.987	7.15E-01	2.10E-01	
?	Ra-226	0.982	7.08E-01	2.15E-01	
	Ac-228	0.985	2.64E-01	5.86E-02	
?	~~U-235~~ Ra-226	~~0.997~~ 0.982	~~4.51E-02~~ 7.08E-01	~~1.37E-02~~ 2.15E-01	

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

Errors quoted at 1.000sigma

JMW 10-31-18

U-235 only 1 peak

Analysis Report for 31-Oct-18-10050

L1-10221F-FSGS-012SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 1:38:05PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

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	4.81E-02	6.20E-02	6.20E-02
	BE-7	477.60		10.44	-1.14E-02	4.53E-01	4.53E-01
+	K-40	1460.82	*	10.66	7.08E+00	7.22E-02	7.22E-02
	Co-60	1173.23		99.85	5.90E-02	5.80E-02	6.79E-02
		1332.49		99.98	4.50E-02		5.80E-02
	Nb-94	702.65		99.81	-1.19E-02	4.54E-02	4.90E-02
		871.09		99.89	-9.33E-04		4.54E-02
	Ag-108m	79.13		6.60	1.18E-01	4.51E-02	1.17E+00
		433.94		90.50	9.39E-03		4.51E-02
		614.28		89.80	-4.14E-03		6.21E-02
		722.94		90.80	2.57E-02		6.33E-02
	Sb-125	176.31		6.84	-2.11E-01	1.30E-01	4.39E-01
		380.45		1.52	-8.91E-01		2.36E+00
		427.87		29.60	4.34E-02		1.30E-01
		463.36		10.49	-3.87E-02		4.14E-01
		600.60		17.65	4.67E-02		2.31E-01
		606.71		4.98	2.24E+00		1.46E+00
		635.95		11.22	-1.76E-01		3.67E-01
		671.44		1.79	-4.78E-01		2.34E+00

Analysis Report for 31-Oct-18-10050

L1-10221F-FSGS-012SS

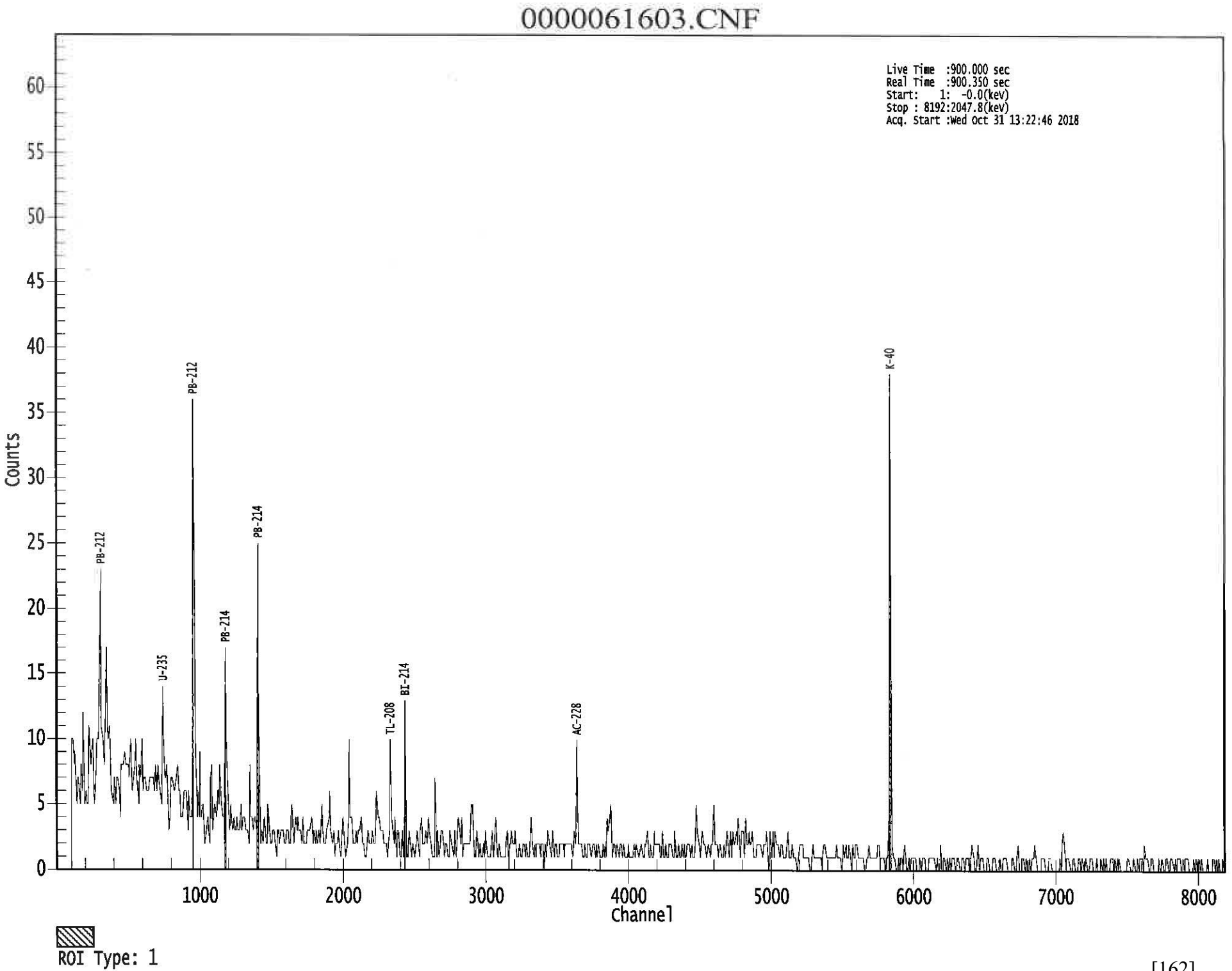
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	4.32E-01	7.43E-02	2.88E+00
	81.00	32.90	-5.47E-02		1.76E-01
	276.40	7.16	-3.17E-01		4.23E-01
	302.85	18.34	1.15E-01		1.80E-01
	356.01	62.05	-2.11E-02		7.43E-02
	383.85	8.94	-5.08E-02		4.10E-01
Cs-134	475.36	1.48	1.12E+00	5.53E-02	3.14E+00
	563.25	8.34	-6.29E-02		5.76E-01
	569.33	15.37	-8.05E-02		2.52E-01
	604.72	97.62	-2.67E-03		6.06E-02
	795.86	85.46	3.40E-03		5.53E-02
	801.95	8.69	3.21E-01		5.57E-01
	1038.61	0.99	1.64E+00		4.46E+00
	1167.97	1.79	-2.28E+00		3.44E+00
	1365.19	3.02	5.08E-01		1.71E+00
Cs-137	661.66	85.10	5.24E-02	6.29E-02	6.29E-02
Eu-152	121.78	28.67	2.65E-02	1.26E-01	1.26E-01
	244.70	7.61	1.41E-01		5.10E-01
	295.94	0.45	1.05E+01		1.06E+01
	344.28	26.60	-3.69E-02		1.31E-01
	367.79	0.86	-2.94E-01		4.08E+00
	411.12	2.24	6.39E-01		1.74E+00
	443.96	2.83	-4.33E-01		1.38E+00
	488.68	0.42	1.41E+00		8.77E+00
	563.99	0.49	-6.70E+00		9.11E+00
	586.26	0.46	-8.61E+00		1.34E+01
	678.62	0.47	1.16E-01		8.93E+00
	688.67	0.86	1.14E+00		5.46E+00
	719.35	0.28	-1.74E+01		1.54E+01
	778.90	12.96	-1.12E-01		3.02E-01
	810.45	0.32	-7.74E+00		1.11E+01
	867.37	4.26	5.60E-01		1.13E+00
	919.33	0.43	-6.68E+00		1.08E+01
	964.08	14.65	4.33E-02		4.80E-01
	1085.87	10.24	3.42E-01		5.80E-01
	1089.74	1.73	1.16E+00		3.13E+00
	1112.07	13.69	-1.11E-01		4.17E-01
	1212.95	1.43	-2.49E-01		5.64E+00
	1249.94	0.19	-3.18E+01		3.46E+01
	1299.14	1.63	3.02E-01		3.14E+00
	1408.01	21.07	5.61E-02		2.57E-01
	1457.64	0.50	1.51E+02		4.45E+01
	1528.10	0.28	-4.18E+00		1.70E+01
Eu-154	123.07	40.40	-2.37E-02	8.73E-02	8.73E-02
	247.93	6.89	2.95E-01		4.90E-01
	591.76	4.95	-4.45E-02		8.77E-01
	692.42	1.78	9.60E-03		2.80E+00
	723.30	20.06	1.25E-01		2.90E-01
	756.80	4.52	-8.18E-01		9.31E-01
	873.18	12.08	-1.51E-01		4.08E-01
	996.29	10.48	1.96E-01		4.32E-01

Analysis Report for 31-Oct-18-10050

L1-10221F-FSGS-012SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	7.73E-02	8.73E-02	2.66E-01
		1274.43		34.80	1.65E-01		2.03E-01
		1596.48		1.80	1.60E+00		2.89E+00
	Eu-155	45.30		1.31	1.88E+00	1.84E-01	1.18E+01
		60.01		1.22	-6.83E+00		1.28E+01
		86.55		30.70	1.19E-01		2.07E-01
		105.31		21.10	2.88E-02		1.84E-01
+	Ra-226	186.21	*	3.64	7.08E-01	6.41E-01	6.41E-01
	Pa-231	27.36		10.30	1.26E+00	1.44E+00	1.44E+00
		283.69		1.70	5.13E-01		2.12E+00
		300.07		2.47	-1.61E+00		1.48E+00
		302.65		2.20	4.37E-01		1.48E+00
		330.06		1.40	2.10E-01		2.61E+00
+	U-235	143.76		10.96	-9.51E-02	4.08E-02	2.98E-01
		163.33		5.08	3.81E-03		6.06E-01
		185.71	*	57.20	4.51E-02		4.08E-02
		202.11		1.08	3.05E-01		3.20E+00
		205.31		5.01	-4.32E-01		6.44E-01
	Am-241	59.54		35.90	-5.81E-03	4.61E-01	4.61E-01

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


0000061603.CNF
Live Time :900.000 sec
Real Time :900.350 sec
Start: 1: -0.0(keV)
Stop : 8192:2047.8(keV)
Acq. Start :Wed Oct 31 13:22:46 2018
Counts
Channel
PB-212
U-235
PB-212
PB-214
PB-214
TL-208
BI-214
AC-228
K-40
ROI Type: 1

[162]

Apex-Gamma

Analysis Report for 31-Oct-18-10051

L1-10221F-FSGS-013SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10051
Sample Description	: L1-10221F-FSGS-013SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.036E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 3:06:00PM
Acquisition Started	: 10/31/2018 1:22:52PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 352
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61604
Fill Height	: 1036.00 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/7/2013 12:00:00PM

J.P. 10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 1:37:57PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

J Graham / C

Analysis Report for 31-Oct-18-10051

L1-10221F-FSGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	185.86	738 -	751	744.16	4.50E+01	13.41	4.90E+01	0.93
2	209.38	835 -	842	838.14	2.02E+01	7.77	1.88E+01	0.52
3	238.61	950 -	960	954.92	8.95E+01	14.67	5.25E+01	1.05
4	294.97	1175 -	1187	1180.11	5.37E+01	10.73	2.33E+01	0.60
5	351.92	1400 -	1414	1407.66	1.07E+02	14.10	3.19E+01	0.90
6	510.95	2038 -	2049	2043.27	2.89E+01	9.73	2.61E+01	0.56
7	583.02	2325 -	2338	2331.40	5.34E+01	9.45	1.26E+01	0.64
8	609.22	2429 -	2444	2436.16	6.51E+01	10.33	1.39E+01	1.49
9	911.29	3637 -	3651	3644.22	4.02E+01	7.62	5.80E+00	0.34
10	1460.64	5830 -	5854	5842.94	2.85E+02	18.33	1.25E+01	2.24

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	3.95E-02	1.36E-02
K-40	0.99	1460.82	*	10.66	6.90E+00	5.36E-01
Tl-208	0.99	583.19	*	85.00	8.68E-02	1.62E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	1.56E-01	2.85E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.04E-01	3.45E-02

Analysis Report for 31-Oct-18-10051

L1-10221F-FSGS-013SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99		7.25		
		295.22	*	18.42	2.50E-01	5.38E-02
		351.93	*	35.60	2.93E-01	4.51E-02
		785.96		1.06		
Ra-226	0.98	186.21	*	3.64	8.37E-01	2.58E-01
Ac-228	0.99	129.07		2.42		
		209.25	*	3.89	3.70E-01	1.46E-01
		270.24		3.46		
		328.00		2.95		
		338.32		11.27		
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	2.91E-01	5.66E-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	5.33E-02	1.65E-02
		202.11		1.08		
		205.31		5.01		

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

Analysis Report for 31-Oct-18-10051

L1-10221F-FSGS-013SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.999	3.95E-02	1.36E-02	
	K-40	0.995	6.90E+00	5.36E-01	
	Tl-208	0.996	8.68E-02	1.62E-02	
X	Bi-211	0.892			
	Pb-212	1.000	1.56E-01	2.85E-02	
	Bi-214	0.999	2.04E-01	3.45E-02	
	Pb-214	0.997	2.75E-01	3.46E-02	
?	Ra-226	0.980	8.37E-01	2.58E-01	
	Ac-228	0.999	3.02E-01	5.28E-02	
?	~~U-235~~ Ra-226	~~0.998~~	~~5.33E-02~~	~~1.65E-02~~	

? = nuclide is part of an undetermined solution

X = nuclide rejected by the interference analysis

@ = nuclide contains energy lines not used in Weighted Mean Activity

Errors quoted at 1.000sigma

JPW 10-31-18

U-235 only 1 Peak

Analysis Report for 31-Oct-18-10051

L1-10221F-FSGS-013SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 1:37:57PM
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	3.95E-02	4.15E-02	4.15E-02
	BE-7	477.60		10.44	2.13E-01	4.05E-01	4.05E-01
+	K-40	1460.82	*	10.66	6.90E+00	6.61E-01	6.61E-01
	Co-60	1173.23		99.85	-3.16E-02	5.03E-02	6.17E-02
		1332.49		99.98	-3.28E-03		5.03E-02
	Nb-94	702.65		99.81	1.52E-02	4.84E-02	4.84E-02
		871.09		99.89	1.38E-02		4.87E-02
	Ag-108m	79.13		6.60	-1.35E-01	4.59E-02	1.59E+00
		433.94		90.50	-1.74E-02		4.59E-02
		614.28		89.80	-1.88E-02		8.10E-02
		722.94		90.80	2.14E-02		5.13E-02
	Sb-125	176.31		6.84	-9.59E-02	1.42E-01	4.77E-01
		380.45		1.52	1.24E+00		2.53E+00
		427.87		29.60	-8.23E-02		1.42E-01
		463.36		10.49	-2.21E-01		3.88E-01
		600.60		17.65	-1.02E-01		2.30E-01
		606.71		4.98	2.34E+00		1.46E+00
		635.95		11.22	2.61E-02		3.64E-01
		671.44		1.79	-7.89E-01		2.48E+00

Analysis Report for 31-Oct-18-10051

L1-10221F-FSGS-013SS

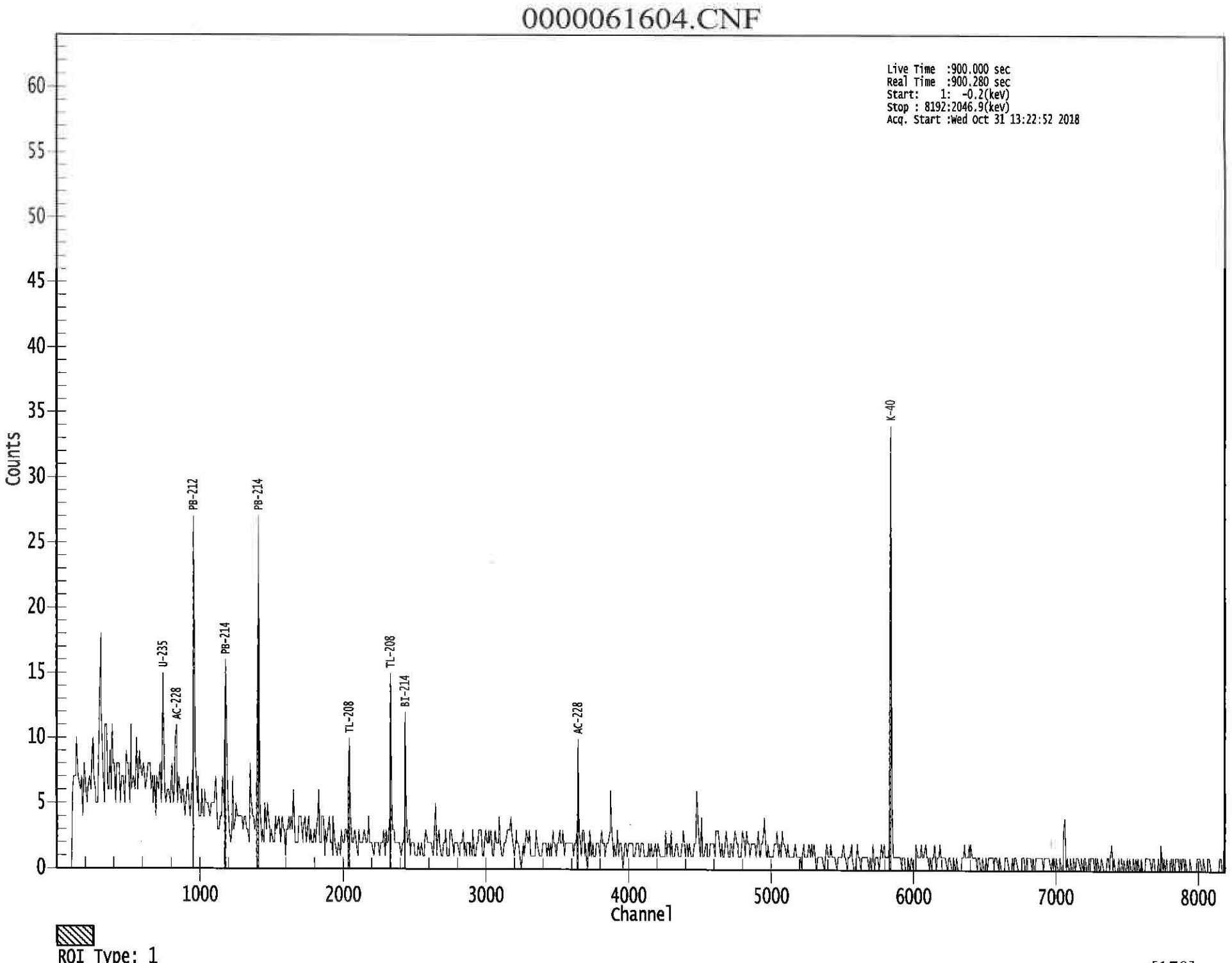
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	1.20E+00	9.18E-02	3.87E+00
	81.00	32.90	-4.11E-01		2.71E-01
	276.40	7.16	1.12E-01		5.56E-01
	302.85	18.34	-2.57E-01		1.94E-01
	356.01	62.05	-9.87E-03		9.18E-02
	383.85	8.94	-7.45E-02		4.54E-01
Cs-134	475.36	1.48	-3.50E-01	6.58E-02	2.56E+00
	563.25	8.34	-3.91E-01		4.13E-01
	569.33	15.37	4.09E-02		2.59E-01
	604.72	97.62	-2.86E-02		6.67E-02
	795.86	85.46	7.51E-03		6.58E-02
	801.95	8.69	-1.97E-01		5.95E-01
	1038.61	0.99	3.11E-01		5.15E+00
	1167.97	1.79	1.64E+00		3.44E+00
	1365.19	3.02	-4.00E-01		1.41E+00
Cs-137	661.66	85.10	2.89E-02	5.81E-02	5.81E-02
Eu-152	121.78	28.67	1.43E-02	1.29E-01	1.40E-01
	244.70	7.61	4.61E-01		5.73E-01
	295.94	0.45	1.27E+01		1.14E+01
	344.28	26.60	-1.85E-01		1.29E-01
	367.79	0.86	2.10E+00		4.71E+00
	411.12	2.24	1.88E-02		1.84E+00
	443.96	2.83	-1.01E-01		1.38E+00
	488.68	0.42	2.56E+00		8.52E+00
	563.99	0.49	-1.86E+00		7.26E+00
	586.26	0.46	2.35E+01		1.50E+01
	678.62	0.47	3.41E+00		9.88E+00
	688.67	0.86	4.85E-01		5.33E+00
	719.35	0.28	-6.28E+00		1.48E+01
	778.90	12.96	-2.85E-01		3.72E-01
	810.45	0.32	-1.71E+01		1.28E+01
	867.37	4.26	1.52E-01		1.10E+00
	919.33	0.43	2.71E+00		1.30E+01
	964.08	14.65	2.58E-01		5.01E-01
	1085.87	10.24	3.89E-02		5.11E-01
	1089.74	1.73	1.21E+00		3.39E+00
	1112.07	13.69	-5.72E-01		3.80E-01
	1212.95	1.43	3.69E+00		5.09E+00
	1249.94	0.19	-2.78E+01		3.23E+01
	1299.14	1.63	-1.29E+00		2.63E+00
	1408.01	21.07	-2.74E-01		2.33E-01
	1457.64	0.50	1.57E+02		4.45E+01
	1528.10	0.28	-7.84E+00		1.48E+01
Eu-154	123.07	40.40	-1.40E-03	9.89E-02	9.89E-02
	247.93	6.89	-2.73E-01		4.99E-01
	591.76	4.95	-4.01E-01		8.70E-01
	692.42	1.78	2.19E-02		2.70E+00
	723.30	20.06	1.11E-01		2.32E-01
	756.80	4.52	3.16E-01		9.80E-01
	873.18	12.08	1.21E-01		4.25E-01
	996.29	10.48	1.37E-01		5.36E-01

Analysis Report for 31-Oct-18-10051

L1-10221F-FSGS-013SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	2.58E-01	9.89E-02	3.51E-01
		1274.43		34.80	8.92E-02		1.87E-01
		1596.48		1.80	5.66E-02		3.31E+00
	Eu-155	45.30		1.31	-1.39E+01	2.27E-01	1.95E+01
		60.01		1.22	-7.19E-01		2.37E+01
		86.55		30.70	1.60E-01		2.46E-01
		105.31		21.10	-2.17E-02		2.27E-01
+	Ra-226	186.21	*	3.64	8.37E-01	7.86E-01	7.86E-01
	Pa-231	27.36		10.30	1.25E+00	1.61E+00	2.27E+00
		283.69		1.70	-4.99E-01		2.15E+00
		300.07		2.47	-1.54E-01		1.62E+00
		302.65		2.20	-2.01E+00		1.61E+00
		330.06		1.40	1.24E+00		2.62E+00
+	U-235	143.76		10.96	-8.21E-02	5.00E-02	3.64E-01
		163.33		5.08	8.65E-02		7.42E-01
		185.71	*	57.20	5.33E-02		5.00E-02
		202.11		1.08	-1.04E+00		3.38E+00
		205.31		5.01	-6.26E-01		7.21E-01
	Am-241	59.54		35.90	6.83E-01	8.51E-01	8.51E-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


0000061604.CNF
Live Time :900.000 sec
Real Time :900.280 sec
Start: 1: -0.2(keV)
Stop : 8192:2046.9(keV)
Acq. Start :Wed Oct 31 13:22:52 2018
Counts
Channel
U-235
AC-228
PB-212
PB-214
PB-214
TL-208
TL-208
BI-214
AC-228
K-40
ROI Type: 1

Apex-Gamma

Analysis Report for 31-Oct-18-10052
L1-10221F-FSGS-014SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10052
Sample Description	: L1-10221F-FSGS-014SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.407E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 3:09:00PM
Acquisition Started	: 10/31/2018 1:44:02PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: 324
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.03 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 4096
Peak Area Range (in channels)	: 120 - 4096
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61605
Fill Height	: 1407.39 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2013 12:00:00PM

10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 1:59:05PM

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

DATA VALIDATED 11/1/18 1300

TGraham

Analysis Report for 31-Oct-18-10052

L1-10221F-FSGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	186.02	368 -	376	372.34	3.36E+01	15.39	9.54E+01	1.03
2	238.62	472 -	481	477.42	1.47E+02	20.81	1.27E+02	1.21
3	295.23	585 -	595	590.52	5.58E+01	14.56	6.42E+01	1.13
4	351.91	699 -	708	703.77	1.19E+02	14.00	3.44E+01	1.56
5	583.11	1160 -	1170	1165.83	5.81E+01	10.86	2.49E+01	0.94
6	609.28	1213 -	1223	1218.15	9.27E+01	11.15	1.33E+01	1.59
7	911.11	1818 -	1826	1821.66	3.12E+01	7.95	1.48E+01	1.25
8	968.93	1935 -	1943	1937.32	2.19E+01	6.95	1.21E+01	0.94
9	1460.68	2913 -	2927	2921.41	3.34E+02	18.95	8.25E+00	1.99

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	6.43E+00	4.60E-01
Tl-208	0.99	583.19	*	85.00	7.64E-02	1.50E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.10E-01	3.41E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.34E-01	3.15E-02
		768.36		4.89		
		806.18		1.26		

Analysis Report for 31-Oct-18-10052

L1-10221F-FSGS-014SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	2.13E-01	5.80E-02
		351.93	*	35.60	2.65E-01	3.77E-02
		785.96		1.06		
Ra-226	0.99	186.21	*	3.64	5.03E-01	2.36E-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	1.81E-01	4.69E-02
		964.77		4.99		
		968.97	*	15.80	2.17E-01	6.94E-02
		1588.20		3.22		
U-235	0.99	143.76		10.96		
		163.33		5.08		
		185.71	*	57.20	3.23E-02	1.50E-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 31-Oct-18-10052

L1-10221F-FSGS-014SS

INTERFERENCE CORRECTED REPORT

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.997	6.43E+00	4.60E-01	
	Tl-208	0.999	7.64E-02	1.50E-02	
X	Bi-211	0.892			
	Pb-212	1.000	2.10E-01	3.41E-02	
	Bi-214	1.000	2.34E-01	3.15E-02	
	Pb-214	1.000	2.49E-01	3.16E-02	
?	Ra-226	0.994	5.08E-01	2.36E-01	
	Ac-228	0.999	1.93E-01	3.89E-02	
?	~~U-235~~ Ra-226	~~0.990~~	~~3.23E-02~~	~~1.50E-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

10-31-18

U-235 only 1 Peak 10-31-18

Analysis Report for 31-Oct-18-10052
L1-10221F-FSGS-014SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 1:59:05PM
Peak Locate From Channel : 120
Peak Locate To Channel : 4096

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.55E-02	5.46E-02	5.46E-02
	BE-7	477.60		10.44	-7.37E-02	3.36E-01	3.36E-01
+	K-40	1460.82	*	10.66	6.43E+00	3.85E-01	3.85E-01
	Co-60	1173.23		99.85	2.35E-02	4.78E-02	5.82E-02
		1332.49		99.98	1.02E-02		4.78E-02
	Nb-94	702.65		99.81	-2.04E-02	3.34E-02	3.34E-02
		871.09		99.89	-1.51E-02		3.77E-02
	Ag-108m	79.13		6.60	5.99E-01	3.29E-02	1.14E+00
		433.94		90.50	-1.68E-02		3.29E-02
		614.28		89.80	-2.87E-02		5.16E-02
		722.94		90.80	2.46E-02		5.08E-02
	Sb-125	176.31		6.84	-1.42E-01	1.11E-01	4.91E-01
		380.45		1.52	-9.69E-01		1.87E+00
		427.87		29.60	4.73E-02		1.11E-01
		463.36		10.49	9.33E-03		3.18E-01
		600.60		17.65	7.62E-02		2.18E-01
		606.71		4.98	-3.30E-01		1.29E+00
		635.95		11.22	-7.69E-02		2.90E-01
		671.44		1.79	-2.34E-01		1.85E+00

Analysis Report for 31-Oct-18-10052

L1-10221F-FSGS-014SS

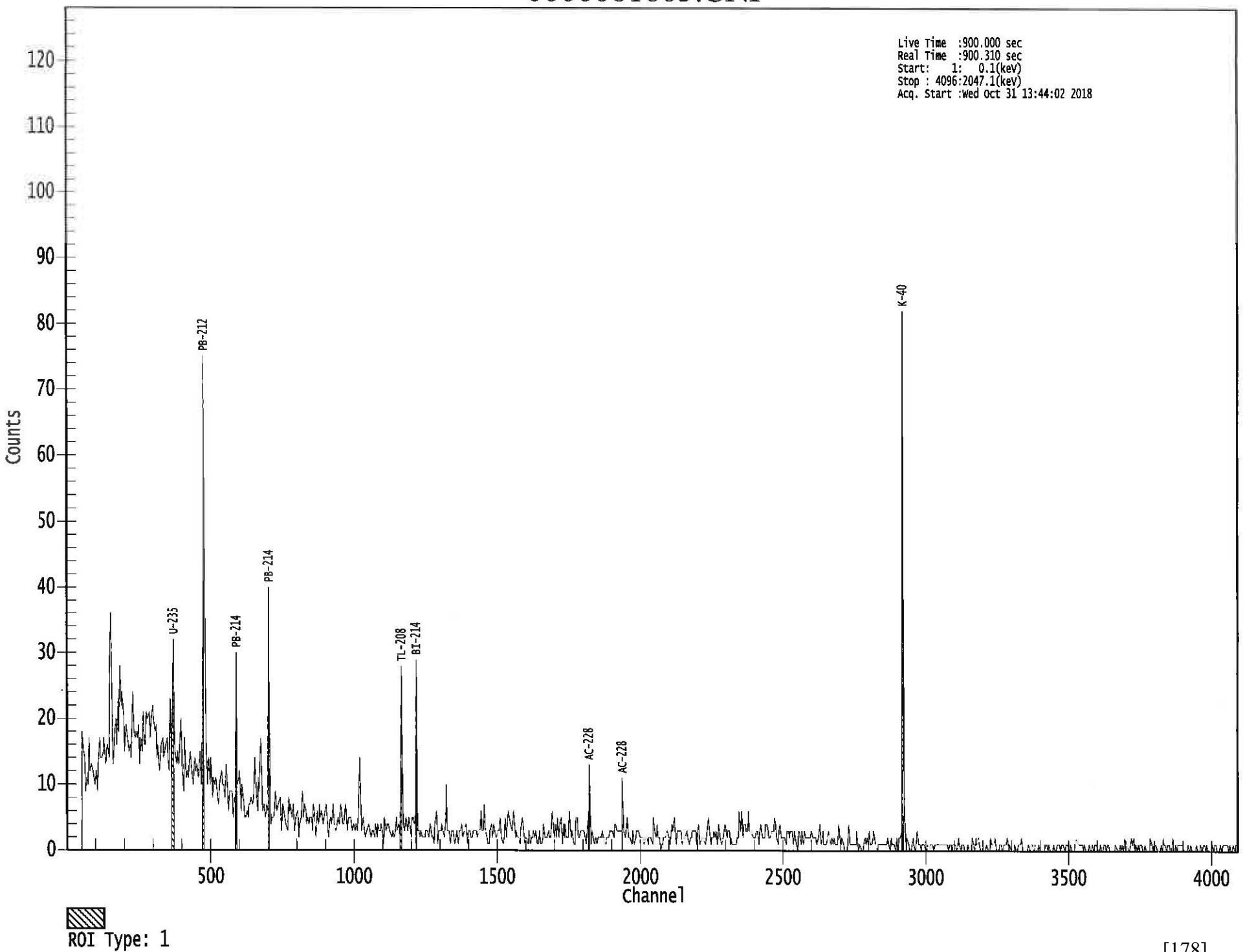
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-1.05E-01	6.87E-02	2.60E+00
	81.00	32.90	-2.54E-01		1.70E-01
	276.40	7.16	1.51E-01		4.82E-01
	302.85	18.34	4.79E-02		1.76E-01
	356.01	62.05	-5.18E-02		6.87E-02
	383.85	8.94	-1.24E-01		3.48E-01
Cs-134	475.36	1.48	4.81E-01	4.56E-02	2.23E+00
	563.25	8.34	1.82E-02		4.06E-01
	569.33	15.37	-4.27E-02		2.07E-01
	604.72	97.62	-5.35E-03		5.74E-02
	795.86	85.46	6.86E-03		4.56E-02
	801.95	8.69	-6.80E-02		3.80E-01
	1038.61	0.99	-4.76E-01		3.76E+00
	1167.97	1.79	7.27E-01		2.70E+00
	1365.19	3.02	2.85E-01		1.27E+00
Cs-137	661.66	85.10	4.01E-02	5.45E-02	5.45E-02
Eu-152	121.78	28.67	7.47E-03	1.13E-01	1.13E-01
	244.70	7.61	-2.17E-01		4.61E-01
	295.94	0.45	-1.31E+00		9.00E+00
	344.28	26.60	-1.09E-01		1.16E-01
	367.79	0.86	2.88E-01		3.92E+00
	411.12	2.24	6.86E-01		1.58E+00
	443.96	2.83	-4.89E-01		1.15E+00
	488.68	0.42	-5.29E+00		7.40E+00
	563.99	0.49	-4.21E-01		6.78E+00
	586.26	0.46	-2.24E-01		1.25E+01
	678.62	0.47	-3.87E-01		6.65E+00
	688.67	0.86	2.16E+00		4.11E+00
	719.35	0.28	-8.90E-01		1.40E+01
	778.90	12.96	-5.78E-02		2.95E-01
	810.45	0.32	-6.33E-01		1.05E+01
	867.37	4.26	-8.74E-01		8.11E-01
	919.33	0.43	2.97E+00		8.60E+00
	964.08	14.65	-5.24E-01		3.58E-01
	1085.87	10.24	2.05E-02		4.79E-01
	1089.74	1.73	-1.07E-01		2.84E+00
	1112.07	13.69	-4.55E-02		3.17E-01
	1212.95	1.43	-9.09E-01		3.58E+00
	1249.94	0.19	2.68E+00		2.75E+01
	1299.14	1.63	3.38E-01		3.44E+00
	1408.01	21.07	7.72E-02		2.15E-01
	1457.64	0.50	-2.04E-01		3.79E+01
	1528.10	0.28	-3.39E+00		1.24E+01
Eu-154	123.07	40.40	-1.10E-04	7.99E-02	7.99E-02
	247.93	6.89	1.22E-01		4.78E-01
	591.76	4.95	-1.68E-01		7.41E-01
	692.42	1.78	-4.83E-01		1.83E+00
	723.30	20.06	9.86E-02		2.32E-01
	756.80	4.52	-1.32E-01		7.76E-01
	873.18	12.08	-6.15E-02		3.41E-01
	996.29	10.48	1.97E-01		4.23E-01

Analysis Report for 31-Oct-18-10052

L1-10221F-FSGS-014SS

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	Eu-154	1004.76		18.01	-1.38E-01	7.99E-02	1.96E-01
		1274.43		34.80	-1.54E-02		1.36E-01
		1596.48		1.80	4.96E-01		1.66E+00
	Eu-155	45.30		1.31	2.04E+00	1.61E-01	1.12E+01
		60.01		1.22	-2.31E+00		1.26E+01
		86.55		30.70	-1.96E-02		1.61E-01
		105.31		21.10	4.28E-02		1.79E-01
+	Ra-226	186.21	*	3.64	5.08E-01	7.73E-01	7.73E-01
	Pa-231	27.36		10.30	7.64E-01	1.18E+00	1.18E+00
		283.69		1.70	-5.55E-01		1.78E+00
		300.07		2.47	-9.37E-02		1.28E+00
		302.65		2.20	3.99E-01		1.47E+00
		330.06		1.40	1.03E+00		2.62E+00
+	U-235	143.76		10.96	1.99E-02	4.92E-02	2.96E-01
		163.33		5.08	-1.71E-01		6.54E-01
		185.71	*	57.20	3.23E-02		4.92E-02
		202.11		1.08	3.32E-01		3.03E+00
		205.31		5.01	-6.85E-02		6.46E-01
	Am-241	59.54		35.90	-7.37E-02	4.38E-01	4.38E-01

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


0000061605.CNF
Live Time :900.000 sec
Real Time :900.310 sec
Start: 1: 0.1(keV)
Stop : 4096:2047.1(keV)
Acq. Start :Wed Oct 31 13:44:02 2018
Counts
Channel
U-235
PB-212
PB-214
PB-214
TL-208
BI-214
AC-228
AC-228
K-40
ROI Type: 1

[178]

Apex-Gamma

Analysis Report for 31-Oct-18-10053

L1-10221F-FSGS-015SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10053
Sample Description	: L1-10221F-FSGS-015SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.458E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 3:12:00PM
Acquisition Started	: 10/31/2018 1:44:08PM
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	: 0.14 %
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	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61606
Fill Height	: 1457.73 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 1:59:13PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

JBroham

Analysis Report for 31-Oct-18-10053

L1-10221F-FSGS-015SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.59	947 -	961	954.46	1.37E+02	17.76	6.19E+01	0.91
2	295.15	1174 -	1187	1180.52	4.53E+01	11.54	3.17E+01	0.80
3	351.93	1398 -	1414	1407.46	9.80E+01	12.30	1.70E+01	1.00
4	583.03	2326 -	2337	2331.35	3.34E+01	7.77	1.06E+01	0.65
5	609.18	2428 -	2442	2435.87	6.50E+01	9.85	1.10E+01	0.86
6	911.13	3637 -	3651	3643.47	3.11E+01	6.99	5.89E+00	1.31
7	968.98	3869 -	3880	3874.90	1.40E+01	6.04	9.00E+00	1.03
8	1460.61	5831 -	5851	5842.29	1.99E+02	14.11	0.00E+00	1.47

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.99	1460.82	*	10.66	5.04E+00	4.19E-01
Tl-208	0.99	583.19	*	85.00	5.64E-02	1.36E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.47E-01	3.78E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.11E-01	3.45E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 31-Oct-18-10053

L1-10221F-FSGS-015SS

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	2.18E-01	5.82E-02
		351.93	*	35.60	2.77E-01	4.13E-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	2.35E-01	5.38E-02
		964.77		4.99		
		968.97	*	15.80	1.80E-01	7.81E-02
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 31-Oct-18-10053

L1-10221F-FSGS-015SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.993	5.04E+00	4.19E-01	
	Tl-208	0.996	5.64E-02	1.36E-02	
X	Bi-211	0.888			
	Pb-212	1.000	2.47E-01	3.78E-02	
	Bi-214	0.999	2.11E-01	3.45E-02	
	Pb-214	1.000	2.58E-01	3.37E-02	
	Ac-228	1.000	2.17E-01	4.43E-02	

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

Errors quoted at 1.000sigma

Analysis Report for 31-Oct-18-10053

L1-10221F-FSGS-015SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 1:59:13PM
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	4.28E-02	6.25E-02	6.25E-02
	BE-7	477.60		10.44	2.55E-01	4.30E-01	4.30E-01
+	K-40	1460.82	*	10.66	5.04E+00	7.28E-02	7.28E-02
	Co-60	1173.23		99.85	2.64E-03	4.73E-02	6.95E-02
		1332.49		99.98	1.51E-02		4.73E-02
	Nb-94	702.65		99.81	1.25E-02	4.39E-02	4.69E-02
		871.09		99.89	-8.50E-03		4.39E-02
	Ag-108m	79.13		6.60	6.38E-01	5.01E-02	1.93E+00
		433.94		90.50	-6.37E-03		5.01E-02
		614.28		89.80	-8.50E-02		6.58E-02
		722.94		90.80	3.49E-02		5.80E-02
	Sb-125	176.31		6.84	-7.95E-02	1.33E-01	5.95E-01
		380.45		1.52	7.22E-01		2.62E+00
		427.87		29.60	-5.63E-02		1.33E-01
		463.36		10.49	1.32E-01		3.94E-01
		600.60		17.65	-9.31E-02		2.32E-01
		606.71		4.98	1.47E+00		1.45E+00
		635.95		11.22	-1.76E-03		3.92E-01
		671.44		1.79	1.37E+00		2.77E+00

Analysis Report for 31-Oct-18-10053

L1-10221F-FSGS-015SS

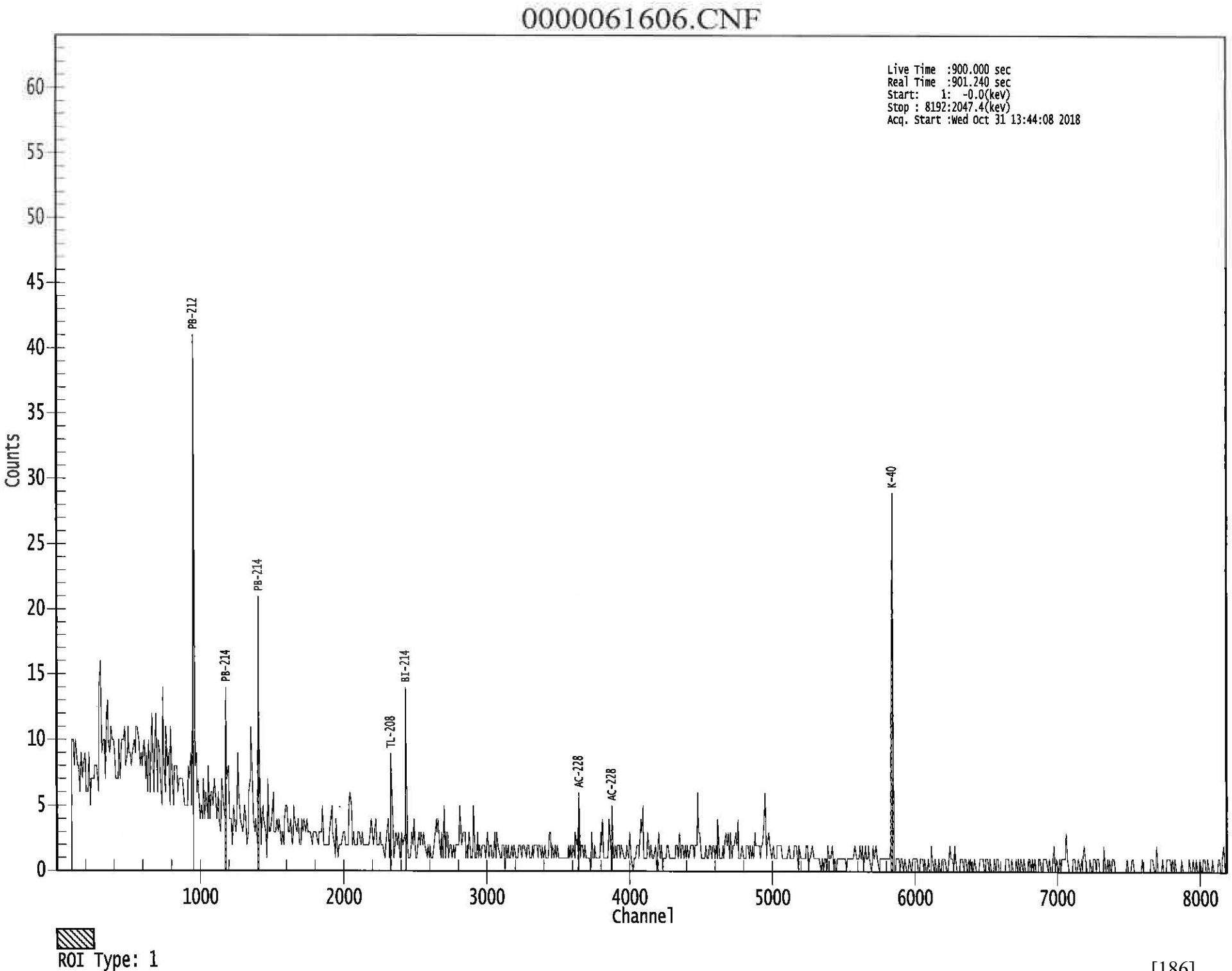
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	1.14E+00	7.76E-02	4.60E+00
	81.00	32.90	-2.62E-01		3.06E-01
	276.40	7.16	2.64E-01		5.78E-01
	302.85	18.34	1.42E-01		2.22E-01
	356.01	62.05	-5.55E-02		7.76E-02
	383.85	8.94	7.07E-02		4.17E-01
Cs-134	475.36	1.48	-1.95E+00	5.08E-02	2.68E+00
	563.25	8.34	-5.61E-02		5.28E-01
	569.33	15.37	-1.76E-01		2.65E-01
	604.72	97.62	-1.17E-02		6.82E-02
	795.86	85.46	2.04E-02		5.08E-02
	801.95	8.69	-3.97E-02		5.34E-01
	1038.61	0.99	-2.46E+00		4.90E+00
	1167.97	1.79	1.44E+00		3.77E+00
	1365.19	3.02	5.07E-02		1.40E+00
Cs-137	661.66	85.10	2.26E-02	6.59E-02	6.59E-02
Eu-152	121.78	28.67	-2.65E-02	1.52E-01	1.64E-01
	244.70	7.61	3.33E-01		5.65E-01
	295.94	0.45	-5.13E+00		1.04E+01
	344.28	26.60	1.04E-02		1.52E-01
	367.79	0.86	5.13E-01		4.15E+00
	411.12	2.24	1.32E+00		1.87E+00
	443.96	2.83	-5.64E-01		1.31E+00
	488.68	0.42	-2.12E+00		8.55E+00
	563.99	0.49	8.52E-01		8.94E+00
	586.26	0.46	-8.69E+00		1.30E+01
	678.62	0.47	6.69E+00		9.70E+00
	688.67	0.86	1.02E+00		4.56E+00
	719.35	0.28	-5.55E+00		1.31E+01
	778.90	12.96	5.68E-02		3.43E-01
	810.45	0.32	5.99E+00		1.50E+01
	867.37	4.26	-1.60E+00		9.20E-01
	919.33	0.43	3.71E-01		1.04E+01
	964.08	14.65	0.00E+00		4.60E-01
	1085.87	10.24	3.92E-01		6.25E-01
	1089.74	1.73	-7.41E-01		3.54E+00
	1112.07	13.69	1.42E-02		4.30E-01
	1212.95	1.43	-1.36E+00		4.45E+00
	1249.94	0.19	2.07E+01		3.66E+01
	1299.14	1.63	1.28E-01		3.62E+00
	1408.01	21.07	1.04E-01		2.75E-01
	1457.64	0.50	1.05E+02		3.83E+01
	1528.10	0.28	-3.37E+00		1.35E+01
Eu-154	123.07	40.40	-2.81E-02	1.13E-01	1.13E-01
	247.93	6.89	-1.03E-02		5.41E-01
	591.76	4.95	-4.82E-02		9.17E-01
	692.42	1.78	4.32E-01		2.40E+00
	723.30	20.06	2.14E-01		2.66E-01
	756.80	4.52	-5.90E-01		8.83E-01
	873.18	12.08	8.84E-02		3.55E-01
	996.29	10.48	-9.16E-03		5.50E-01

Analysis Report for 31-Oct-18-10053

L1-10221F-FSGS-015SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	5.24E-02	1.13E-01	2.82E-01
	1274.43	34.80	-5.47E-02		1.32E-01
	1596.48	1.80	-2.84E+00		1.56E+00
Eu-155	45.30	1.31	-7.06E+00	2.55E-01	2.97E+01
	60.01	1.22	1.51E+00		3.04E+01
	86.55	30.70	-2.45E-02		2.55E-01
	105.31	21.10	-1.74E-01		2.66E-01
Ra-226	186.21	3.64	5.02E-01	1.13E+00	1.13E+00
Pa-231	27.36	10.30	3.21E+00	1.68E+00	3.70E+00
	283.69	1.70	-1.71E+00		2.04E+00
	300.07	2.47	2.60E-01		1.68E+00
	302.65	2.20	5.26E-01		1.82E+00
	330.06	1.40	-1.39E+00		2.81E+00
U-235	143.76	10.96	-1.49E-01	7.03E-02	3.86E-01
	163.33	5.08	2.18E-01		8.60E-01
	185.71	57.20	4.91E-03		7.03E-02
	202.11	1.08	-1.37E+00		3.62E+00
	205.31	5.01	-2.58E-01		7.38E-01
Am-241	59.54	35.90	-7.32E-02	1.09E+00	1.09E+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


0000061606.CNF
Live Time :900.000 sec
Real Time :901.240 sec
Start: 1: -0.0(keV)
Stop : 8192:2047.4(keV)
Acq. Start :Wed Oct 31 13:44:08 2018
Counts
Channel
PB-212
PB-214
PB-214
TL-208
BI-214
AC-228
AC-228
K-40
ROI Type: 1

[186]

Apex-Gamma

Analysis Report for 31-Oct-18-10054

L1-10221F-FSGS-016SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10054
Sample Description	: L1-10221F-FSGS-016SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.236E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 3:15:00PM
Acquisition Started	: 10/31/2018 1:44:14PM
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	: 10/15/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61607
Fill Height	: 1235.51 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 1:59:26PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

T Graham / C

Analysis Report for 31-Oct-18-10054

L1-10221F-FSGS-016SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.78	946 -	961	954.70	1.25E+02	19.17	8.04E+01	0.42
2	338.29	1348 -	1358	1352.25	2.65E+01	8.58	1.95E+01	0.63
3	351.94	1401 -	1413	1406.79	8.41E+01	13.17	3.39E+01	1.08
4	511.12	2036 -	2048	2042.85	4.70E+01	9.01	1.30E+01	0.33
5	583.16	2324 -	2337	2330.75	6.29E+01	9.81	1.21E+01	1.07
6	609.08	2428 -	2443	2434.35	6.37E+01	9.78	1.03E+01	0.67
7	910.73	3635 -	3645	3640.37	1.52E+01	6.40	1.08E+01	0.75
8	1460.36	5828 -	5851	5839.36	2.44E+02	16.31	5.64E+00	1.39

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
An Pk	0.99	511.00	*	100.00	6.32E-02	1.29E-02
K-40	0.96	1460.82	*	10.66	5.91E+00	4.70E-01
Tl-208	1.00	583.19	*	85.00	1.01E-01	1.69E-02
Bi-211	0.88	351.07	*	13.02	6.13E-01	1.08E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.08E-01	3.62E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	1.97E-01	3.24E-02
		768.36		4.89		

Analysis Report for 31-Oct-18-10054

L1-10221F-FSGS-016SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	0.99	806.18		1.26		
		934.06		3.11		
		1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.51	241.99		7.25		
		295.22		18.42		
		351.93	*	35.60	2.24E-01	3.94E-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	2.17E-01	7.23E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.09E-01	4.63E-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 31-Oct-18-10054

L1-10221F-FSGS-016SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	An Pk	0.998	6.32E-02	1.29E-02	
	K-40	0.966	5.91E+00	4.70E-01	
	Tl-208	1.000	1.01E-01	1.69E-02	
?	Bi-211	0.885	6.13E-01	1.08E-01	
	Pb-212	0.997	2.08E-01	3.62E-02	
	Bi-214	0.996	1.97E-01	3.24E-02	
?	Pb-214	0.512	2.24E-01	3.94E-02	
	Ac-228	0.989	1.41E-01	3.90E-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 31-Oct-18-10054
L1-10221F-FSGS-016SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 1:59:26PM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

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	6.32E-02	3.05E-02	3.05E-02
	BE-7	477.60		10.44	8.72E-03	3.98E-01	3.98E-01
+	K-40	1460.82	*	10.66	5.91E+00	4.51E-01	4.51E-01
	Co-60	1173.23		99.85	-3.17E-02	4.88E-02	4.88E-02
		1332.49		99.98	-1.03E-02		5.01E-02
	Nb-94	702.65		99.81	2.01E-02	3.61E-02	3.61E-02
		871.09		99.89	6.70E-03		4.38E-02
	Ag-108m	79.13		6.60	1.31E+00	4.06E-02	1.24E+00
		433.94		90.50	-1.74E-02		4.06E-02
		614.28		89.80	-1.35E-02		5.79E-02
		722.94		90.80	2.97E-02		5.08E-02
	Sb-125	176.31		6.84	-7.69E-02	1.33E-01	4.46E-01
		380.45		1.52	1.10E+00		2.26E+00
		427.87		29.60	1.10E-02		1.33E-01
		463.36		10.49	1.43E-01		4.20E-01
		600.60		17.65	-1.05E-01		2.09E-01
		606.71		4.98	-3.21E-01		1.37E+00
		635.95		11.22	-2.57E-01		3.54E-01
		671.44		1.79	6.74E-01		2.49E+00

Analysis Report for 31-Oct-18-10054

L1-10221F-FSGS-016SS

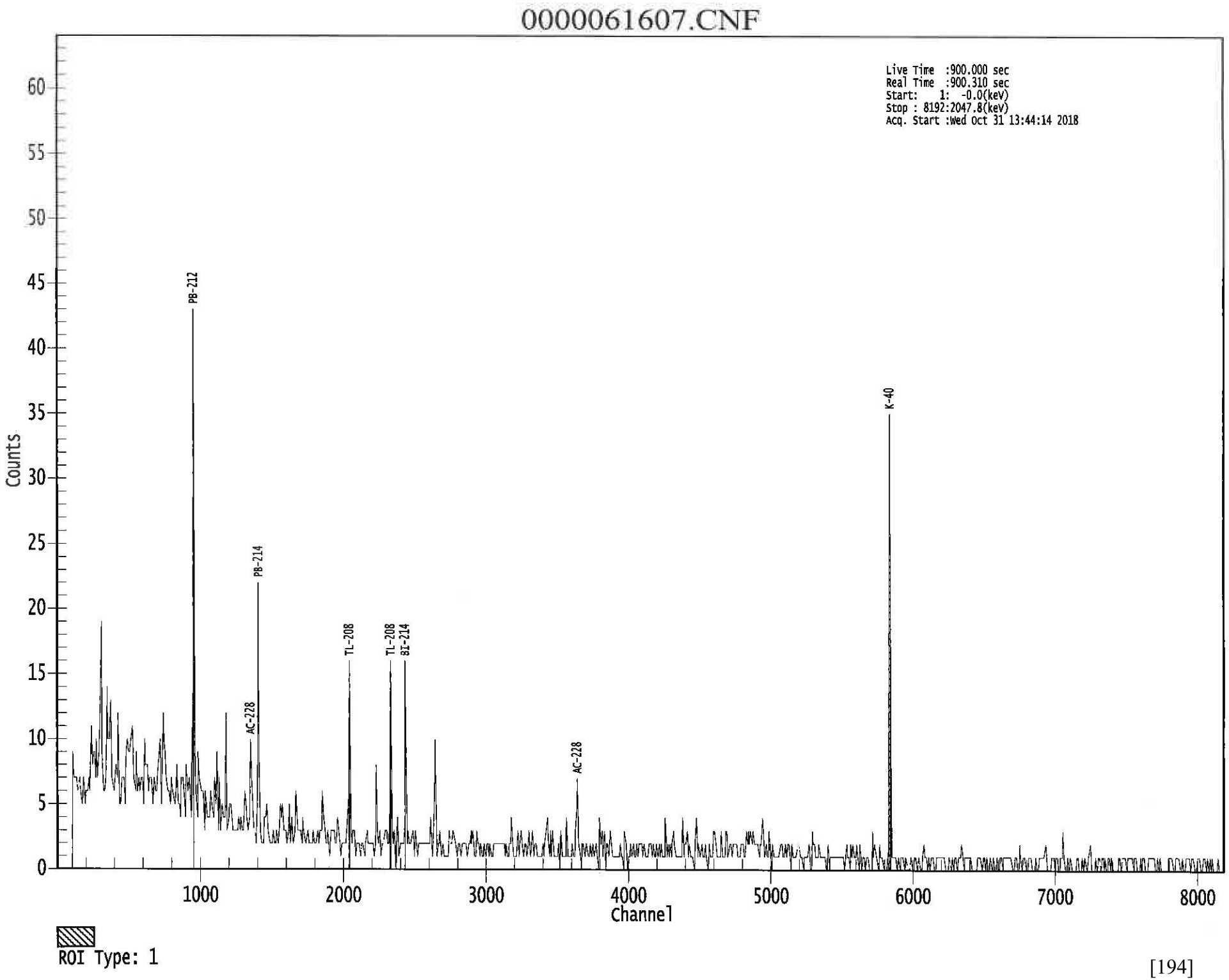
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	2.64E+00	6.69E-02	3.01E+00
	81.00	32.90	-2.64E-01		1.86E-01
	276.40	7.16	4.49E-01		4.90E-01
	302.85	18.34	1.14E-01		1.93E-01
	356.01	62.05	-1.10E-02		6.69E-02
	383.85	8.94	1.25E-01		3.93E-01
Cs-134	475.36	1.48	1.06E+00	5.34E-02	2.64E+00
	563.25	8.34	-9.02E-01		4.95E-01
	569.33	15.37	-6.34E-02		2.48E-01
	604.72	97.62	-2.29E-02		6.31E-02
	795.86	85.46	1.72E-02		5.34E-02
	801.95	8.69	1.23E-01		4.89E-01
	1038.61	0.99	-3.27E+00		4.55E+00
	1167.97	1.79	3.61E-01		3.07E+00
	1365.19	3.02	-1.43E-01		1.53E+00
Cs-137	661.66	85.10	7.13E-02	7.53E-02	7.53E-02
Eu-152	121.78	28.67	3.26E-02	1.17E-01	1.17E-01
	244.70	7.61	7.78E-02		4.98E-01
	295.94	0.45	3.29E+00		9.01E+00
	344.28	26.60	-2.76E-02		1.21E-01
	367.79	0.86	3.49E-01		3.78E+00
	411.12	2.24	-2.63E-01		1.69E+00
	443.96	2.83	2.98E-02		1.11E+00
	488.68	0.42	4.75E+00		9.86E+00
	563.99	0.49	-5.71E+00		8.38E+00
	586.26	0.46	2.68E-01		1.44E+01
	678.62	0.47	-2.20E+00		6.69E+00
	688.67	0.86	2.38E+00		5.27E+00
	719.35	0.28	-1.21E+01		1.38E+01
	778.90	12.96	1.71E-02		3.39E-01
	810.45	0.32	1.57E+01		1.67E+01
	867.37	4.26	7.05E-01		1.17E+00
	919.33	0.43	-1.14E+01		9.38E+00
	964.08	14.65	-1.55E-01		3.79E-01
	1085.87	10.24	-1.82E-01		4.86E-01
	1089.74	1.73	-2.57E+00		2.36E+00
	1112.07	13.69	-2.38E-01		3.33E-01
	1212.95	1.43	1.53E+00		5.37E+00
	1249.94	0.19	3.55E+00		2.83E+01
	1299.14	1.63	2.47E+00		3.29E+00
	1408.01	21.07	-1.47E-01		2.32E-01
	1457.64	0.50	1.29E+02		4.04E+01
	1528.10	0.28	-7.50E-01		1.39E+01
Eu-154	123.07	40.40	7.29E-02	8.87E-02	8.87E-02
	247.93	6.89	-2.27E-01		4.48E-01
	591.76	4.95	-3.34E-01		7.21E-01
	692.42	1.78	1.42E+00		2.56E+00
	723.30	20.06	4.47E-02		2.27E-01
	756.80	4.52	-1.97E-01		8.60E-01
	873.18	12.08	-8.11E-02		3.63E-01
	996.29	10.48	-6.64E-02		3.81E-01

Analysis Report for 31-Oct-18-10054

L1-10221F-FSGS-016SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	1.53E-01	8.87E-02	2.69E-01
	1274.43	34.80	-1.89E-02		1.73E-01
	1596.48	1.80	1.39E+00		2.66E+00
Eu-155	45.30	1.31	-1.91E+00	1.77E-01	9.93E+00
	60.01	1.22	6.04E-01		1.21E+01
	86.55	30.70	9.59E-02		1.77E-01
	105.31	21.10	1.11E-01		1.96E-01
Ra-226	186.21	3.64	9.91E-01	9.94E-01	9.94E-01
Pa-231	27.36	10.30	1.17E+00	1.19E+00	1.19E+00
	283.69	1.70	-2.24E+00		1.85E+00
	300.07	2.47	-2.69E+00		1.31E+00
	302.65	2.20	1.44E+00		1.63E+00
	330.06	1.40	2.09E+00		2.78E+00
U-235	143.76	10.96	-1.47E-01	6.20E-02	2.90E-01
	163.33	5.08	-7.53E-04		6.20E-01
	185.71	57.20	2.73E-02		6.20E-02
	202.11	1.08	-5.31E-01		2.76E+00
	205.31	5.01	-3.74E-01		6.29E-01
Am-241	59.54	35.90	1.80E-01	4.32E-01	4.32E-01

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


0000061607.CNF
Live Time :900.000 sec
Real Time :900.310 sec
Start: 1: -0.0(keV)
Stop : 8192:2047.8(keV)
Acq. Start :Wed Oct 31 13:44:14 2018
PB-212
PB-214
AC-228
TL-208
TL-208
BI-214
AC-228
K-40
Counts
Channel
ROI Type: 1

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Apex-Gamma

Analysis Report for 31-Oct-18-10055

L1-10221F-FSGS-017SS

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 31-Oct-18-10055
Sample Description	: L1-10221F-FSGS-017SS
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.231E+03 grams
Facility	: Default
Sample Taken On	: 10/25/2018 3:18:00PM
Acquisition Started	: 10/31/2018 2:28:16PM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.4 seconds
Dead Time	: 0.16 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 10/31/2018
Efficiency Calibration Description	:
Sample Number	: 61609
Fill Height	: 1230.57 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

10-31-18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 10/31/2018 2:43:21PM

Peak Analysis From Channel : 120

Peak Analysis To Channel : 8192

DATA VALIDATED 11/1/18 1300

JGraham

Analysis Report for 31-Oct-18-10055

L1-10221F-FSGS-017SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	238.67	947 -	961	954.76	1.62E+02	18.89	6.75E+01	1.20
2	295.15	1174 -	1185	1180.51	6.31E+01	11.74	2.99E+01	1.06
3	338.35	1347 -	1358	1353.17	4.11E+01	11.11	3.29E+01	0.62
4	351.92	1401 -	1413	1407.42	8.34E+01	14.20	4.36E+01	0.68
5	583.15	2323 -	2339	2331.79	6.74E+01	10.03	1.06E+01	1.70
6	609.27	2429 -	2445	2436.26	8.18E+01	10.04	6.16E+00	0.80
7	911.01	3636 -	3650	3643.00	4.35E+01	8.07	7.50E+00	0.74
8	1460.56	5830 -	5854	5842.07	3.17E+02	18.44	5.84E+00	1.68

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.98	1460.82	*	10.66	8.54E+00	6.20E-01
Tl-208	1.00	583.19	*	85.00	1.20E-01	1.93E-02
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	3.07E-01	4.34E-02
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	2.81E-01	3.84E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		

Analysis Report for 31-Oct-18-10055

L1-10221F-FSGS-017SS

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
Bi-214	1.00	1120.29		14.92		
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		
		1407.99		2.39		
		1509.21		2.13		
		1661.27		1.05		
		1729.59		2.88		
		1764.49		15.30		
		1847.43		2.03		
		2118.51		1.16		
Pb-214	1.00	241.99		7.25		
		295.22	*	18.42	3.18E-01	6.45E-02
		351.93	*	35.60	2.48E-01	4.66E-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	3.74E-01	1.06E-01
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.48E-01	6.62E-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 31-Oct-18-10055

L1-10221F-FSGS-017SS

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.989	8.54E+00	6.20E-01	
	Tl-208	1.000	1.20E-01	1.93E-02	
X	Bi-211	0.891			
	Pb-212	1.000	3.07E-01	4.34E-02	
	Bi-214	1.000	2.81E-01	3.84E-02	
	Pb-214	1.000	2.72E-01	3.78E-02	
	Ac-228	0.998	3.55E-01	5.61E-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 31-Oct-18-10055

L1-10221F-FSGS-017SS

UNIDENTIFIED PEAKS

Peak Locate Performed on : 10/31/2018 2:43:21PM
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	6.41E-02	7.40E-02	7.40E-02
	BE-7	477.60		10.44	-3.24E-01	4.15E-01	4.15E-01
+	K-40	1460.82	*	10.66	8.54E+00	5.16E-01	5.16E-01
	Co-60	1173.23		99.85	2.39E-02	5.75E-02	7.98E-02
		1332.49		99.98	6.03E-03		5.75E-02
	Nb-94	702.65		99.81	-3.84E-02	4.75E-02	4.96E-02
		871.09		99.89	-2.83E-02		4.75E-02
	Ag-108m	79.13		6.60	9.45E-01	5.00E-02	2.14E+00
		433.94		90.50	-1.09E-02		5.00E-02
		614.28		89.80	-2.73E-02		7.57E-02
		722.94		90.80	2.46E-02		5.56E-02
	Sb-125	176.31		6.84	1.67E-01	1.65E-01	6.31E-01
		380.45		1.52	-2.64E-01		2.78E+00
		427.87		29.60	6.11E-02		1.65E-01
		463.36		10.49	1.69E-01		4.66E-01
		600.60		17.65	-3.01E-01		2.71E-01
		606.71		4.98	-7.99E-02		1.71E+00
		635.95		11.22	-1.97E-01		4.20E-01
		671.44		1.79	-4.69E-01		2.89E+00

Analysis Report for 31-Oct-18-10055

L1-10221F-FSGS-017SS

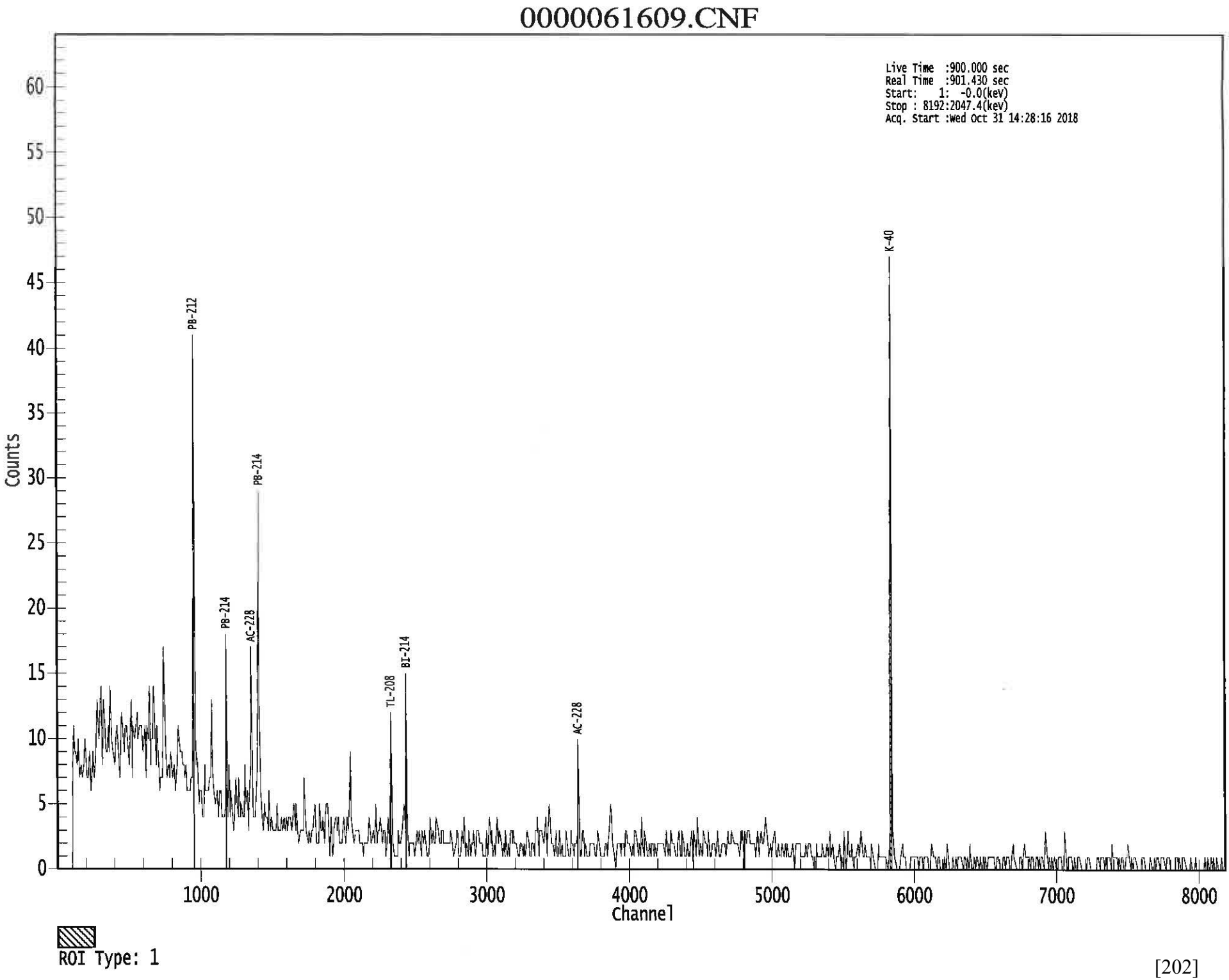
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-1.40E+00	9.15E-02	4.98E+00
	81.00	32.90	-3.98E-01		3.51E-01
	276.40	7.16	3.15E-01		5.83E-01
	302.85	18.34	7.09E-02		2.41E-01
	356.01	62.05	-6.14E-02		9.15E-02
	383.85	8.94	8.21E-02		4.90E-01
Cs-134	475.36	1.48	-6.59E-01	6.63E-02	2.97E+00
	563.25	8.34	2.80E-01		6.05E-01
	569.33	15.37	1.60E-01		2.84E-01
	604.72	97.62	-1.81E-02		7.62E-02
	795.86	85.46	-4.49E-02		6.63E-02
	801.95	8.69	-1.54E-01		5.65E-01
	1038.61	0.99	-1.80E+00		5.94E+00
	1167.97	1.79	-9.94E-01		3.94E+00
	1365.19	3.02	-3.21E-01		1.77E+00
Cs-137	661.66	85.10	4.70E-02	7.73E-02	7.73E-02
Eu-152	121.78	28.67	3.65E-02	1.74E-01	1.75E-01
	244.70	7.61	9.85E-02		6.08E-01
	295.94	0.45	5.98E+00		1.21E+01
	344.28	26.60	-7.05E-02		1.74E-01
	367.79	0.86	1.94E+00		5.16E+00
	411.12	2.24	-7.17E-01		1.93E+00
	443.96	2.83	5.63E-01		1.52E+00
	488.68	0.42	9.57E+00		1.19E+01
	563.99	0.49	2.68E-01		1.00E+01
	586.26	0.46	-1.70E+00		1.62E+01
	678.62	0.47	-1.31E+00		1.06E+01
	688.67	0.86	2.88E+00		5.60E+00
	719.35	0.28	-9.29E+00		1.49E+01
	778.90	12.96	2.96E-01		4.23E-01
	810.45	0.32	-4.80E-01		1.47E+01
	867.37	4.26	-5.54E-01		1.26E+00
	919.33	0.43	2.67E+00		1.37E+01
	964.08	14.65	4.74E-01		5.44E-01
	1085.87	10.24	-3.81E-01		6.22E-01
	1089.74	1.73	-2.31E+00		3.69E+00
	1112.07	13.69	-2.17E-01		4.47E-01
	1212.95	1.43	-1.00E+00		5.71E+00
	1249.94	0.19	7.45E+00		4.01E+01
	1299.14	1.63	-3.37E+00		3.57E+00
	1408.01	21.07	1.72E-01		3.15E-01
	1457.64	0.50	1.82E+02		5.12E+01
	1528.10	0.28	-6.07E+00		1.74E+01
Eu-154	123.07	40.40	-4.49E-02	1.19E-01	1.19E-01
	247.93	6.89	4.49E-01		6.27E-01
	591.76	4.95	-8.40E-02		8.47E-01
	692.42	1.78	-6.73E-01		2.76E+00
	723.30	20.06	1.51E-01		2.52E-01
	756.80	4.52	1.28E+00		1.27E+00
	873.18	12.08	2.79E-02		4.21E-01
	996.29	10.48	2.28E-01		6.89E-01

Analysis Report for 31-Oct-18-10055

L1-10221F-FSGS-017SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	-2.95E-02	1.19E-01	3.68E-01
	1274.43	34.80	-4.00E-02		2.07E-01
	1596.48	1.80	-9.15E-01		2.51E+00
Eu-155	45.30	1.31	1.01E+00	3.05E-01	3.35E+01
	60.01	1.22	-1.29E+01		3.35E+01
	86.55	30.70	9.23E-02		3.05E-01
	105.31	21.10	1.28E-01		3.06E-01
Ra-226	186.21	3.64	1.46E+00	1.33E+00	1.33E+00
Pa-231	27.36	10.30	3.39E+00	1.78E+00	3.68E+00
	283.69	1.70	0.00E+00		2.54E+00
	300.07	2.47	-2.16E+00		1.78E+00
	302.65	2.20	1.84E+00		2.06E+00
	330.06	1.40	-2.80E+00		2.99E+00
U-235	143.76	10.96	-4.30E-02	8.29E-02	4.63E-01
	163.33	5.08	2.52E-01		9.23E-01
	185.71	57.20	8.15E-02		8.29E-02
	202.11	1.08	-2.14E+00		3.83E+00
	205.31	5.01	-1.91E-01		7.78E-01
Am-241	59.54	35.90	-5.73E-01	1.18E+00	1.18E+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


0000061609.CNF
Live Time :900.000 sec
Real Time :901.430 sec
Start: 1: -0.0(kev)
Stop : 8192:2047.4(kev)
Acq. Start :Wed Oct 31 14:28:16 2018
Counts
Channel
PB-212
PB-214
AC-228
PB-214
TL-208
BI-214
AC-228
K-40
ROI Type: 1

[202]

Apex-Gamma

Analysis Report for 28-Nov-18-10027
L1-10221F-FSGS-002SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 28-Nov-18-10027
Sample Description	: L1-10221F-FSGS-002SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.316E+03 grams
Facility	: Default
Sample Taken On	: 10/26/2018 2:50:00PM
Acquisition Started	: 11/28/2018 10:26:48AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P40818B
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 901.5 seconds
Dead Time	: 0.17 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 9/29/2018
Efficiency Calibration Used Done On	: 11/28/2018
Efficiency Calibration Description	:
Sample Number	: 62763
Fill Height	: 1315.79 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 1/30/2012 12:00:00PM

11/28/18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/28/2018 10:41:52AM
Peak Analysis From Channel : 120
Peak Analysis To Channel : 8192

DATA VALIDATED 11/29/18 0900
J GRAHAM

Analysis Report for 28-Nov-18-10027

L1-10221F-FSGS-002SB

	Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
M	1	238.52	948 -	973	954.19	1.46E+02	13.52	6.40E+01	0.98
m	2	241.74	948 -	973	967.05	5.87E+01	9.18	4.80E+01	0.98
	3	295.15	1175 -	1185	1180.50	5.07E+01	12.20	4.13E+01	0.97
	4	338.20	1347 -	1358	1352.56	2.89E+01	9.62	2.51E+01	0.60
	5	351.81	1397 -	1415	1406.99	1.48E+02	15.36	2.61E+01	0.61
	6	582.98	2325 -	2337	2331.15	4.52E+01	9.59	1.78E+01	0.76
	7	609.12	2429 -	2443	2435.65	9.94E+01	11.57	1.16E+01	1.51
	8	911.20	3636 -	3650	3643.77	4.06E+01	8.23	9.40E+00	1.54
	9	1460.48	5831 -	5853	5841.73	3.37E+02	19.19	8.32E+00	1.13
	10	1764.05	7051 -	7064	7057.21	1.80E+01	4.24	0.00E+00	0.28

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	0.98	1460.82	*	10.66	8.83E+00	6.33E-01
Tl-208	0.99	583.19	*	85.00	7.87E-02	1.74E-02
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.70E-01	3.32E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	3.33E-01	4.37E-02
		768.36		4.89		

Analysis Report for 28-Nov-18-10027

L1-10221F-FSGS-002SB

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	3.81E-01	9.12E-02
		1847.43		2.03		
		2118.51		1.16		
Pb-214	0.99	241.99	*	7.25	6.57E-01	1.16E-01
		295.22	*	18.42	2.51E-01	6.36E-02
		351.93	*	35.60	4.30E-01	5.64E-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	2.58E-01	8.84E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	3.17E-01	6.57E-02
		964.77		4.99		
		968.97		15.80		
		1588.20		3.22		

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

INTERFERENCE CORRECTED REPORT

Analysis Report for 28-Nov-18-10027

L1-10221F-FSGS-002SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.981	8.83E+00	6.33E-01	
	Tl-208	0.993	7.87E-02	1.74E-02	
X	Bi-211	0.915			
	Pb-212	0.998	2.70E-01	3.32E-02	
	Bi-214	0.993	3.42E-01	3.94E-02	
	Pb-214	0.997	3.87E-01	3.96E-02	
	Ac-228	1.000	2.96E-01	5.27E-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 28-Nov-18-10027

L1-10221F-FSGS-002SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/28/2018 10:41:52AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

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

All peaks were identified.

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

NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)		Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
	An Pk	511.00		100.00	6.26E-02	9.40E-02	9.40E-02
	BE-7	477.60		10.44	-4.90E-02	6.06E-01	6.06E-01
+	K-40	1460.82	*	10.66	8.83E+00	5.76E-01	5.76E-01
	Co-60	1173.23		99.85	2.25E-02	6.27E-02	7.95E-02
		1332.49		99.98	-1.71E-02		6.27E-02
	Nb-94	702.65		99.81	1.26E-02	4.95E-02	5.79E-02
		871.09		99.89	-3.43E-02		4.95E-02
	Ag-108m	79.13		6.60	-4.34E-01	5.33E-02	2.20E+00
		433.94		90.50	1.33E-02		5.33E-02
		614.28		89.80	7.58E-03		7.69E-02
		722.94		90.80	8.31E-03		7.02E-02
	Sb-125	176.31		6.84	9.52E-02	1.54E-01	6.27E-01
		380.45		1.52	-1.86E+00		2.69E+00
		427.87		29.60	-7.43E-02		1.54E-01
		463.36		10.49	2.23E-01		4.80E-01
		600.60		17.65	-2.03E-02		2.94E-01
		606.71		4.98	2.84E+00		1.80E+00
		635.95		11.22	-1.56E-01		3.78E-01
		671.44		1.79	-2.67E-01		2.32E+00

Analysis Report for 28-Nov-18-10027

L1-10221F-FSGS-002SB

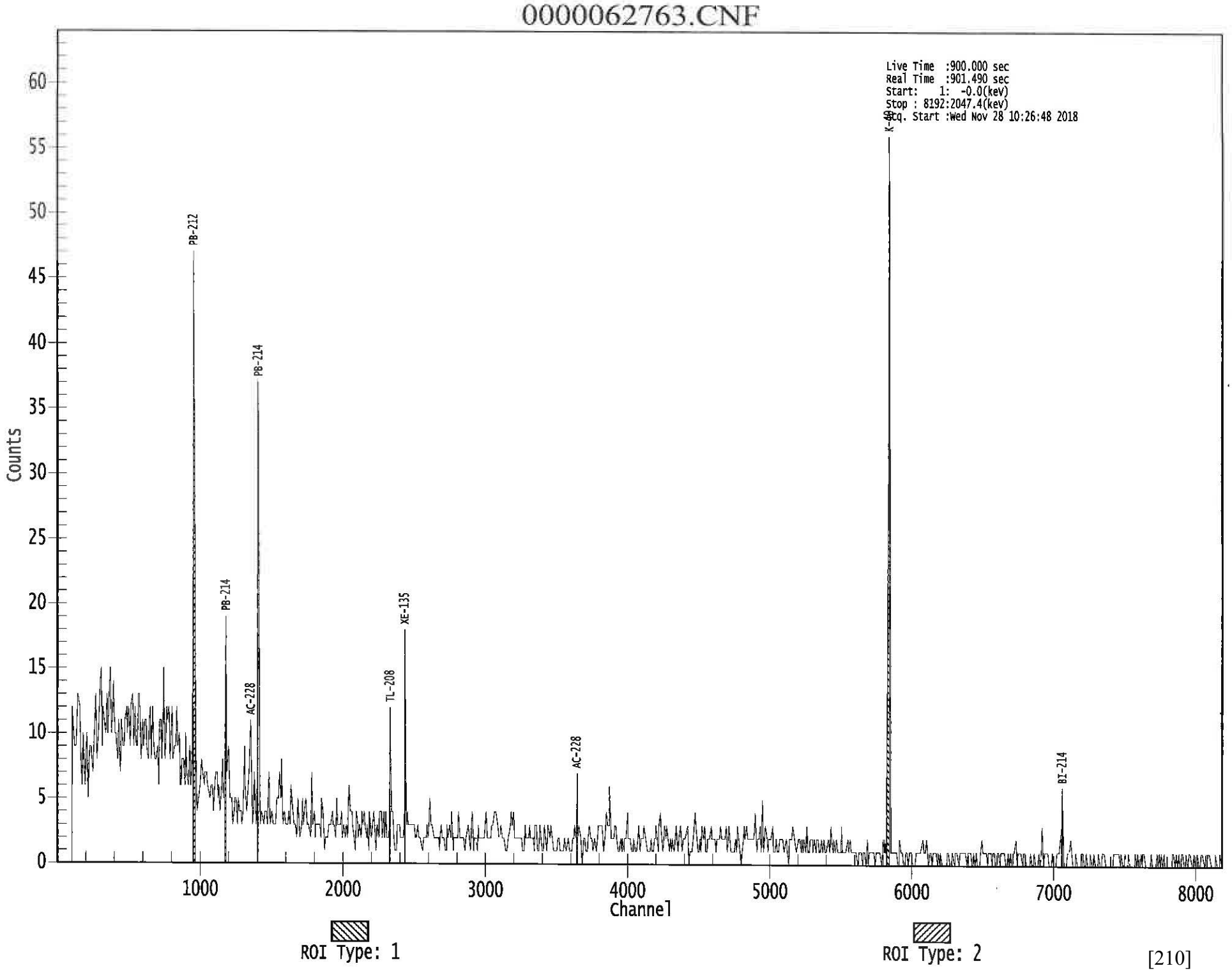
Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Ba-133	79.61	2.65	-2.14E+00	8.77E-02	5.19E+00
	81.00	32.90	-1.17E-01		3.63E-01
	276.40	7.16	2.16E-02		6.14E-01
	302.85	18.34	1.88E-01		2.57E-01
	356.01	62.05	-1.12E-02		8.77E-02
	383.85	8.94	1.92E-01		5.16E-01
Cs-134	475.36	1.48	7.10E-01	7.59E-02	2.90E+00
	563.25	8.34	-3.77E-01		5.36E-01
	569.33	15.37	-5.75E-02		3.13E-01
	604.72	97.62	-5.21E-02		8.49E-02
	795.86	85.46	1.57E-02		7.59E-02
	801.95	8.69	5.19E-01		6.74E-01
	1038.61	0.99	-1.55E+00		5.93E+00
	1167.97	1.79	7.33E-01		4.71E+00
	1365.19	3.02	-1.63E+00		2.25E+00
Cs-137	661.66	85.10	-2.53E-02	4.93E-02	4.93E-02
Eu-152	121.78	28.67	-7.39E-02	1.66E-01	1.69E-01
	244.70	7.61	-1.76E-01		6.50E-01
	295.94	0.45	2.33E+00		1.26E+01
	344.28	26.60	4.62E-02		1.66E-01
	367.79	0.86	1.89E+00		4.75E+00
	411.12	2.24	2.35E-01		2.05E+00
	443.96	2.83	-2.39E-01		1.47E+00
	488.68	0.42	2.58E+00		1.17E+01
	563.99	0.49	-2.96E-01		9.37E+00
	586.26	0.46	-8.87E+00		1.54E+01
	678.62	0.47	-3.05E+00		9.40E+00
	688.67	0.86	-3.41E-01		5.83E+00
	719.35	0.28	6.63E+00		1.97E+01
	778.90	12.96	1.30E-01		3.76E-01
	810.45	0.32	-8.17E+00		1.44E+01
	867.37	4.26	2.94E-01		1.29E+00
	919.33	0.43	4.66E+00		1.32E+01
	964.08	14.65	3.45E-01		5.57E-01
	1085.87	10.24	1.89E-01		6.08E-01
	1089.74	1.73	1.66E+00		3.85E+00
	1112.07	13.69	-6.27E-01		3.83E-01
	1212.95	1.43	-3.16E+00		5.58E+00
	1249.94	0.19	-1.48E+01		3.86E+01
	1299.14	1.63	4.35E-01		4.09E+00
	1408.01	21.07	-1.39E-01		2.02E-01
	1457.64	0.50	1.86E+02		5.21E+01
	1528.10	0.28	1.24E+01		2.01E+01
Eu-154	123.07	40.40	-1.45E-03	1.23E-01	1.23E-01
	247.93	6.89	9.75E-02		5.89E-01
	591.76	4.95	-3.12E-01		9.39E-01
	692.42	1.78	-8.73E-01		2.95E+00
	723.30	20.06	2.33E-01		3.26E-01
	756.80	4.52	-7.73E-02		1.25E+00
	873.18	12.08	3.66E-01		4.60E-01
	996.29	10.48	-3.09E-01		5.53E-01

Analysis Report for 28-Nov-18-10027

L1-10221F-FSGS-002SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	1004.76	18.01	6.14E-02	1.23E-01	3.46E-01
	1274.43	34.80	3.29E-02		2.13E-01
	1596.48	1.80	-4.62E-01		3.16E+00
Eu-155	45.30	1.31	3.91E+00	2.79E-01	3.41E+01
	60.01	1.22	3.67E+00		3.63E+01
	86.55	30.70	1.21E-03		2.79E-01
	105.31	21.10	6.35E-02		3.03E-01
Ra-226	186.21	3.64	7.02E-01	1.22E+00	1.22E+00
Pa-231	27.36	10.30	3.15E+00	1.93E+00	3.96E+00
	283.69	1.70	-2.30E+00		2.16E+00
	300.07	2.47	-9.84E-01		1.93E+00
	302.65	2.20	1.14E+00		2.12E+00
	330.06	1.40	9.53E-01		3.43E+00
U-235	143.76	10.96	3.32E-01	7.78E-02	4.52E-01
	163.33	5.08	1.70E-01		9.30E-01
	185.71	57.20	3.34E-03		7.78E-02
	202.11	1.08	1.58E+00		4.23E+00
	205.31	5.01	-4.30E-01		8.86E-01
Am-241	59.54	35.90	9.28E-02	1.30E+00	1.30E+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


0000062763.CNF
Live Time :900.000 sec
Real Time :901.490 sec
Start: 1: -0.0(keV)
Stop : 8192:2047.4(keV)
Acq. Start :Wed Nov 28 10:26:48 2018
PB-212
PB-214
AC-228
PB-214
TL-208
XE-135
AC-228
K-40
BI-214
Counts
Channel
ROI Type: 1
ROI Type: 2

[210]

Apex-Gamma

Analysis Report for 28-Nov-18-10028
L1-10221F-FSGS-011SB

GAMMA SPECTRUM ANALYSIS

Sample Identification	: 28-Nov-18-10028
Sample Description	: L1-10221F-FSGS-011SB
Sample Type	: Soil
Unit	:
Sample Point	:
Sample Size	: 1.513E+03 grams
Facility	: Default
Sample Taken On	: 10/26/2018 3:05:00PM
Acquisition Started	: 11/28/2018 10:26:56AM
Procedure	: 130G_SOIL_1
Operator	: Administrator
Detector Name	: P11314
Geometry	: 130G_SOIL_1
Live Time	: 900.0 seconds
Real Time	: 900.3 seconds
Dead Time	: 0.04 %
Peak Locate Threshold	: 3.00
Peak Locate Range (in channels)	: 120 - 8192
Peak Area Range (in channels)	: 120 - 8192
Identification Energy Tolerance	: 1.000 keV
Energy Calibration Used Done On	: 10/15/2018
Efficiency Calibration Used Done On	: 11/28/2018
Efficiency Calibration Description	:
Sample Number	: 62764
Fill Height	: 1512.92 gram
Certificate Name	: Eu155-Na22
Certificate Date	: 12/22/2008 12:00:00PM

11/28/18

PEAK ANALYSIS REPORT

Peak Analysis Performed on : 11/28/2018 10:42:14AM

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

DATA VALIDATED 11/29/18 0900
J GRAHAM

Analysis Report for 28-Nov-18-10028

L1-10221F-FSGS-011SB

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	FWHM (keV)
1	31.32	124 -	131	126.11	1.47E+01	8.41	2.53E+01	0.34
2	238.80	948 -	961	954.77	1.28E+02	17.87	6.82E+01	0.99
3	295.19	1175 -	1187	1180.03	5.49E+01	11.73	3.11E+01	1.09
4	338.21	1346 -	1357	1351.93	4.02E+01	9.90	2.28E+01	0.43
5	351.94	1399 -	1413	1406.76	9.74E+01	12.51	2.06E+01	1.20
6	609.04	2428 -	2441	2434.20	7.02E+01	10.69	1.58E+01	1.21
7	910.93	3635 -	3646	3641.18	2.30E+01	7.28	1.20E+01	0.42
8	1460.07	5827 -	5848	5838.20	2.28E+02	15.43	2.67E+00	1.68

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

No background subtract performed on this spectrum.

NUCLIDE IDENTIFICATION REPORT

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

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)		Yield(%)	Activity (pCi/grams)	Activity Uncertainty
K-40	0.91	1460.82	*	10.66	5.14E+00	4.13E-01
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	2.03E-01	3.23E-02
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	2.04E-01	3.34E-02
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29		14.92		

Analysis Report for 28-Nov-18-10028

L1-10221F-FSGS-011SB

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	2.35E-01	5.36E-02
		351.93	*	35.60	2.46E-01	3.72E-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	3.11E-01	8.07E-02
		409.46		1.92		
		463.00		4.40		
		794.95		4.25		
		911.20	*	25.80	1.55E-01	4.95E-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 28-Nov-18-10028

L1-10221F-FSGS-011SB

	Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
	K-40	0.913	5.14E+00	4.13E-01	
X	Bi-211	0.887			
	Pb-212	0.996	2.03E-01	3.28E-02	
	Bi-214	0.995	2.04E-01	3.34E-02	
	Pb-214	1.000	2.42E-01	3.06E-02	
	Ac-228	0.996	1.98E-01	4.22E-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 28-Nov-18-10028
L1-10221F-FSGS-011SB

UNIDENTIFIED PEAKS

Peak Locate Performed on : 11/28/2018 10:42:14AM
Peak Locate From Channel : 120
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
1	31.32	1.63403E-02	57.16		

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	6.25E-02	7.44E-02	7.44E-02
	BE-7	477.60		10.44	-2.88E-01	4.78E-01	4.78E-01
+	K-40	1460.82	*	10.66	5.14E+00	3.04E-01	3.04E-01
	Co-60	1173.23		99.85	1.93E-02	4.25E-02	5.79E-02
		1332.49		99.98	-5.93E-02		4.25E-02
	Nb-94	702.65		99.81	1.67E-02	3.91E-02	4.56E-02
		871.09		99.89	-6.74E-03		3.91E-02
	Ag-108m	79.13		6.60	1.08E+00	3.88E-02	1.25E+00
		433.94		90.50	6.92E-03		3.88E-02
		614.28		89.80	-6.17E-05		5.35E-02
		722.94		90.80	-1.95E-02		4.77E-02
	Sb-125	176.31		6.84	-9.90E-02	1.12E-01	4.58E-01
		380.45		1.52	1.69E-01		2.38E+00
		427.87		29.60	-6.25E-02		1.12E-01
		463.36		10.49	3.28E-02		3.50E-01
		600.60		17.65	3.22E-02		2.28E-01
		606.71		4.98	2.33E+00		1.43E+00
		635.95		11.22	2.71E-02		3.15E-01

Analysis Report for 28-Nov-18-10028

L1-10221F-FSGS-011SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Sb-125	671.44	1.79	-7.17E-01	1.12E-01	2.05E+00
Ba-133	79.61	2.65	1.39E+00	6.48E-02	2.96E+00
	81.00	32.90	-2.58E-01		1.85E-01
	276.40	7.16	3.73E-03		4.73E-01
	302.85	18.34	-4.36E-02		1.76E-01
	356.01	62.05	-1.17E-03		6.48E-02
	383.85	8.94	2.42E-01		4.28E-01
Cs-134	475.36	1.48	1.24E+00	4.65E-02	2.52E+00
	563.25	8.34	-6.13E-01		4.23E-01
	569.33	15.37	6.44E-02		2.43E-01
	604.72	97.62	-4.87E-02		6.89E-02
	795.86	85.46	-1.96E-03		4.65E-02
	801.95	8.69	4.72E-02		4.89E-01
	1038.61	0.99	-2.52E+00		4.91E+00
	1167.97	1.79	-4.13E-01		2.87E+00
	1365.19	3.02	-6.71E-01		1.52E+00
Cs-137	661.66	85.10	5.10E-02	6.06E-02	6.06E-02
Eu-152	121.78	28.67	1.52E-03	1.15E-01	1.15E-01
	244.70	7.61	1.34E-01		4.94E-01
	295.94	0.45	4.55E+00		9.90E+00
	344.28	26.60	7.68E-02		1.26E-01
	367.79	0.86	2.75E+00		3.94E+00
	411.12	2.24	4.75E-03		1.46E+00
	443.96	2.83	2.97E-01		1.22E+00
	488.68	0.42	-5.36E+00		7.15E+00
	563.99	0.49	-9.10E+00		6.64E+00
	586.26	0.46	9.58E+00		1.26E+01
	678.62	0.47	-3.65E+00		7.03E+00
	688.67	0.86	3.18E+00		4.83E+00
	719.35	0.28	-1.07E+01		1.18E+01
	778.90	12.96	5.75E-02		2.60E-01
	810.45	0.32	9.36E-01		1.37E+01
	867.37	4.26	-9.90E-02		9.19E-01
	919.33	0.43	-3.59E+00		1.12E+01
	964.08	14.65	1.02E-01		4.21E-01
	1085.87	10.24	1.90E-01		4.87E-01
	1089.74	1.73	5.85E-01		2.94E+00
	1112.07	13.69	-1.76E-01		3.46E-01
	1212.95	1.43	2.73E+00		4.75E+00
	1249.94	0.19	1.04E+01		2.77E+01
	1299.14	1.63	1.16E+00		3.00E+00
	1408.01	21.07	1.87E-02		1.73E-01
	1457.64	0.50	1.08E+02		3.66E+01
	1528.10	0.28	7.08E+00		1.46E+01
Eu-154	123.07	40.40	6.23E-02	8.32E-02	8.32E-02
	247.93	6.89	-2.86E-02		4.22E-01
	591.76	4.95	1.12E-01		7.91E-01
	692.42	1.78	-1.13E+00		2.42E+00
	723.30	20.06	-7.76E-03		2.21E-01
	756.80	4.52	3.33E-01		8.30E-01
	873.18	12.08	1.75E-01		3.27E-01

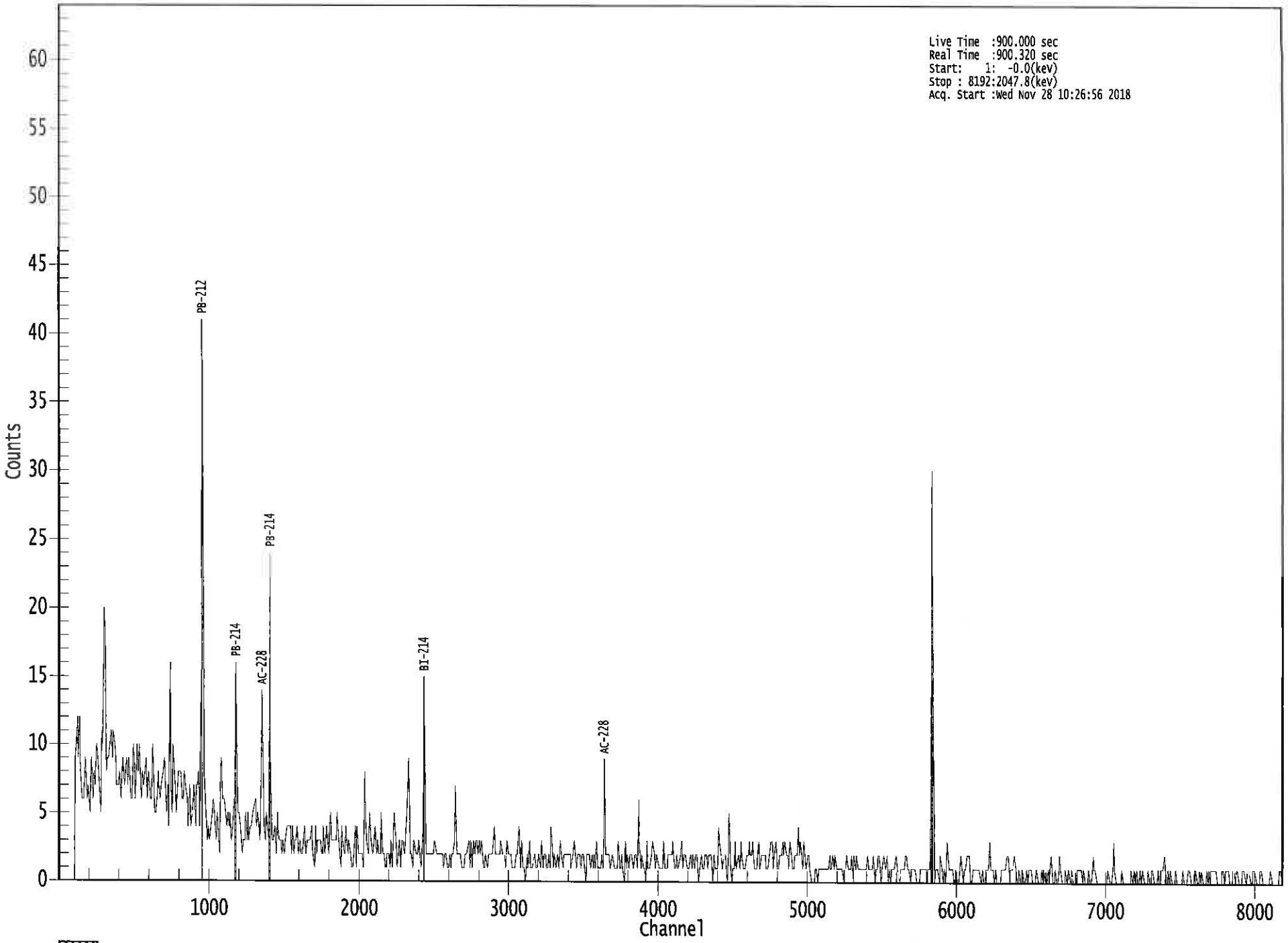
Analysis Report for 28-Nov-18-10028

L1-10221F-FSGS-011SB

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)
Eu-154	996.29	10.48	-3.16E-01	8.32E-02	4.41E-01
	1004.76	18.01	-3.61E-02		2.35E-01
	1274.43	34.80	3.86E-02		1.42E-01
	1596.48	1.80	1.15E+00		2.37E+00
Eu-155	45.30	1.31	-1.50E+01	1.85E-01	3.07E+02
	60.01	1.22	-3.30E+00		1.21E+01
	86.55	30.70	6.82E-02		1.85E-01
	105.31	21.10	6.71E-02		1.89E-01
Ra-226	186.21	3.64	6.35E-01	9.12E-01	9.12E-01
Pa-231	27.36	10.30	2.12E+03	1.36E+00	3.10E+03
	283.69	1.70	7.59E-01		1.71E+00
	300.07	2.47	7.10E-01		1.36E+00
	302.65	2.20	1.83E-02		1.48E+00
	330.06	1.40	7.40E-01		2.63E+00
U-235	143.76	10.96	1.49E-01	5.80E-02	3.08E-01
	163.33	5.08	1.93E-01		5.92E-01
	185.71	57.20	9.99E-03		5.80E-02
	202.11	1.08	-6.41E-01		2.80E+00
	205.31	5.01	-3.89E-02		5.75E-01
Am-241	59.54	35.90	-6.40E-02	4.17E-01	4.17E-01

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

0000062764.CNF



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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-44985

February 12, 2019

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

CASE NARRATIVE
Work Order # 18-12109-OR

SAMPLE RECEIPT

This work order contains six soil samples received 12/21/2018. Samples were analyzed for Total Strontium, Tritium, Nickel-63 and by Gamma Spectroscopy.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
L1-10221F-FSGS-005-SS-B	18-12109-04	L1-10220E-FSGS-010-SS-B	18-12109-07
L1-10221F-FSGS-011-SS-B	18-12109-05	L1-10220B-FSGS-009-SS-A	18-12109-08
L1-10220E-FSGS-006-SS-A	18-12109-06	L1-10220B-FSGS-012-SS-B	18-12109-09

ANALYTICAL METHODS

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

Laboratory qualifiers are as follows:

U - Result is less than the MDA.

ANALYTICAL RESULTS

Combined Standard Uncertainty is reported at 1-sigma value.

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

TOTAL STRONTIUM

Samples were prepared by aliquoting as appropriate and adding Strontium recovery carriers to each sample. Chemical separations were conducted using selective extractions. Strontium precipitated was mounted on tared filter media. Chemical recovery was determined by Strontium carrier mass determinations. Samples were counted by gas flow proportional counting and corrected for Yttrium-90 ingrowth.

ANALYTICAL RESULTS CONTINUED

TOTAL STRONTIUM CONTINUED

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

TRITIUM

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

Samples demonstrated acceptable results for all Tritium analyses. Laboratory fraction -09 (Client ID: L1-10220B-FSGS-012-SS-B) was recounted due to the presence of static. The Tritium method blank demonstrated an acceptable result. Results for the Tritium duplicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Tritium laboratory control sample demonstrated an acceptable percent recovery.

NICKEL-63

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

1st Analytical Run

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.

2nd Analytical Run

Laboratory fraction -08 (Client ID: L1-10220B-FSGS-009-SS-A) was reanalyzed due to a positive bias. Sample demonstrated acceptable results for all Nickel-63 reanalyses. 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.

ANALYTICAL RESULTS CONTINUED

GAMMA SPECTROSCOPY

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

Samples demonstrated acceptable results for all gamma-emitting radionuclides as reported. The method blank demonstrated acceptable results for all radionuclides as reported. Results for the Bismuth-214, Cesium-137 and Potassium-40 replicate demonstrated an acceptable relative percent difference and normalized difference. Results for the Cobalt-60 and Cesium-137 laboratory control sample demonstrated an acceptable percent recovery.

CERTIFICATION OF ACCURACY

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

M.R. McDougall
Laboratory Manager

Date: 2/12/2019

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Patricia Giza	SDG:	18-12109
Zion Solutions	Purchase Order:	677118
101 Shiloh Blvd	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
18-12109-01	LCS	KNOWN	12/21/18 00:00	12/21/2018	1/8/2019	18-12109	Tritium	LANL ER-210 Modified	2.14E+02	7.71E+00				pCi/g
18-12109-01	LCS	SPIKE	12/21/18 00:00	12/21/2018	1/8/2019	18-12109	Tritium	LANL ER-210 Modified	2.19E+02	5.62E+00	1.35E+01	3.82E+00		pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	1/8/2019	18-12109	Tritium	LANL ER-210 Modified	1.89E+00	2.26E+00	2.26E+00	3.80E+00	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	1/8/2019	18-12109	Tritium	LANL ER-210 Modified	2.11E+00	2.30E+00	2.31E+00	3.86E+00	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	1/8/2019	18-12109	Tritium	LANL ER-210 Modified	2.12E+00	2.32E+00	2.32E+00	3.89E+00	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	1/8/2019	18-12109	Tritium	LANL ER-210 Modified	9.28E-01	2.20E+00	2.20E+00	3.74E+00	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	1/9/2019	18-12109	Tritium	LANL ER-210 Modified	2.29E+00	2.30E+00	2.30E+00	3.84E+00	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	1/9/2019	18-12109	Tritium	LANL ER-210 Modified	2.06E+00	2.24E+00	2.25E+00	3.76E+00	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	1/9/2019	18-12109	Tritium	LANL ER-210 Modified	2.63E+00	2.27E+00	2.28E+00	3.79E+00	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	1/1/2019	18-12109	Tritium	LANL ER-210 Modified	1.69E+00	2.24E+00	2.24E+00	3.78E+00	U	pCi/g
18-12109-01	LCS	KNOWN	12/21/18 00:00	12/21/2018	1/5/2019	18-12109	Nickel-63	ASTM 3500-Ni Modified	1.52E+03	4.57E+01				pCi/g
18-12109-01	LCS	SPIKE	12/21/18 00:00	12/21/2018	1/5/2019	18-12109	Nickel-63	ASTM 3500-Ni Modified	1.49E+03	8.84E+00	8.82E+01	2.04E+00		pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	1/5/2019	18-12109	Nickel-63	ASTM 3500-Ni Modified	-4.01E-01	1.18E+00	1.18E+00	2.03E+00	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	1/5/2019	18-12109	Nickel-63	ASTM 3500-Ni Modified	4.87E-01	1.21E+00	1.21E+00	2.06E+00	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	1/5/2019	18-12109	Nickel-63	ASTM 3500-Ni Modified	1.62E-01	1.20E+00	1.20E+00	2.06E+00	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	1/5/2019	18-12109	Nickel-63	ASTM 3500-Ni Modified	-7.28E-01	1.18E+00	1.18E+00	2.05E+00	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	1/6/2019	18-12109	Nickel-63	ASTM 3500-Ni Modified	-7.96E-02	1.18E+00	1.18E+00	2.02E+00	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	1/6/2019	18-12109	Nickel-63	ASTM 3500-Ni Modified	8.00E-02	1.19E+00	1.19E+00	2.03E+00	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	1/10/2019	18-12109	Nickel-63	ASTM 3500-Ni Modified	-3.28E-01	1.20E+00	1.20E+00	2.07E+00	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	1/6/2019	18-12109	Nickel-63	ASTM 3500-Ni Modified	1.71E-01	1.27E+00	1.27E+00	2.17E+00	U	pCi/g
18-12109-01	LCS	KNOWN	12/21/18 00:00	12/21/2018	1/10/2019	18-12109	Strontium-90	ElChroM SRW01 Modified	5.03E+01	2.82E-01				pCi/g
18-12109-01	LCS	SPIKE	12/21/18 00:00	12/21/2018	1/10/2019	18-12109	Strontium-90	ElChroM SRW01 Modified	5.07E+01	1.43E+00	1.77E+01	7.25E-01		pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	1/10/2019	18-12109	Strontium-90	ElChroM SRW01 Modified	-4.05E-02	3.82E-01	3.83E-01	8.21E-01	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	1/10/2019	18-12109	Strontium-90	ElChroM SRW01 Modified	1.46E-01	3.46E-01	3.50E-01	7.24E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	1/10/2019	18-12109	Strontium-90	ElChroM SRW01 Modified	1.29E-01	2.69E-01	2.73E-01	5.62E-01	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	1/10/2019	18-12109	Strontium-90	ElChroM SRW01 Modified	8.45E-02	3.06E-01	3.08E-01	6.46E-01	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	1/10/2019	18-12109	Strontium-90	ElChroM SRW01 Modified	1.54E-01	3.12E-01	3.16E-01	6.50E-01	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	1/10/2019	18-12109	Strontium-90	ElChroM SRW01 Modified	3.61E-01	3.07E-01	3.32E-01	6.16E-01	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	1/10/2019	18-12109	Strontium-90	ElChroM SRW01 Modified	4.36E-01	2.70E-01	3.10E-01	5.25E-01	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	1/10/2019	18-12109	Strontium-90	ElChroM SRW01 Modified	7.42E-02	3.00E-01	3.01E-01	6.34E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Patricia Giza	SDG:	18-12109
Zion Solutions	Purchase Order:	677118
101 Shiloh Blvd	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
18-12109-01	LCS	KNOWN	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Cobalt-60	EPA 901.1 Modified	1.31E+02	5.10E+00				pCi/g
18-12109-01	LCS	KNOWN	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Cesium-137	EPA 901.1 Modified	8.26E+01	3.39E+00				pCi/g
18-12109-01	LCS	SPIKE	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Cobalt-60	EPA 901.1 Modified	1.41E+02	9.12E+00	1.17E+01	1.35E+00		pCi/g
18-12109-01	LCS	SPIKE	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Cesium-137	EPA 901.1 Modified	9.13E+01	1.00E+01	1.11E+01	2.00E+00		pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Actinium-228	EPA 901.1 Modified	6.86E-02	4.28E-02	4.29E-02	8.45E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Silver-108m	EPA 901.1 Modified	-1.28E-02	1.32E-02	1.32E-02	1.69E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Americium-241	EPA 901.1 Modified	-7.94E-02	3.51E-02	3.53E-02	3.92E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Barium-133	EPA 901.1 Modified	-2.06E-02	1.88E-02	1.88E-02	2.49E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Bismuth-214	EPA 901.1 Modified	3.69E-02	2.66E-02	2.66E-02	4.74E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Cobalt-60	EPA 901.1 Modified	1.50E-02	1.22E-02	1.22E-02	2.37E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Cesium-134	EPA 901.1 Modified	-2.12E-02	1.60E-02	1.61E-02	1.95E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Cesium-137	EPA 901.1 Modified	-1.06E-03	1.37E-02	1.37E-02	2.12E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Europium-152	EPA 901.1 Modified	1.70E-02	5.67E-02	5.67E-02	5.39E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Europium-154	EPA 901.1 Modified	-9.90E-03	3.38E-02	3.38E-02	2.78E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Europium-155	EPA 901.1 Modified	2.19E-02	2.56E-02	2.56E-02	4.34E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Holmium-166m	EPA 901.1 Modified	2.72E-03	2.26E-02	2.26E-02	2.21E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Iodine-129	EPA 901.1 Modified	5.19E-02	5.23E-02	5.24E-02	7.34E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Potassium-40	EPA 901.1 Modified	1.69E-01	9.24E-02	9.28E-02	2.21E-01	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Manganese-54	EPA 901.1 Modified	-7.06E-03	1.40E-02	1.40E-02	1.80E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Molybdenum-93	EPA 901.1 Modified	-7.20E-03	1.14E-02	1.14E-02	1.54E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Niobium-94	EPA 901.1 Modified	-2.75E-03	1.10E-02	1.10E-02	1.62E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Lead-210	EPA 901.1 Modified	3.64E-01	2.64E-01	2.64E-01	4.56E-01	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Lead-212	EPA 901.1 Modified	2.68E-02	2.11E-02	2.11E-02	3.48E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Lead-214	EPA 901.1 Modified	1.55E-02	2.73E-02	2.73E-02	4.37E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Promethium-145	EPA 901.1 Modified	7.83E-03	4.32E-02	4.32E-02	5.78E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Radium-226	EPA 901.1 Modified	3.69E-02	2.66E-02	2.66E-02	4.74E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Antimony-125	EPA 901.1 Modified	-1.30E-03	3.86E-02	3.86E-02	5.82E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Thorium-234	EPA 901.1 Modified	8.71E-01	2.60E-01	2.63E-01	4.75E-01	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Thallium-208	EPA 901.1 Modified	-7.39E-03	3.84E-02	3.84E-02	5.74E-02	U	pCi/g
18-12109-02	MBL	BLANK	12/21/18 00:00	12/21/2018	12/28/2018	18-12109	Uranium-235	EPA 901.1 Modified	4.93E-02	1.51E-01	1.51E-01	1.12E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	Work Order Details:	
Patricia Giza	SDG:	18-12109
Zion Solutions	Purchase Order:	677118
101 Shiloh Blvd	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
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Actinium-228	EPA 901.1 Modified	7.41E-01	3.01E-01	3.04E-01	5.85E-01		pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Silver-108m	EPA 901.1 Modified	1.30E-02	3.07E-02	3.07E-02	9.47E-02	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Americium-241	EPA 901.1 Modified	-6.89E-02	1.11E-01	1.12E-01	1.58E-01	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Barium-133	EPA 901.1 Modified	-3.17E-04	4.15E-02	4.15E-02	1.78E-01	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Bismuth-214	EPA 901.1 Modified	7.46E-01	1.89E-01	1.93E-01	3.00E-01		pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Cobalt-60	EPA 901.1 Modified	5.01E-02	9.02E-02	9.03E-02	1.51E-01	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Cesium-134	EPA 901.1 Modified	-1.78E-02	4.14E-02	4.14E-02	1.30E-01	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Cesium-137	EPA 901.1 Modified	2.12E-01	8.62E-02	8.69E-02	1.59E-01		pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Europium-152	EPA 901.1 Modified	8.55E-02	1.51E-01	1.51E-01	2.39E-01	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Europium-154	EPA 901.1 Modified	1.96E-02	2.36E-01	2.36E-01	1.23E-01	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Europium-155	EPA 901.1 Modified	3.27E-01	1.68E-01	1.69E-01	2.27E-01		pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Holmium-166m	EPA 901.1 Modified	-6.00E-02	1.30E-01	1.30E-01	9.44E-02	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Iodine-129	EPA 901.1 Modified	8.81E-03	8.27E-02	8.27E-02	1.21E-01	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Potassium-40	EPA 901.1 Modified	1.97E+01	2.59E+00	2.78E+00	1.12E+00		pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Manganese-54	EPA 901.1 Modified	8.15E-02	7.95E-02	7.96E-02	1.40E-01	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Molybdenum-93	EPA 901.1 Modified	3.75E-02	7.66E-02	7.66E-02	8.83E-02	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Niobium-94	EPA 901.1 Modified	-3.38E-02	6.69E-02	6.69E-02	9.98E-02	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Lead-210	EPA 901.1 Modified	3.45E+00	1.16E+00	1.17E+00	1.80E+00		pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Lead-212	EPA 901.1 Modified	7.95E-01	1.33E-01	1.39E-01	2.84E-01		pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Lead-214	EPA 901.1 Modified	8.98E-01	1.75E-01	1.81E-01	2.95E-01		pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Promethium-145	EPA 901.1 Modified	-6.07E-02	1.05E-01	1.05E-01	1.48E-01	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Radium-226	EPA 901.1 Modified	7.46E-01	1.89E-01	1.93E-01	3.00E-01		pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Antimony-125	EPA 901.1 Modified	-1.82E-02	2.25E-01	2.25E-01	3.07E-01	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Thorium-234	EPA 901.1 Modified	2.09E+00	1.05E+00	1.06E+00	1.61E+00	U	pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Thallium-208	EPA 901.1 Modified	5.82E-01	1.89E-01	1.91E-01	2.79E-01		pCi/g
18-12109-03	DUP	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/27/2018	18-12109	Uranium-235	EPA 901.1 Modified	1.83E-01	8.44E-01	8.44E-01	4.86E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Patricia Giza		SDG:	18-12109
Zion Solutions		Purchase Order:	677118
101 Shiloh Blvd		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
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Actinium-228	EPA 901.1 Modified	7.82E-01	3.23E-01	3.25E-01	6.73E-01		pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Silver-108m	EPA 901.1 Modified	-1.00E-03	4.07E-02	4.07E-02	8.93E-02	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Americium-241	EPA 901.1 Modified	-1.26E-01	1.15E-01	1.15E-01	1.56E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Barium-133	EPA 901.1 Modified	-8.89E-03	4.17E-02	4.17E-02	1.82E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Bismuth-214	EPA 901.1 Modified	7.06E-01	1.71E-01	1.74E-01	2.53E-01		pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Cobalt-60	EPA 901.1 Modified	7.40E-02	1.05E-01	1.06E-01	1.29E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Cesium-134	EPA 901.1 Modified	2.33E-02	5.14E-02	5.14E-02	1.31E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Cesium-137	EPA 901.1 Modified	2.04E-01	8.82E-02	8.88E-02	2.56E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Europium-152	EPA 901.1 Modified	-5.05E-03	1.45E-01	1.45E-01	2.35E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Europium-154	EPA 901.1 Modified	-1.48E-01	2.13E-01	2.13E-01	1.20E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Europium-155	EPA 901.1 Modified	9.11E-02	1.37E-01	1.37E-01	2.00E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Holmium-166m	EPA 901.1 Modified	-8.99E-02	1.48E-01	1.48E-01	9.07E-02	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Iodine-129	EPA 901.1 Modified	1.72E-02	8.01E-02	8.01E-02	1.18E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Potassium-40	EPA 901.1 Modified	1.67E+01	2.26E+00	2.42E+00	1.73E+00		pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Manganese-54	EPA 901.1 Modified	-7.71E-03	8.03E-02	8.03E-02	1.28E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Molybdenum-93	EPA 901.1 Modified	1.30E-03	2.13E-02	2.13E-02	9.84E-02	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Niobium-94	EPA 901.1 Modified	-1.59E-02	6.65E-02	6.65E-02	1.03E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Lead-210	EPA 901.1 Modified	3.38E+00	1.18E+00	1.19E+00	1.84E+00		pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Lead-212	EPA 901.1 Modified	9.91E-01	1.84E-01	1.91E-01	2.49E-01		pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Lead-214	EPA 901.1 Modified	8.34E-01	1.77E-01	1.82E-01	2.92E-01		pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Promethium-145	EPA 901.1 Modified	-1.09E-01	1.05E-01	1.05E-01	1.46E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Radium-226	EPA 901.1 Modified	7.06E-01	1.71E-01	1.74E-01	2.53E-01		pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Antimony-125	EPA 901.1 Modified	1.57E-01	2.05E-01	2.06E-01	3.03E-01	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Thorium-234	EPA 901.1 Modified	9.16E-01	1.02E+00	1.02E+00	1.53E+00	U	pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Thallium-208	EPA 901.1 Modified	5.53E-01	2.09E-01	2.11E-01	4.30E-01		pCi/g
18-12109-04	DO	L1-10221F-FSGS-005-SS-B	10/25/18 14:42	12/21/2018	12/28/2018	18-12109	Uranium-235	EPA 901.1 Modified	3.53E-01	8.51E-01	8.51E-01	5.08E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Patricia Giza		SDG:	18-12109
Zion Solutions		Purchase Order:	677118
101 Shiloh Blvd		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
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Actinium-228	EPA 901.1 Modified	5.39E-01	1.48E-01	1.50E-01	2.49E-01		pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Silver-108m	EPA 901.1 Modified	-6.15E-03	1.56E-02	1.56E-02	4.58E-02	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Americium-241	EPA 901.1 Modified	9.02E-02	8.26E-02	8.28E-02	1.15E-01	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Barium-133	EPA 901.1 Modified	0.00E+00	2.50E-02	2.50E-02	6.52E-02	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Bismuth-214	EPA 901.1 Modified	4.40E-01	1.46E-01	1.47E-01	3.41E-01		pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Cobalt-60	EPA 901.1 Modified	6.41E-03	4.18E-02	4.18E-02	6.52E-02	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Cesium-134	EPA 901.1 Modified	-1.48E-01	5.56E-02	5.61E-02	4.92E-02	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Cesium-137	EPA 901.1 Modified	3.62E-01	7.98E-02	8.19E-02	9.46E-02		pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Europium-152	EPA 901.1 Modified	9.16E-02	1.24E-01	1.24E-01	1.39E-01	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Europium-154	EPA 901.1 Modified	-1.08E-01	1.27E-01	1.27E-01	7.02E-02	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Europium-155	EPA 901.1 Modified	1.57E-01	9.02E-02	9.05E-02	1.16E-01	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Holmium-166m	EPA 901.1 Modified	2.09E-02	6.17E-02	6.17E-02	6.38E-02	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Iodine-129	EPA 901.1 Modified	2.85E+00	1.18E+01	1.18E+01	1.81E+00	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Potassium-40	EPA 901.1 Modified	1.11E+01	1.52E+00	1.63E+00	8.62E-01		pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Manganese-54	EPA 901.1 Modified	-1.84E-02	4.04E-02	4.04E-02	5.77E-02	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Molybdenum-93	EPA 901.1 Modified	1.63E-02	3.03E-02	3.03E-02	4.83E-02	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Niobium-94	EPA 901.1 Modified	-1.43E-03	3.15E-02	3.15E-02	4.71E-02	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Lead-210	EPA 901.1 Modified	2.78E+00	1.66E+00	1.66E+00	2.61E+00		pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Lead-212	EPA 901.1 Modified	4.25E-01	8.23E-02	8.52E-02	1.75E-01		pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Lead-214	EPA 901.1 Modified	4.72E-01	9.89E-02	1.02E-01	1.90E-01		pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Promethium-145	EPA 901.1 Modified	8.76E-02	3.34E-01	3.34E-01	5.10E-01	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Radium-226	EPA 901.1 Modified	4.40E-01	1.46E-01	1.47E-01	3.41E-01		pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Antimony-125	EPA 901.1 Modified	-1.97E-02	7.80E-02	7.80E-02	1.28E-01	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Thorium-234	EPA 901.1 Modified	9.18E-01	8.30E-01	8.31E-01	1.14E+00	U	pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Thallium-208	EPA 901.1 Modified	3.03E-01	8.08E-02	8.23E-02	1.08E-01		pCi/g
18-12109-05	TRG	L1-10221F-FSGS-011-SS-B	10/25/18 15:00	12/21/2018	12/28/2018	18-12109	Uranium-235	EPA 901.1 Modified	-3.15E-01	6.26E-01	6.26E-01	3.14E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Patricia Giza		SDG:	18-12109
Zion Solutions		Purchase Order:	677118
101 Shiloh Blvd		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
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Actinium-228	EPA 901.1 Modified	4.64E-01	1.62E-01	1.64E-01	3.07E-01		pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Silver-108m	EPA 901.1 Modified	7.92E-03	3.67E-02	3.67E-02	4.72E-02	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Americium-241	EPA 901.1 Modified	-4.11E-02	5.95E-02	5.96E-02	8.37E-02	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Barium-133	EPA 901.1 Modified	4.92E-04	1.60E-02	1.60E-02	7.30E-02	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Bismuth-214	EPA 901.1 Modified	3.34E-01	1.20E-01	1.22E-01	1.88E-01		pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Cobalt-60	EPA 901.1 Modified	3.18E-02	4.91E-02	4.92E-02	8.51E-02	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Cesium-134	EPA 901.1 Modified	-5.53E-04	1.84E-02	1.84E-02	6.86E-02	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Cesium-137	EPA 901.1 Modified	1.37E-01	5.30E-02	5.35E-02	7.81E-02		pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Europium-152	EPA 901.1 Modified	-3.28E-02	8.72E-02	8.72E-02	1.13E-01	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Europium-154	EPA 901.1 Modified	-7.93E-02	1.48E-01	1.48E-01	5.68E-02	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Europium-155	EPA 901.1 Modified	8.47E-02	6.01E-02	6.03E-02	1.13E-01	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Holmium-166m	EPA 901.1 Modified	3.25E-02	5.96E-02	5.96E-02	4.81E-02	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Iodine-129	EPA 901.1 Modified	-8.19E-02	1.48E-01	1.48E-01	2.08E-01	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Potassium-40	EPA 901.1 Modified	1.37E+01	2.56E+00	2.66E+00	1.23E+00		pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Manganese-54	EPA 901.1 Modified	-1.53E-02	4.04E-02	4.04E-02	6.51E-02	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Molybdenum-93	EPA 901.1 Modified	5.30E-03	3.20E-02	3.20E-02	5.16E-02	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Niobium-94	EPA 901.1 Modified	-1.35E-02	3.72E-02	3.72E-02	5.50E-02	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Lead-210	EPA 901.1 Modified	9.37E-01	7.80E-01	7.81E-01	1.29E+00	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Lead-212	EPA 901.1 Modified	5.77E-01	1.26E-01	1.29E-01	1.75E-01		pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Lead-214	EPA 901.1 Modified	3.73E-01	9.30E-02	9.50E-02	1.65E-01		pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Promethium-145	EPA 901.1 Modified	-1.21E-02	9.88E-02	9.88E-02	1.42E-01	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Radium-226	EPA 901.1 Modified	3.34E-01	1.20E-01	1.22E-01	1.88E-01		pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Antimony-125	EPA 901.1 Modified	1.87E-02	1.11E-01	1.11E-01	1.56E-01	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Thorium-234	EPA 901.1 Modified	9.01E-01	5.31E-01	5.33E-01	8.04E-01	U	pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Thallium-208	EPA 901.1 Modified	3.82E-01	1.65E-01	1.66E-01	2.56E-01		pCi/g
18-12109-06	TRG	L1-10220E-FSGS-006-SS-A	10/20/18 13:30	12/21/2018	12/28/2018	18-12109	Uranium-235	EPA 901.1 Modified	-1.26E-01	4.72E-01	4.72E-01	2.57E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:	
Patricia Giza	
Zion Solutions	
101 Shiloh Blvd	
Zion, IL 60099	

Work Order Details:	
SDG:	18-12109
Purchase Order:	677118
Analysis Category:	ENVIRONMENTAL
Sample Matrix:	SO

Lab ID	Sample Type	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	CU	CSU	MDA	Qualifier	Report Units
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Actinium-228	EPA 901.1 Modified	3.86E-01	1.21E-01	1.23E-01	2.69E-01		pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Silver-108m	EPA 901.1 Modified	1.35E-03	1.57E-02	1.57E-02	3.55E-02	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Americium-241	EPA 901.1 Modified	-2.27E-01	7.20E-02	7.29E-02	9.16E-02	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Barium-133	EPA 901.1 Modified	-3.73E-03	1.43E-02	1.43E-02	6.63E-02	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Bismuth-214	EPA 901.1 Modified	2.90E-01	8.26E-02	8.39E-02	1.34E-01		pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Cobalt-60	EPA 901.1 Modified	4.20E-02	3.28E-02	3.29E-02	4.63E-02	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Cesium-134	EPA 901.1 Modified	-2.23E-01	6.63E-02	6.73E-02	4.26E-02	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Cesium-137	EPA 901.1 Modified	1.91E-02	2.99E-02	2.99E-02	4.77E-02	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Europium-152	EPA 901.1 Modified	-4.10E-03	7.27E-02	7.27E-02	1.21E-01	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Europium-154	EPA 901.1 Modified	-6.45E-03	8.21E-02	8.21E-02	6.22E-02	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Europium-155	EPA 901.1 Modified	1.57E-01	8.99E-02	9.02E-02	1.28E-01		pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Holmium-166m	EPA 901.1 Modified	1.52E-02	4.60E-02	4.60E-02	4.60E-02	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Iodine-129	EPA 901.1 Modified	1.10E-02	1.06E-01	1.06E-01	1.39E-01	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Potassium-40	EPA 901.1 Modified	1.04E+01	1.20E+00	1.31E+00	7.08E-01		pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Manganese-54	EPA 901.1 Modified	2.05E-02	3.12E-02	3.12E-02	5.00E-02	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Molybdenum-93	EPA 901.1 Modified	2.36E-02	2.41E-02	2.42E-02	3.35E-02	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Niobium-94	EPA 901.1 Modified	9.89E-04	2.51E-02	2.51E-02	3.72E-02	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Lead-210	EPA 901.1 Modified	6.18E-01	5.83E-01	5.84E-01	9.72E-01	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Lead-212	EPA 901.1 Modified	3.46E-01	6.26E-02	6.51E-02	1.24E-01		pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Lead-214	EPA 901.1 Modified	3.52E-01	8.06E-02	8.26E-02	1.34E-01		pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Promethium-145	EPA 901.1 Modified	-3.85E-02	9.64E-02	9.64E-02	1.19E-01	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Radium-226	EPA 901.1 Modified	2.90E-01	8.26E-02	8.39E-02	1.34E-01		pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Antimony-125	EPA 901.1 Modified	-3.31E-02	7.39E-02	7.39E-02	1.07E-01	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Thorium-234	EPA 901.1 Modified	1.95E+00	1.07E+00	1.08E+00	3.09E+00	U	pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Thallium-208	EPA 901.1 Modified	2.40E-01	7.78E-02	7.88E-02	1.57E-01		pCi/g
18-12109-07	TRG	L1-10220E-FSGS-010-SS-B	10/20/18 13:38	12/21/2018	12/28/2018	18-12109	Uranium-235	EPA 901.1 Modified	-2.14E-01	3.68E-01	3.68E-01	2.51E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Patricia Giza		SDG:	18-12109
Zion Solutions		Purchase Order:	677118
101 Shiloh Blvd		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
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Actinium-228	EPA 901.1 Modified	5.17E-01	1.48E-01	1.50E-01	3.56E-01		pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Silver-108m	EPA 901.1 Modified	-1.16E-02	1.94E-02	1.94E-02	4.38E-02	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Americium-241	EPA 901.1 Modified	4.12E-02	9.51E-02	9.51E-02	1.27E-01	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Barium-133	EPA 901.1 Modified	2.37E-02	3.25E-02	3.25E-02	6.67E-02	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Bismuth-214	EPA 901.1 Modified	5.61E-01	1.27E-01	1.30E-01	1.85E-01		pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Cobalt-60	EPA 901.1 Modified	4.96E-02	4.58E-02	4.59E-02	6.36E-02	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Cesium-134	EPA 901.1 Modified	5.95E-03	1.47E-02	1.47E-02	4.66E-02	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Cesium-137	EPA 901.1 Modified	7.20E-02	6.16E-02	6.18E-02	1.01E-01	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Europium-152	EPA 901.1 Modified	-4.61E-02	1.65E-01	1.65E-01	1.55E-01	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Europium-154	EPA 901.1 Modified	-8.00E-02	1.34E-01	1.34E-01	7.96E-02	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Europium-155	EPA 901.1 Modified	1.29E-01	9.16E-02	9.18E-02	1.20E-01	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Holmium-166m	EPA 901.1 Modified	-3.07E-03	6.75E-02	6.75E-02	6.57E-02	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Iodine-129	EPA 901.1 Modified	4.21E+00	1.74E+01	1.74E+01	1.92E+00	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Potassium-40	EPA 901.1 Modified	1.29E+01	1.73E+00	1.85E+00	9.26E-01		pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Manganese-54	EPA 901.1 Modified	-2.76E-02	4.89E-02	4.89E-02	6.50E-02	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Molybdenum-93	EPA 901.1 Modified	2.82E-03	3.44E-02	3.44E-02	5.15E-02	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Niobium-94	EPA 901.1 Modified	1.13E-02	3.73E-02	3.73E-02	5.44E-02	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Lead-210	EPA 901.1 Modified	2.54E+00	1.24E+00	1.25E+00	2.79E+00	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Lead-212	EPA 901.1 Modified	5.46E-01	9.80E-02	1.02E-01	1.90E-01		pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Lead-214	EPA 901.1 Modified	4.29E-01	1.10E-01	1.12E-01	1.81E-01		pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Promethium-145	EPA 901.1 Modified	1.07E-02	3.46E-01	3.46E-01	5.26E-01	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Radium-226	EPA 901.1 Modified	5.61E-01	1.27E-01	1.30E-01	1.85E-01		pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Antimony-125	EPA 901.1 Modified	2.43E-02	8.86E-02	8.86E-02	1.49E-01	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Thorium-234	EPA 901.1 Modified	9.32E-01	8.83E-01	8.84E-01	1.21E+00	U	pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Thallium-208	EPA 901.1 Modified	3.24E-01	9.07E-02	9.22E-02	1.38E-01		pCi/g
18-12109-08	TRG	L1-10220B-FSGS-009-SS-A	10/20/18 09:55	12/21/2018	12/28/2018	18-12109	Uranium-235	EPA 901.1 Modified	4.00E-01	6.35E-01	6.36E-01	3.28E-01	U	pCi/g

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

Eberline Analytical
Final Report of Analysis

Report To:		Work Order Details:	
Patricia Giza		SDG:	18-12109
Zion Solutions		Purchase Order:	677118
101 Shiloh Blvd		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
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Actinium-228	EPA 901.1 Modified	4.50E-01	1.97E-01	1.99E-01	4.80E-01	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Silver-108m	EPA 901.1 Modified	5.56E-02	5.18E-02	5.19E-02	7.08E-02	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Americium-241	EPA 901.1 Modified	3.51E-02	2.93E-02	2.94E-02	1.33E-01	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Barium-133	EPA 901.1 Modified	1.31E-04	2.31E-02	2.31E-02	1.07E-01	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Bismuth-214	EPA 901.1 Modified	3.25E-01	1.48E-01	1.49E-01	2.52E-01		pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Cobalt-60	EPA 901.1 Modified	-3.27E-02	7.34E-02	7.34E-02	1.12E-01	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Cesium-134	EPA 901.1 Modified	1.39E-02	2.06E-02	2.06E-02	9.98E-02	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Cesium-137	EPA 901.1 Modified	8.41E-02	7.90E-02	7.91E-02	1.30E-01	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Europium-152	EPA 901.1 Modified	5.96E-02	1.37E-01	1.37E-01	1.50E-01	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Europium-154	EPA 901.1 Modified	4.12E-02	1.90E-01	1.90E-01	7.66E-02	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Europium-155	EPA 901.1 Modified	2.48E-02	6.25E-02	6.25E-02	1.20E-01	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Holmium-166m	EPA 901.1 Modified	1.27E-02	8.49E-02	8.49E-02	6.57E-02	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Iodine-129	EPA 901.1 Modified	3.10E-02	2.05E-01	2.05E-01	2.99E-01	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Potassium-40	EPA 901.1 Modified	1.57E+01	3.01E+00	3.11E+00	1.28E+00		pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Manganese-54	EPA 901.1 Modified	1.25E-02	6.15E-02	6.15E-02	9.86E-02	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Molybdenum-93	EPA 901.1 Modified	7.44E-04	4.63E-02	4.63E-02	7.33E-02	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Niobium-94	EPA 901.1 Modified	-1.48E-02	4.95E-02	4.95E-02	7.66E-02	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Lead-210	EPA 901.1 Modified	1.63E+00	1.05E+00	1.06E+00	1.73E+00	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Lead-212	EPA 901.1 Modified	5.09E-01	1.02E-01	1.05E-01	2.10E-01		pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Lead-214	EPA 901.1 Modified	4.62E-01	1.27E-01	1.29E-01	2.21E-01		pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Promethium-145	EPA 901.1 Modified	-5.62E-02	1.39E-01	1.39E-01	1.98E-01	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Radium-226	EPA 901.1 Modified	3.25E-01	1.48E-01	1.49E-01	2.52E-01		pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Antimony-125	EPA 901.1 Modified	1.15E-01	1.56E-01	1.56E-01	2.31E-01	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Thorium-234	EPA 901.1 Modified	1.10E+00	7.39E-01	7.41E-01	1.11E+00	U	pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Thallium-208	EPA 901.1 Modified	4.34E-01	2.16E-01	2.17E-01	3.42E-01		pCi/g
18-12109-09	TRG	L1-10220B-FSGS-012-SS-B	10/20/18 11:01	12/21/2018	12/28/2018	18-12109	Uranium-235	EPA 901.1 Modified	-2.10E-01	6.39E-01	6.39E-01	3.49E-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

18-12109 REC'D DEC 21 2018

Attachment 1 – Chain-of-Custody Form

~~18-12108~~ RS 12-21-18

	Sample ID	Sample Log	Matrix	Sample Type	Sample Container Vol	Unit	Type	Qty	Sample Date	Sample Time	Analysis Type	Preservative	Remarks
	L1-10209E-TJGS-001-SS-B	NA	NA	SOIL	500	ml	MARINELLI	1	10/17/2018	0812	(1) FULL SUITE	NA	611.24g
	L1-10209E-TJGS-002-SS-B	NA	NA	SOIL	500	ml	MARINELLI	1	10/17/2018	0813	(1) FULL SUITE	NA	631.82g
	L1-10209E-TJGS-003-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/17/2018	0814	(1) FULL SUITE	NA	620.54g
4	L1-10221F-FSGS-005-SS-B	NA	NA	SOIL	500	ml	MARINELLI	1	10/25/2018	1442	(2) 5 ROC HTD	NA	577.91g
5	L1-10221F-FSGS-011-SS-B	NA	NA	SOIL	500	ml	MARINELLI	1	10/25/2018	1500	(2) 5 ROC HTD	NA	612.13g
6	L1-10220E-FSGS-006-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/20/2018	1330	(2) 5 ROC HTD	NA	743.96g
7	L1-10220E-FSGS-010SS-B	NA	NA	SOIL	500	ml	MARINELLI	1	10/20/2018	1338	(2) 5 ROC HTD	NA	800.24g
8	L1-10220B-FSGS-009-SS-A	NA	NA	SOIL	500	ml	MARINELLI	1	10/20/2018	0955	(2) 5 ROC HTD	NA	613.15g
9	L1-10220B-FSGS-012-SS-B	NA	NA	SOIL	500	ml	MARINELLI	1	10/20/2018	1101	(2) 5 ROC HTD	NA	563.75g

Laboratory:	Date Submitted To Lab:	Ship Container No.:	Cooler Temperature:	Airbill Number:
EBERLINE LABS		**NA**	**N/A**	FedEx 2nd Day 8115 9539 7107

Relinquished by:	Date (mm/dd/yyyy):	Time:	Received by:	Date: (mm/dd/yyyy):	Time:
[illegible]	12/19/18	0655	Richard E. Bickert	12/19/2018	0655
Richard E. Bickert	12/19/18	1630	FedEx 2nd Day	12/19/2018	1630
FedEx			[illegible] Spencer	12/21/2018	1048

Comments 5-ROC- HTD (2) Billing PO# 677118*
FULL (1) Billing # 677116
28 Day Turnaround time

[232]