



**ZION STATION RESTORATION PROJECT  
FINAL STATUS SURVEY RELEASE RECORD**

**NORTHEAST CORNER OF EXCLUSION AREA  
SURVEY UNIT 10213A**



FSS RELEASE RECORD  
NORTHEAST CORNER OF EXCLUSION AREA  
SURVEY UNIT 10213A

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**LIST OF ACRONYMS AND ABBREVIATIONS**

DQO	Data Quality Objective
DCGL	Derived Concentration Guideline Level
FSS	Final Status Survey
GPS	Global Positioning System
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDCR	Minimal Detectable Count Rate
NAD	North American Datum
NaI	Sodium Iodide
OpDCGL	Operational Derived Concentration Guideline Level
QC	Quality Control
RE	Radiological Engineer
ROC	Radionuclides of Concern
SOF	Sum-of-Fraction
VCC	Vertical Concrete Cask
ZSRP	Zion Station Restoration Project

## 1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for survey unit 10213A, “Northeast Corner of Exclusion Area,” has been generated for the Zion Station Restoration Project (ZSRP) in accordance with ZionSolutions 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 Final Status Survey (FSS) package (L3-10213A-F) was developed in accordance with ZionSolutions procedure ZS-LT-300-001-001, “*Final Status Survey Package Development*” (Reference 3), the ZSRP LTP, and with guidance from NUREG-1575, Revision 1, “*Multi-Agency Radiation Survey and Site Investigation Manual*” (MARSSIM) (Reference 4).

This open land survey unit has a MARSSIM classification of 3. A survey plan was designed based upon use of the Sign Test as the nonparametric statistical test for compliance. Both the Type I ( $\alpha$ ) and Type II ( $\beta$ ) decision error rates were set at 0.05. As a systematic sample population, fourteen (14) randomly located surface soil samples were acquired from the survey unit. In addition, surface scanning was performed on 5% of the total surface area in the survey unit. The analytical results for all soil samples taken in survey unit 10213A indicate that the Sum-of-Fraction (SOF) for each sample, considering the concentration of all applicable Radionuclides of Concern (ROC), either by direct measurement or by inference, is less than 0.1068 when applying the respective Operational Derived Concentration Guideline Levels (OpDCGL). Therefore, the null hypothesis is rejected and survey unit 10213A is acceptable for unrestricted release.

## 2. SURVEY UNIT DESCRIPTION

Northeast Corner of Exclusion Area, survey unit 10213A, is an impacted Class 3 open land survey unit. It is bounded by Shiloh Boulevard to the north. The area of the survey unit is 11,887 m<sup>2</sup>. The FSS was designed and performed to the previous area of the survey unit, which was 12,255 m<sup>2</sup>. A portion of the southwest corner of the survey unit was a major vehicle traffic area. To minimize the impact of vehicles driving over a portion of the survey unit after FSS was performed, the southwest corner (approximately 368 m<sup>2</sup> in area) was attributed to the adjacent survey unit which will be surveyed in a later phase of the project.

The topography of the survey unit is mainly flat with some small dips and depressions. The soil is loam. The terrain consists of thick underbrush and trees. Solid physical items such as rocks, telephone poles, power lines, chain-link fencing, and jersey barriers are present in the area.



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) 1927. The reference coordinates associated with this survey unit are denoted on Figure 1 located in Attachment 1.

### SU10213A



### 3. CLASSIFICATION BASIS

Survey unit 10213A was classified in accordance with *ZionSolutions* procedure ZS-LT-300-001-002, “*Survey Unit Classification*” (Reference 5).

Impacted Class 3 open land survey unit 10213A was originally identified as non-impacted by the “*Historical Site Assessment*” (HSA) (Reference 6). To accommodate anticipated future decommissioning activities, it was reclassified as a Class 3 open land survey unit on September 18, 2012. The HSA does not cite any processes and/or incidents involving the use and/or handling of radioactive material in this open land survey unit and an inspection of the survey unit did not identify any visual indications that there are any subsurface burial sites present in this area.

Characterization surveys were performed in this survey unit from September 21, 2012, through October 19, 2012. The survey design for this survey unit called for the acquisition of twenty-four (24) surface soil samples taken at systematic locations. The

survey design also required the acquisition of a subsurface soil sample to a depth of one-meter at each location where a surface soil sample was taken.

Three-thousand and sixty-four (3,064) square meters or approximately 25% of the total surface area in the survey unit was scanned using a Ludlum Model 2350-1 and a Model 44-10 NaI detector. For the area scanned, the average observed background in the survey unit was 5,822 cpm. The average observed scan measurement was 5,459 cpm with a maximum observed measurement of 9,798 cpm. Three (3) scan alarms were observed in this survey unit with the scan alarm set-point set at the MDCR plus background. The area was investigated by additional scans. The scan alarms were not reproduced.

Twenty-four (24) surface soil samples and two (2) QC split samples were acquired and analyzed by the on-site gamma spectroscopy system. Twenty-four (24) subsurface samples were taken to a depth of one-meter and analyzed by the on-site gamma spectroscopy system. Cs-137 was identified at concentrations greater than the MDC of the instrument in six (6) of the surface soil samples taken and two (2) of the subsurface soil samples taken. No other potential plant-derived radionuclides were positively identified. The average Cs-137 concentration observed in the analysis of the surface soil samples was 0.17 pCi/g with a maximum observed concentration of 0.29 pCi/g. The average Cs-137 concentration observed in the analysis of the subsurface soil samples was 0.07 pCi/g with a maximum observed concentration of 0.08 pCi/g.

The locations of scan areas and surface soil samples taken during characterization in survey unit 10213A are illustrated on Figure 2 in Attachment 1. A summary of the analyses results for the surface soil samples taken during site characterization are presented in Table 1.

**Table 1 - Statistical Quantities for Cs-137 and Co-60 from the 2012 Characterization Survey**

Statistical Quantities	Cs-137 (pCi/g)	Co-60 (pCi/g)
Minimum Value :	9.00E-02	< 1.00E-02
Maximum Value :	2.90E-01	< 8.00E-02
Mean :	1.70E-01	< 5.00E-02
Median :	1.00E-01	< 5.00E-02
Standard Deviation :	0.08	N/A

A Radiological Engineer (RE) performed a visual inspection and walk-down of the survey unit on 04/11/2016 prior to performing FSS. The purpose of the walk-down was to assess the physical condition of the survey unit, evaluate access points and travel paths and



identify potentially hazardous conditions. A final classification assessment was performed in accordance with procedure ZS-LT-300-001-002, “*Survey Unit Classification*” as part of the survey design for FSS.

Based upon completion of Survey Unit Classification Basis for final classification, which included a review of the historical information, the results of the Characterization Survey data and, completion of a final Survey Unit Classification Worksheet, it was concluded that there was a low probability for the presence of residual radioactivity in soils in concentrations greater than 50% of the Operational DCGLs, justifying a final survey unit classification of Class 3.

#### **4. DATA QUALITY OBJECTIVES (DQO)**

Final Status Survey 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 will be developed using the DQO process as outlined in Appendix D of MARSSIM. A summary of seven steps of the DQO process are outlined as follows.

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 10213A did not exceed the release criteria specified in the LTP and that the potential dose from residual radioactivity is As Low As Reasonably Achievable (ALARA).

ZionSolutions TSD 11-001, “*Potential Radionuclides of Concern during the Decommissioning of Zion Station*” (Reference 7) established the basis for an initial suite of potential ROC for the decommissioning of the Zion Nuclear Power Station (ZNPS). LTP Chapter 2 provides detailed characterization data that describes the results of surveys taken of soils. Surface and subsurface soil samples were taken in each impacted open land

survey units and analyzed for the presence of plant-derived radionuclides. The results of surface and subsurface soil characterization in the impacted area surrounding ZNPS indicate that there is minimal residual radioactivity in soil. Consequently, due to the absence of any significant source term in soil, the suite of ROC and radionuclide mixture derived for non-activated concrete was considered as a reasonably conservative mixture to apply to soils for FSS planning and implementation.

LTP Chapter 6, section 6.5.2 discusses the process used to derive the ROC for the decommissioning of ZNPS, including the elimination of insignificant dose contributors (IC) from the initial suite. Based upon the analysis of the mixture, it was determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 accounted for 99.5% of all dose in the non-activated contaminated concrete mixes.

Table 2 presents the ROC for the decommissioning of soils at ZNPS and the normalized mixture fractions based on the radionuclide mixture.

**Table 2 - Dose Significant Radionuclides and Mixture**

Radionuclide	% of Total Activity (normalized) <sup>(1)(2)</sup>
Co-60	0.92%
Cs-134	0.01%
Cs-137	75.32%
Ni-63	23.71%
Sr-90	0.05%

(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 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. ZionSolutions TSD 14-011, “Soil Area Factors” (Reference 8) 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 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 Base Case DCGLs for the unrestricted release of open land survey units are provided in Table 3 and Table 4, respectively. The IC dose percentage of 10% was used to adjust the DCGLs in soils to account for the dose from the eliminated IC radionuclides.

**Table 3 - Base Case DCGLs for Surface Soils (BcDCGLSS)**

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

**Table 4 - Base Case DCGLs for Subsurface Soils (BcDCGLSB)**

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 Base Case DCGL 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/year or less after all FSS is completed, the Base Case DCGLs 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 Base Case DCGLs 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 Operational DCGL is then used as the DCGL for the FSS design of the survey unit (calculation of surrogate DCGLs, investigations levels, etc.). Details of the Operational DCGLs derived for each dose component and the basis for the applied *a priori* dose fractions are provided in ZionSolutions TSD 17-004, “Operational Derived Concentration Guideline Levels for Final Status Survey” (Reference 9).

The Operational DCGLs for the FSS of surface and subsurface soils are presented in Table 5 and Table 6, respectively.

**Table 5 - Operational DCGLs for Surface Soils (OpDCGLSS)**

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 6 - Operational DCGLs for Subsurface Soils (OpDCGLSB)**

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

Instrument DQOs included a verification of the ability of the survey instrument to detect the radiation(s) of interest relative to the Operational DCGL. 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 assure 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”. 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 minimum acceptable MDC for measurements obtained using field instruments was 50 percent of the applicable Operational DCGL.

## 5. SURVEY DESIGN

The level of effort associated with planning a survey is based on the complexity of the survey and nature of the hazards. Guidance for preparing FSS plans is provided in procedure ZS-LT-300-001-001 “*Final Status Survey Package Development.*” The FSS plan uses an integrated sample design that combines scanning surveys and sampling which can be either random or judgmental.

The DQO process determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 would be the ROC in survey unit 10213A. 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 ZionSolutions TSD 14-019, “*Radionuclides of Concern for Soil and Basement Fill Model Source Terms*” (Reference 10) and are presented in Table 7. The maximum ratios will be used in the surrogate calculations during FSS unless area specific ratios are determined by continuing characterization.

**Table 7 - 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 10213A, the surrogate Operational DCGLs for Co-60 and Cs-137 were computed based on the maximum ratios from Table 7.

The equation for calculating a surrogate DCGL is as follows:

**Equation 1**

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

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

$DCGL_{2,3,\dots,n}$  = 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 Operational DCGLs presented in Table 5 and the maximum ratios from Table 7, the following surrogate calculations were performed:

**Equation 2**

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

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

**Equation 3**

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



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

The action level for investigation in a Class 3 open land survey unit is 50% of the Operational DCGL. The surrogate DCGL for Co-60 while inferring Ni-63 is 0.898 pCi/g, and the surrogate DCGL for Cs-137 while inferring Sr-90 is 3.622 pCi/g. Using the normalized mixture for gamma emitting ROC from Table 2, the surrogate adjusted gamma DCGL is then calculated as follows:

$$Surrogate_{DCGL} (gamma) = \frac{1}{\left[ \left( \frac{0.012}{0.898_{(Co-60)}} \right) + \left( \frac{0.00001}{1.733_{Cs-134}} \right) + \left( \frac{0.988}{3.622_{(Ni-63)}} \right) \right]} = 3.494 \text{ pCi/g}$$

The surrogate adjusted gamma DCGL equals 3.494 pCi/g. The action levels for survey unit 10213A are based on 50% of the DCGL and are presented in Table 8.

**Table 8 - Action Levels for Survey Unit 10213A**

ROC	DCGL (pCi/g)
Co-60 <sup>(1)</sup>	0.449
Cs-134 <sup>(2)</sup>	0.867
Cs-137 <sup>(3)</sup>	1.811
Gross Gamma <sup>(4)</sup>	1.747

- (1) Based on 50% of surrogate adjusted DCGL of 0.898 pCi/g for Co-60 while inferring Ni-63
- (2) Based on 50% of Operational DCGL
- (3) Based on 50% of surrogate adjusted DCGL of 3.622 pCi/g for Cs-137 while inferring Sr-90
- (4) Based on 50% of normalized surrogate adjusted DCGLs of 3.494 pCi/g for gamma emitting ROC

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 Elevated Measurement Comparison (EMC) did not apply to this survey unit since it is a Class 3 survey unit and discrete, elevated areas of contamination were not expected.

The number of soil samples for FSS was determined in accordance with procedure ZS-LT-300-001-001 “*Final Status Survey Package Development.*” The relative shift ( $\Delta/\sigma$ ) for the survey unit data set is defined as shift ( $\Delta$ ), which is the Upper Boundary 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 ( $\sigma$ ), which is the standard deviation of the data set

used for survey design. The optimal value for  $\Delta/\sigma$  should range between 1 and 3. The largest value the  $\Delta/\sigma$  can have is 3. If the  $\Delta/\sigma$  exceeds 3, then the value of 3 will be used for  $\Delta/\sigma$ . The  $\Delta/\sigma$  for survey unit 10213A, based on characterization data for Cs-137, was calculated as follows:

**Equation 4**

$$\Delta/\sigma = 0.5/0.02 = 25$$

As the calculated relative shift (25) was greater than 3, then a value of 3 was used as the adjusted  $\Delta/\sigma$ . Both the Type I error, or  $\alpha$  value and the Type II error, or  $\beta$  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 14.

A Prospective Power Curve was generated using COMPASS, a software package developed under the sponsorship of the United States Nuclear Regulatory Commission (USNRC) for implementation of the MARSSIM in support of the decommissioning license termination rule (10CFR20, Subpart E). The result of the COMPASS computer run showed adequate power for the survey design. The survey design specified fourteen (14) surface soil samples for non-parametric statistical testing.

As the survey unit was classified as Class 3, systematic sample locations were selected at random. The random locations of the systematic surface soil samples were selected using Visual Sample Plan (VSP), in accordance with ZS-LT-300-001-001. Input parameters included use of Bing or Google Maps aerial photographs and the random sampling tool set with a predetermined number (14) of sample points. These coordinates were integrated with a GPS to locate sample locations in the field. Sample measurement locations for the surface soil samples taken for systematic design are listed with the GPS coordinates in Table 9.

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 7). 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 7). If the derived ratio from the confirmatory samples exceeds the maximum ratios (see Table 7), then the area-specific ratios as determined by actual survey data will be used in lieu of the maximum ratios.

**Table 9 - Systematic and QC Sample Measurement Locations**

MEASUREMENT ID	NORTHING	EASTING
L3-10213A-FRGS-001SS	642125.8577	343640.8578
L3-10213A-FRGS-002SS	642118.1129	343712.9794
L3-10213A-FRGS-003SS	642108.8191	343724.9997
L3-10213A-FRGS-004SS	642111.9171	343688.9389
L3-10213A-FRGS-005SS	642104.1722	343664.8983
L3-10213A-FRGS-006SS	642084.0357	343720.9929
L3-10213A-FRGS-007SS	642076.2909	343648.8713
L3-10213A-FRGS-008SS	642066.9971	343660.8916
L3-10213A-FRGS-009SS	642062.3502	343696.9524
L3-10213A-FRGS-010SS	642048.4095	343672.9118
L3-10213A-FRGS-011SS	642042.2136	343656.8848
L3-10213A-FRGS-012SS	642025.1750	343692.9456
L3-10213A-FRGS-013SS	642011.2343	343680.9253
L3-10213A-FRGS-014SS	642020.5281	343632.8443
L3-10213A-FQGS-007SS	642076.2909	343648.8713

Fourteen (14) surface soil samples were required for the non-parametric statistical test (sample size N = 14). In addition, two (2) investigational surface soil samples were collected to investigate scan alarms. In total, sixteen (16) surface soil samples were collected for the FSS of this survey unit. The Sample Measurement Locations for the judgmental and investigational surface soil samples and ISOCS measurement are listed with the GPS coordinates in Table 10.

**Table 10 - Investigational Sample Measurement Locations**

MEASUREMENT ID	NORTHING	EASTING
L3-10213A-FIGS-001SS	642011.236	343672.393
L3-10213A-FIGS-002SS	642012.605	343669.933

A map of the surface soil sample locations and the ISOCS measurement location are provided in Figure 3 in Attachment 1.

The selection of two (2) soil sample met the requirement that 10% of the samples collected for the FSS of survey unit 10213A be analyzed for HTD ROC. Sample numbers L3-10213A-FRGS-006-SS-A and L3-10213A-FRGS-008-SS-A were selected based on exhibiting the highest concentration of Cs-137. Each selected sample was sent off-site (Eberline Analytical) for analysis of the HTD ROC as specified in LTP Chapter 5, section 5.1.

The implementation of quality control measures as referenced by LTP Chapter 5, section 5.9 and ZionSolutions ZS-LT-01, “Quality Assurance Project Plan (for Characterization and FSS)” (QAPP) (Reference 11) includes the collection of a soil sample for “split sample” analysis on 5% of the soil samples taken in a survey unit with the locations selected at random. One (1) surface soil sample, L3-10213A-FQGS-007-SS was selected randomly for split sample analysis for the FSS of this survey unit.

LTP Chapter 5, section 5.6.4.4 and Table 5-24 specifies that for Class 3 survey units, judgmental (biased) surface scans will be performed on areas with the greatest potential of contamination. For open land areas, this may include surface drainage areas and collection points. The fraction of scanning coverage required for survey unit 10213A was determined during the DQO process with the total amount and location(s) based on the likelihood of finding elevated activity during FSS. Based on the HSA, the results of the characterization survey, and the operational use of this survey unit, fourteen (14) different scan areas representing 616 m<sup>2</sup>, or approximately 5% of the survey unit, of surface area was chosen at random. A map of the scan grid locations are provided in Figure 3.

For this Class 3 open land survey unit, the “Investigation Levels” for area scanning and soil sample measurement results are those levels specified in LTP Chapter 5, Table 5-25 and are reproduced below in Table 11.

**Table 11 - Investigation Levels**

<b>Classification</b>	<b>Scan Investigation Levels</b>	<b>Direct Investigation Levels</b>
Class 3	>Operational DCGL or >MDC <sub>scan</sub> if MDC <sub>scan</sub> is greater than Operational DCGL	>0.5 Operational DCGL

Table 12 provides a synopsis of the survey design for survey unit 10213A.

**Table 12 - Synopsis of Survey Design**

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Land Area	12,255 m <sup>2</sup>	GPS measurements of area
Number of Measurements (N)	14 (systematic)	<ul style="list-style-type: none"> <li>• <math>\sigma = 0.02</math></li> <li>• UBGR = SOF of 1</li> <li>• LBGR = SOF of 0.5</li> <li>• Type I error = 0.05</li> <li>• Type II error = 0.05</li> <li>• <math>\Delta/\sigma = 3</math> (adjusted)</li> <li>• MARSSIM Table 5.5</li> </ul>
Grid Spacing	Random	(LTP Chapter 5, section 5.6.4.5.2)
DCGLs	<ul style="list-style-type: none"> <li>• Co-60 – 1.091 pCi/g</li> <li>• Cs-134 – 1.733 pCi/g</li> <li>• Cs-137 – 3.630 pCi/g</li> <li>• Ni-63 – 914.458 pCi/g</li> <li>• Sr-90 – 3.095 pCi/g</li> </ul>	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)
Soil Investigation Level	>0.5 Operational DCGL	(LTP Chapter 5, Table 5-25)
Scan Survey Area Coverage	616 m <sup>2</sup> or ~5% areal coverage	Judgmental areal coverage, (LTP Chapter 5, Table 5-24)
Scan Investigation Level	1.747 pCi/g (Based on 50% of normalized surrogate adjusted DCGLs for gamma emitting ROC)	(LTP Chapter 5, Table 5-25)
QC	One (1) surface soil sample selected randomly for split sample analysis	(LTP Chapter 5, section 5.9)

## 6. SURVEY IMPLEMENTATION

For survey unit 10213A, 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, section 5.7.1.6.2, no subsurface soil sample(s) will be taken as part of the survey design in Class 3 open land survey units. However, if during the performance of FSS, the analysis of a surface soil sample, or the results of a surface gamma scan indicates 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 10213A. Consequently, no subsurface soil samples were collected during FSS.

In addition, LTP Chapter 5, section 5.1 states that if levels of residual gamma radioactivity in an individual soil sample exceed a SOF of 0.1, then the sample(s) will be analyzed for HTD ROC. This threshold was encountered during the FSS of survey unit 10213A and sample L3-10213A-FRGS-006-SS-A was sent off-site for HTD ROC analysis as a response.

FSS field activities were conducted under FSS Sample Plan L3-10213A-F. FSS Sample Plan L3-10213A-F included DQOs, survey design, detailed FSS instructions, job safety analysis, and related procedures for reference. 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 eight (8) 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 March 30, 2016 and concluding on April 19, 2016.

The fourteen (14) systematic surface soil sample locations were marked with flags based on GPS coordinates provided by VSP. Around each surface soil sample location, a 44 m<sup>2</sup> scan area was marked out. A total of fourteen (14) different scan areas were established, constituting an areal scan coverage of 616 m<sup>2</sup>, or approximately 5% of the surface area in survey unit 10213A. Background was assessed in the survey unit and it was determined that, using an Ludlum 2350-1 paired with a Model 44-10 (2"x 2") sodium iodide (NaI) detector, background ranged from 1,644 counts per minute (cpm) up to 3,120 cpm.

All designated scan areas as denoted on Figure 3 in Attachment 1 were scanned 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 as close to the ground as possible and was moved at a scan speed of approximately 0.25 meters per second. In accordance with ZionSolutions TSD 11-004, “*Ludlum Model 44-10 Detector Sensitivity*” (Reference 12), scan MDC was sufficient to detect residual radioactivity at the action level (adjusted gross gamma DCGL of 1.747 pCi/g, which was based on 50% of the normalized surrogate adjusted Operational DCGLs for gamma emitting ROC). Complete scan results are provided in Attachment 2.

In accordance with FSS design, fourteen (14) surface soil samples were collected at random locations for the systematic sample population. As an investigation of scan alarms in scan area 13, two (2) surface soil samples were collected. The addition of the systematic and investigational samples results in a total of sixteen (16) surface soil samples collected for the FSS of this survey unit. Each surface soil sample consisted of 1 liter of soil. The sample media was sifted to remove stones and other media larger than 1 centimeter in diameter. All collected soil samples were controlled, transported, stored, and transferred to the on-site laboratory using Chain-of-Custody (CoC) process from ZionSolutions procedure ZS-LT-100-001-004, “*Sample Media Preparation*” (Reference 13).

Two (2) samples (L3-10213A-FRGS-006-SS-A and L3-10213A-FRGS-008-SS-A) were selected for HTD radionuclide analysis.

The implementation of survey specific QC measures included the collection of one (1) sample (L3-10213A-FQGS-007-SS) for “split sample” analysis.

## **7. SURVEY RESULTS**

The scan areas identified in the FSS plan were scanned for elevated radiation levels. No elevated measurement locations were identified by surface scan. Table 13 provides an overview of the scan results. Complete scan results are provided in Attachment 2.

**Table 13 - Synopsis of Scan Results**

Scan Area	Highest Logged Reading (cpm)	Action Level <sup>(1)</sup> (cpm)	# of Scan Alarms	Investigation Samples
GS001	2360	2423	None	None
GS002	2420	2423	None	None
GS003	2410	2423	None	None
GS004	2410	2423	None	None
GS005	2350	2423	None	None
GS006	2260	2573	None	None
GS007	2550	2573	None	None
GS008	2530	2573	None	None
GS009	2350	2573	None	None
GS010	2380	2886	None	None
GS011	2390	2886	None	None
GS012	2630	3311	None	None
GS013	4600	2573	8	2
GS014	3560	3584	None	None
GS015	2980	2991	None	None
GS016	3690	4193	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 on-site laboratory analyzed the fourteen (14) soil samples taken for non-parametric statistical testing using the on-site gamma spectroscopy system. A summary of the fourteen (14) samples collected for non-parametric statistical testing results is provided in Table 14. Gamma spectroscopy results (summarized in Table 14) revealed five (5) samples above MDC for Cs-137 and no samples above 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 7. 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 at within the vicinity of the ZNPS as presented in ZionSolutions TSD 13-004, “Examination of Cs-137 Global Fallout in Soils at Zion Station” (Reference 14). The complete gamma spectroscopy reports are presented in Attachment 3. The basic statistics for the systematic sample population is summarized in Table 15.

**Table 14 - Summary of Gamma Spectroscopy Results for Surface Soil Samples Comprising the Statistical Sample Population**

MEASUREMENT ID	Co-60 (pCi/g)	Cs-134 (pCi/g)	Cs-137 (pCi/g)	Ni-63 (pCi/g)	Sr-90 (pCi/g)
L3-10213A-FRGS-001SS	2.34E-02	1.86E-03	2.36E-02	4.22E+00	4.72E-05
L3-10213A-FRGS-002SS	0.00E+00	1.30E-02	0.00E+00	0.00E+00	0.00E+00
L3-10213A-FRGS-003SS	0.00E+00	1.79E-03	4.90E-02	0.00E+00	9.80E-05
L3-10213A-FRGS-004SS	1.04E-02	4.16E-03	1.85E-02	1.88E+00	3.70E-05
L3-10213A-FRGS-005SS	9.25E-03	1.11E-02	1.26E-01	1.67E+00	2.52E-04
L3-10213A-FRGS-006SS	1.85E-02	0.00E+00	3.12E-01	3.34E+00	6.24E-04
L3-10213A-FRGS-007SS	0.00E+00	0.00E+00	7.43E-02	0.00E+00	1.49E-04
L3-10213A-FRGS-008SS	0.00E+00	1.32E-03	3.49E-01	0.00E+00	6.98E-04
L3-10213A-FRGS-009SS	5.32E-03	0.00E+00	1.84E-01	9.60E-01	3.68E-04
L3-10213A-FRGS-010SS	2.49E-02	8.53E-03	6.44E-02	4.49E+00	1.29E-04
L3-10213A-FRGS-011SS	1.12E-02	1.64E-03	1.79E-01	2.02E+00	3.58E-04
L3-10213A-FRGS-012SS	1.16E-03	1.00E-02	8.12E-02	2.09E-01	1.62E-04
L3-10213A-FRGS-013SS	0.00E+00	2.41E-02	2.43E-02	0.00E+00	4.86E-05
L3-10213A-FRGS-014SS	0.00E+00	1.06E-02	5.31E-02	0.00E+00	1.06E-04

**Table 15 - 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	7.44E-03	3.24E-03	2.49E-02	0.00E+00	0.00913	4.26	1.75E-03	4.36E-02
Cs-134	6.29E-03	3.01E-03	2.41E-02	0.00E+00	0.00697	6.77	9.30E-04	2.32E-02
Cs-137	1.10E-01	6.94E-02	3.49E-01	0.00E+00	0.10914	14.18	7.75E-03	1.94E-01
Ni-63	1.34E+00	5.85E-01	4.49E+00	0.00E+00	1.64760	3572.1	3.76E-04	9.39E-03
Sr-90	2.20E-04	1.39E-04	6.98E-04	0.00E+00	0.00022	12.09	1.82E-05	4.54E-04

The off-site laboratory, Eberline Analytical, processed the two (2) samples selected for HTD ROC analysis as specified in the survey design. Sample numbers L3-10213A-FRGS-006-SS-A and L3-10213A-FRGS-008-SS-A were selected. Only HTD radionuclides included as ROC (Ni-63 and Sr-90 for soils) were included in the analysis. All analyses met the required MDC. LTP Chapter 5, section 5.1 states that for soil samples or concrete cores with positive results for both a HTD ROC and the corresponding surrogate radionuclide (Cs-137 or Co-60), the HTD to surrogate ratio will

be derived. This threshold was not encountered during the FSS of survey unit 10213A. Ni-63 and Cs-137 were positively detected at concentrations greater than MDC for both samples. The results are provided in Table 16.

**Table 16 - Off-Site Analysis Results (Eberline Analytical) for Sample ID #s L3-10213AA-FRGS-003-SS-A and L3-10213AA-FRGS-017-SS-A**

**Sample # L3-10213A-FRGS-006-SS-A**

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	4.93E-02	4.81E-02	5.54E-02	No
Cs-134	1.42E-02	3.07E-02	9.48E-02	No
Cs-137	3.42E-01	7.70E-02	9.48E-02	No
Ni-63	2.91E-01	7.05E-01	1.20E+00	No
Sr-90	4.41E-01	2.17E-01	4.14E-01	No

**Sample # L3-10213A-FRGS-008-SS-A**

ROC	Result (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	>MDC
Co-60	1.89E-02	2.04E-02	2.86E-02	No
Cs-134	-3.06E-03	1.04E-02	2.78E-02	No
Cs-137	4.11E-01	6.15E-02	3.88E-02	Yes
Ni-63	3.46E+00	1.39E+00	2.25E+00	Yes
Sr-90	3.59E-01	3.59E-01	7.29E-01	No

The on-site laboratory analyzed two (2) investigational surface soil samples taken from scan area 13. A summary of the analytical results for the two (2) surface samples collected for investigations is provided in Table 17. Gamma spectroscopy results (summarized in Table 17) revealed one (1) sample above MDC for Cs-137 and no samples above 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 7. The complete gamma spectroscopy reports are presented in Attachment 3.

**Table 17 - Summary of Gamma Spectroscopy Results for Investigational Surface Soil Samples**

MEASUREMENT ID	Co-60 (pCi/g)	Cs-134 (pCi/g)	Cs-137 (pCi/g)	Ni-63 (pCi/g)	Sr-90 (pCi/g)
L3-10213AA-FIGS-001SS	1.51E-02	6.12E-02	9.83E-02	2.72E+00	1.97E-04
L3-10213AA-FIGS-002SS	2.91E-02	0.00E+00	1.28E-01	5.25E+00	2.56E-04

The implementation of survey specific QC measures included the collection of one (1) sample (L3-10213A-FQGS-007-SS) for “split sample” analysis. The on-site laboratory analyzed the designated QC sample using the on-site gamma spectroscopy system. A summary of the analytical results for the QC sample is provided in Table 18. Gamma spectroscopy results (summarized in Table 18) revealed a concentration above MDC for Cs-137 and none above 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 7.

**Table 18 - Summary of Gamma Spectroscopy Results for QC Surface Soil Sample**

MEASUREMENT ID	Co-60 (pCi/g)	Cs-134 (pCi/g)	Cs-137 (pCi/g)	Ni-63 (pCi/g)	Sr-90 (pCi/g)
L3-10213A-FQGS-007-SS	1.86E-03	8.08E-03	4.12E-02	3.36E-01	8.24E-05

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

**Equation 5**

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

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 as well as the judgmental samples for survey unit 10213A are provided in Table 19.

**Table 19 - Sum-of-Fractions for Individual Surface Soil Samples (Systematic and QC)**

MEASUREMENT ID	FRACTION OF OPERATIONAL DCGL					SOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L3-10213A-FRGS-001-SS	0.02145	0.00107	0.00650	0.00462	0.00002	0.03365
L3-10213A-FRGS-002-SS	0.00000	0.00750	0.00000	0.00000	0.00000	0.00750
L3-10213A-FRGS-003-SS	0.00000	0.00103	0.01350	0.00000	0.00750	0.01456
L3-10213A-FRGS-004-SS	0.00953	0.00240	0.00510	0.00205	0.00000	0.01909
L3-10213A-FRGS-005-SS	0.00848	0.00641	0.03471	0.00182	0.00000	0.05150
L3-10213A-FRGS-006-SS	0.01696	0.00000	0.08595	0.00365	0.00000	0.10676
L3-10213A-FRGS-007-SS	0.00000	0.00000	0.02047	0.00000	0.00000	0.02052
L3-10213A-FRGS-008-SS	0.00000	0.00076	0.09614	0.00000	0.00103	0.09713
L3-10213A-FRGS-009-SS	0.00488	0.00000	0.05069	0.00105	0.01350	0.05673
L3-10213A-FRGS-010-SS	0.02282	0.00492	0.01774	0.00491	0.00000	0.05044
L3-10213A-FRGS-011-SS	0.01027	0.00095	0.04931	0.00221	0.00003	0.06285
L3-10213A-FRGS-012-SS	0.00106	0.00577	0.02237	0.00023	0.00953	0.02948
L3-10213A-FRGS-013-SS	0.00000	0.01391	0.00669	0.00000	0.00240	0.02062
L3-10213A-FRGS-014-SS	0.00000	0.00612	0.01463	0.00000	0.00510	0.02078
L3-10213A-FQGS-007-SS	0.00170	0.00466	0.01135	0.00037	0.00205	0.01811

**Systematic Measurements**

Number of Systematic Measurements =	14
# of Systematic Measurements with SOF $\geq$ 1 =	0
# of Systematic Measurements with SOF > 0.1 (HTD Assessment) =	1
Max Individual Systematic Measurement SOF =	0.1068
Mean Systematic Measurement SOF =	0.0423



**Table 19 (continued) – Sum-of-Fractions for Individual Surface Soil Samples (Investigational)**

MEASUREMENT ID	FRACTION OF OPERATIONAL DCGL					SOF
	Co-60	Cs-134	Cs-137	Ni-63	Sr-90	
L3-10213A-FIGS-001SS	0.01384	0.03531	0.02708	0.00298	0.00006	0.07928
L3-10213A-FIGS-002SS	0.02667	0.00000	0.03526	0.00574	0.00008	0.01811

**Systematic Measurements**

Number of Judgmental Measurements =	0
Number of Investigation Measurements =	2
# of Judgmental/Investigation Measurements with SOF > 1 =	0
# of Judgmental/Investigation Measurements with SOF > 0.1 (HTD Assessment) =	0
Max Individual Judgmental/Investigation Measurement SOF =	0.0793

The mean of all identified isotopes are less than the Consultation Triggers for Residential Soil Concentration depicted in Table H.1 of NUREG 1757, Vol.1, Rev. 2 (MOU Table 1). The full table is included in Attachment 4 of this Release Record.

**8. QUALITY CONTROL**

The on-site laboratory processed one (1) split sample, L3-10213A-FQGS-007-SS, using gamma spectroscopy analysis. The data was evaluated using USNRC acceptance criteria specified in Inspection Procedure No. 84750, “Radioactive Waste Treatment, and Effluent and Environmental Monitoring” (Reference 15). There was acceptable agreement between field split results. Refer to Attachment 5 for data and quality control analysis results.

**9. INVESTIGATIONS AND RESULTS**

Two (2) surface soil samples were taken to investigate the alarms at scan area 13. The 2 samples, L3-10213A-FIGS-001-SS and L3-10213A-FIGS-002-SS, were analyzed using the on-site gamma spectroscopy system. Gamma spectroscopy results revealed one (1) sample above MDC for Cs-137 and no samples above MDC for Co-60 or Cs-134.

**10. REMEDIATION AND RESULTS**

Historically, no radiological remedial action as described by MARSSIM Section 5.4 was performed in this survey unit prior to or as a result of the FSS. Chapter 4 of the ZSRP

LTP determined that remediation beyond that required to meet the release criteria is unnecessary and that the remaining residual radioactivity in soil was ALARA.

## **11. CHANGES FROM THE FINAL STATUS SURVEY PLAN**

There were no addendums to the FSS plan.

## **12. DATA QUALITY ASSESSMENT (DQA)**

The DQO sample design and data were reviewed in accordance with *ZionSolutions* 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 and were sufficient to ensure that the survey unit was properly designated as Class 3. 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. 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 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**

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

## 14. CONCLUSION

Survey unit 10213A 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 applicable 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 survey unit is properly classified as Class 3.

The dose contribution from soil in survey unit 10213A is 0.2705 mrem/yr TEDE, based on the average concentration of the ROC in samples used for non-parametric statistical sampling.

Survey unit 10213A is acceptable for unrestricted release.

## 15. REFERENCES

1. *ZionSolutions* procedure ZS-LT-300-001-005, “Final Status Survey Data Reporting”
2. “Zion Station Restoration Project License Termination Plan”
3. *ZionSolutions* procedure ZS-LT-300-001-001, “Final Status Survey Package Development”
4. NUREG-1575, Revision 1, “Multi-Agency Radiation Survey and Site Investigation Manual” (MARSSIM)
5. *ZionSolutions* procedure ZS-LT-300-001-002, “Survey Unit Classification”
6. “Historical Site Assessment” (HSA)
7. *ZionSolutions* TSD 11-001, “Potential Radionuclides of Concern during the Decommissioning of Zion Station”
8. *ZionSolutions* TSD 14-011, “Soil Area Factors”
9. *ZionSolutions* TSD 17-004, “Operational Derived Concentration Guideline Levels for Final Status Survey”
10. *ZionSolutions* TSD 14-019, “Radionuclides of Concern for Soil and Basement Fill

Model Source Terms”

11. ZionSolutions ZS-LT-01, “Quality Assurance Project Plan (for Characterization and FSS)” (QAPP)
12. ZionSolutions TSD 11-004, “Ludlum Model 44-10 Detector Sensitivity”
13. ZionSolutions procedure ZS-LT-100-001-004, “Sample Media Preparation”
14. ZionSolutions TSD 13-004, “Examination of Cs-137 Global Fallout in Soils at Zion Station”
15. U.S. NRC Inspection Procedure No. 84750, “Radioactive Waste Treatment, and Effluent and Environmental Monitoring”
16. ZionSolutions procedure ZS-LT-300-001-004, “Final Status Survey Data Assessment”

**16. ATTACHMENTS**

Attachment 1 – Figures and Maps

Attachment 2 – Scan Data

Attachment 3 – Sample Analytical Reports

Attachment 4 – Consultation Triggers for Residential Soil Concentration

Attachment 5 – QC Sample Assessment

Attachment 6 – Graphical Presentations

Attachment 7 – Eberline Analytical Report

# **ATTACHMENT 1**

## **FIGURES AND MAPS**

Figure 1 - Survey Unit 10213A Boundary





Figure 2 - Survey Unit 10213A Characterization Survey Sample Locations

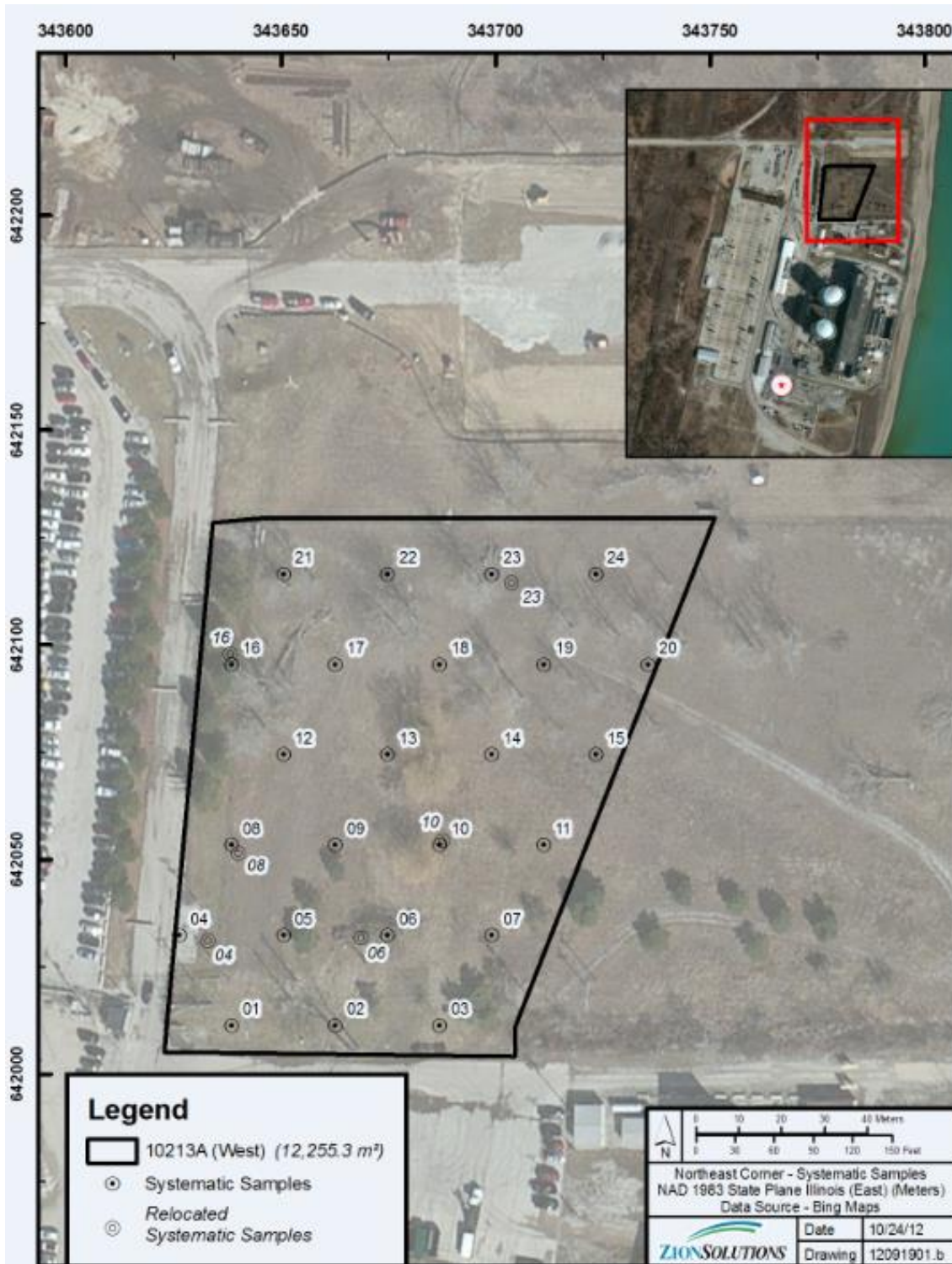




Figure 3 - Survey Unit 10213A Final Status Survey



# **ATTACHMENT 2**

## **SCAN DATA**

FSS RELEASE RECORD  
 NORTHEAST CORNER OF EXCLUSION AREA  
 SURVEY UNIT 10213A



Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR311756	266669	10213	GS002	4/12/2016 8:20	2390	1644	2423	No
44-10	PR311756	266669	10213	GS002	4/12/2016 8:21	2190	1644	2423	No
44-10	PR311756	266669	10213	GS002	4/12/2016 8:22	2340	1644	2423	No
44-10	PR311756	266669	10213	GS002	4/12/2016 8:25	2330	1644	2423	No
44-10	PR311756	266669	10213	GS002	4/12/2016 8:26	2320	1644	2423	No
44-10	PR311756	266669	10213	GS002	4/12/2016 8:27	2260	1644	2423	No
44-10	PR311756	266669	10213	GS002	4/12/2016 8:29	2420	1644	2423	No
44-10	PR311756	266669	10213	GS003	4/12/2016 8:37	2240	1644	2423	No
44-10	PR311756	266669	10213	GS003	4/12/2016 8:39	2310	1644	2423	No
44-10	PR311756	266669	10213	GS003	4/12/2016 8:41	2400	1644	2423	No
44-10	PR311756	266669	10213	GS003	4/12/2016 8:43	2410	1644	2423	No
44-10	PR311756	266669	10213	GS003	4/12/2016 8:44	2380	1644	2423	No
44-10	PR311756	266669	10213	GS003	4/12/2016 8:49	2360	1644	2423	No
44-10	PR311756	266669	10213	GS003	4/12/2016 8:51	2390	1644	2423	No
44-10	PR311756	266669	10213	GS003	4/12/2016 8:51	2260	1644	2423	No
44-10	PR311756	266669	10213	GS003	4/12/2016 8:52	2340	1644	2423	No
44-10	PR311756	266669	10213	GS004	4/12/2016 9:45	2250	1644	2423	No
44-10	PR311756	266669	10213	GS004	4/12/2016 9:46	2230	1644	2423	No
44-10	PR311756	266669	10213	GS004	4/12/2016 9:47	2130	1644	2423	No
44-10	PR311756	266669	10213	GS004	4/12/2016 9:48	2240	1644	2423	No
44-10	PR311756	266669	10213	GS004	4/12/2016 9:49	2160	1644	2423	No
44-10	PR311756	266669	10213	GS004	4/12/2016 9:50	2030	1644	2423	No

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Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR311756	266669	10213	GS004	4/12/2016 9:51	2270	1644	2423	No
44-10	PR311756	266669	10213	GS004	4/12/2016 9:52	2410	1644	2423	No
44-10	PR311756	266669	10213	GS005	4/12/2016 9:56	2350	1644	2423	No
44-10	PR311756	266669	10213	GS005	4/12/2016 9:57	2030	1644	2423	No
44-10	PR311756	266669	10213	GS005	4/12/2016 9:58	2080	1644	2423	No
44-10	PR311756	266669	10213	GS005	4/12/2016 9:59	2330	1644	2423	No
44-10	PR311756	266669	10213	GS005	4/12/2016 10:00	2340	1644	2423	No
44-10	PR311756	266669	10213	GS005	4/12/2016 10:01	2230	1644	2423	No
44-10	PR311756	266669	10213	GS005	4/12/2016 10:02	2070	1644	2423	No
44-10	PR311756	266669	10213	GS001	4/12/2016 10:17	2340	1644	2423	No
44-10	PR311756	266669	10213	GS001	4/12/2016 10:18	2360	1644	2423	No
44-10	PR311756	266669	10213	GS001	4/12/2016 10:19	2240	1644	2423	No
44-10	PR311756	266669	10213	GS001	4/12/2016 10:21	1850	1644	2423	No
44-10	PR311756	266669	10213	GS001	4/12/2016 10:25	2110	1644	2423	No
44-10	PR311756	266669	10213	GS001	4/12/2016 10:28	2150	1644	2423	No
44-10	PR311756	266669	10213	GS015	4/12/2016 10:36	1900	1644	2423	No
44-10	PR311756	266669	10213	GS015	4/12/2016 10:37	2130	1644	2423	No
44-10	PR311756	266669	10213	GS015	4/12/2016 10:37	2390	1644	2423	No
44-10	PR311756	266669	10213	GS015	4/12/2016 10:38	2390	1644	2423	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:31	2910	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:32	2750	2109	2991	No

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Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR311756	266669	10213	GS015	4/12/2016 12:32	2530	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:33	2540	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:35	2630	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:35	2160	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:36	2530	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:38	2650	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:39	2550	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:40	2490	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:41	2790	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:41	2650	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:42	2890	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:43	2470	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:44	2870	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:45	2780	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:47	2510	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:50	2610	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:50	2450	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:51	2680	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:52	2970	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:54	2880	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:55	2460	2109	2991	No

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Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR311756	266669	10213	GS015	4/12/2016 12:55	2540	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:56	2810	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:58	2610	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 12:59	2840	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 13:00	2640	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 13:00	2670	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 13:02	2790	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 13:03	2790	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 13:04	2980	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 13:04	2630	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 13:07	2880	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 13:08	2510	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 13:08	2960	2109	2991	No
44-10	PR311756	266669	10213	GS015	4/12/2016 13:10	2890	2109	2991	No
44-10	PR316938	293136	10213	GS006	4/12/2016 9:37	2010	1766	2573	No
44-10	PR316938	293136	10213	GS006	4/12/2016 9:39	2260	1766	2573	No
44-10	PR316938	293136	10213	GS006	4/12/2016 9:39	2040	1766	2573	No
44-10	PR316938	293136	10213	GS006	4/12/2016 9:40	2240	1766	2573	No
44-10	PR316938	293136	10213	GS006	4/12/2016 9:40	2000	1766	2573	No
44-10	PR316938	293136	10213	GS006	4/12/2016 9:41	2130	1766	2573	No
44-10	PR316938	293136	10213	GS006	4/12/2016 9:41	1870	1766	2573	No

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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	10213	GS006	4/12/2016 9:42	1800	1766	2573	No
44-10	PR316938	293136	10213	GS007	4/12/2016 9:49	2550	1766	2573	No
44-10	PR316938	293136	10213	GS007	4/12/2016 9:51	2280	1766	2573	No
44-10	PR316938	293136	10213	GS007	4/12/2016 9:52	2530	1766	2573	No
44-10	PR316938	293136	10213	GS007	4/12/2016 9:53	2040	1766	2573	No
44-10	PR316938	293136	10213	GS007	4/12/2016 9:53	2060	1766	2573	No
44-10	PR316938	293136	10213	GS007	4/12/2016 9:54	1910	1766	2573	No
44-10	PR316938	293136	10213	GS007	4/12/2016 9:54	1940	1766	2573	No
44-10	PR316938	293136	10213	GS008	4/12/2016 9:58	2530	1766	2573	No
44-10	PR316938	293136	10213	GS008	4/12/2016 9:59	2260	1766	2573	No
44-10	PR316938	293136	10213	GS008	4/12/2016 9:59	2270	1766	2573	No
44-10	PR316938	293136	10213	GS008	4/12/2016 10:00	2250	1766	2573	No
44-10	PR316938	293136	10213	GS008	4/12/2016 10:00	2160	1766	2573	No
44-10	PR316938	293136	10213	GS008	4/12/2016 10:01	2070	1766	2573	No
44-10	PR316938	293136	10213	GS008	4/12/2016 10:02	2380	1766	2573	No
44-10	PR316938	293136	10213	GS008	4/12/2016 10:02	2180	1766	2573	No
44-10	PR316938	293136	10213	GS009	4/12/2016 10:07	2270	1766	2573	No
44-10	PR316938	293136	10213	GS009	4/12/2016 10:08	2350	1766	2573	No
44-10	PR316938	293136	10213	GS009	4/12/2016 10:08	2180	1766	2573	No
44-10	PR316938	293136	10213	GS009	4/12/2016 10:09	2160	1766	2573	No
44-10	PR316938	293136	10213	GS009	4/12/2016 10:09	2030	1766	2573	No



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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	10213	GS009	4/12/2016 10:10	2210	1766	2573	No
44-10	PR316938	293136	10213	GS009	4/12/2016 10:10	1950	1766	2573	No
44-10	PR316938	293136	10213	GS013	4/12/2016 13:40	3810	1766	2573	Yes
44-10	PR316938	293136	10213	GS013	4/12/2016 13:41	4600	1766	2573	Yes
44-10	PR316938	293136	10213	GS013	4/12/2016 13:42	4110	1766	2573	Yes
44-10	PR316938	293136	10213	GS013	4/12/2016 13:43	3730	1766	2573	Yes
44-10	PR316938	293136	10213	GS013	4/12/2016 13:43	3500	1766	2573	Yes
44-10	PR316938	293136	10213	GS013	4/12/2016 13:43	3950	1766	2573	Yes
44-10	PR316938	293136	10213	GS013	4/12/2016 13:44	4140	1766	2573	Yes
44-10	PR316938	293136	10213	GS013	4/12/2016 13:44	2520	1766	2573	No
44-10	PR316938	293136	10213	GS013	4/12/2016 13:45	3950	1766	2573	Yes
44-10	PR316938	293136	10213	GS014	4/16/2016 9:21	3330	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:21	3420	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:22	3560	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:24	3520	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:25	3400	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:25	3360	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:25	3280	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:26	2710	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:26	2780	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:27	3500	2604	3584	No

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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	10213	GS014	4/16/2016 9:27	3420	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:27	2800	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:28	3450	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:28	3340	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:29	2530	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:29	2690	2604	3584	No
44-10	PR316938	293136	10213	GS014	4/16/2016 9:30	3460	2604	3584	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:49	1940	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:50	2220	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:50	2260	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:50	2220	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:51	2160	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:51	2220	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:52	2240	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:52	2280	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:53	2320	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:53	2260	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:53	2390	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:54	2340	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:54	2270	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:55	2600	2375	3311	No

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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	10213	GS012	4/16/2016 9:55	2370	2375	3311	No
44-10	PR316938	293136	10213	GS012	4/16/2016 9:55	2630	2375	3311	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:10	2150	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:10	2120	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:11	2010	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:11	2150	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:11	2030	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:12	2080	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:12	2270	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:13	2250	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:13	2390	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:13	2340	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:14	2230	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:14	2030	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:15	2310	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:15	2210	2022	2886	No
44-10	PR316938	293136	10213	GS011	4/16/2016 10:15	2040	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:28	2080	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:28	2060	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:28	2160	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:29	2250	2022	2886	No

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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	10213	GS010	4/16/2016 10:29	2020	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:30	2090	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:30	2190	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:31	2230	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:31	2010	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:32	1910	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:32	2380	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:33	2200	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:33	2110	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:34	2310	2022	2886	No
44-10	PR316938	293136	10213	GS010	4/16/2016 10:34	2190	2022	2886	No
44-10	PR308037	266657	10213	GS007Q	4/13/2016 13:03	1780	1776	2586	No
44-10	PR308037	266657	10213	GS007Q	4/13/2016 13:03	1830	1776	2586	No
44-10	PR308037	266657	10213	GS007Q	4/13/2016 13:04	1850	1776	2586	No
44-10	PR308037	266657	10213	GS007Q	4/13/2016 13:04	1890	1776	2586	No
44-10	PR308037	266657	10213	GS007Q	4/13/2016 13:05	1910	1776	2586	No
44-10	PR308037	266657	10213	GS007Q	4/13/2016 13:05	1950	1776	2586	No
44-10	PR308037	266657	10213	GS007Q	4/13/2016 13:06	1700	1776	2586	No
44-10	PR308037	266657	10213	GS007Q	4/13/2016 13:06	1780	1776	2586	No
44-10	PR308037	266657	10213	GS007Q	4/13/2016 13:07	1730	1776	2586	No
44-10	PR308037	266657	10213	GS007Q	4/13/2016 13:07	1740	1776	2586	No

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 NORTHEAST CORNER OF EXCLUSION AREA  
 SURVEY UNIT 10213A



Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR308037	266657	10213	GS007Q	4/13/2016 13:08	1740	1776	2586	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:23	3120	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:23	3430	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:25	2060	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:25	2860	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:26	2260	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:26	2110	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:28	2370	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:28	3320	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:29	3570	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:29	3240	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:29	3430	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:30	3430	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:30	2380	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:31	2710	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:31	2300	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:32	2290	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:32	2140	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:32	2410	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:33	2660	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:33	3340	3120	4193	No

FSS RELEASE RECORD  
 NORTHEAST CORNER OF EXCLUSION AREA  
 SURVEY UNIT 10213A



Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR308037	266657	10213	GS016	4/13/2016 13:34	3690	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:34	3260	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:35	3280	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:35	3310	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:35	3480	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:36	3400	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:36	3610	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:37	3500	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:37	3410	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:37	2570	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:38	2580	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:38	2240	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:39	2130	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:39	2100	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:40	2080	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:40	2270	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:41	2290	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:41	2520	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:42	2590	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:42	3120	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:42	2990	3120	4193	No

FSS RELEASE RECORD  
 NORTHEAST CORNER OF EXCLUSION AREA  
 SURVEY UNIT 10213A



Detector Type	Detector ID	M2350-1 ID	Survey Unit	Location	Date/Time	Scan Logged Result (cpm)	Avg Background (cpm)	Action Level (cpm)	Scan Alarms
44-10	PR308037	266657	10213	GS016	4/13/2016 13:43	2800	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:43	3590	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:44	3320	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:44	3210	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:45	2880	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:45	2830	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:46	2770	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:46	3270	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:46	2650	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:47	2470	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:47	2250	3120	4193	No
44-10	PR308037	266657	10213	GS016	4/13/2016 13:48	2270	3120	4193	No



**ATTACHMENT 3**  
**SAMPLE ANALYTICAL REPORTS**

Analysis Report for 20-Apr-16-10004  
L3-10213A-FRGS-002SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10004  
Sample Description : L3-10213A-FRGS-002SS  
Sample Type : 1L 130G Soil Sample  
Unit :  
Sample Point :  
  
Sample Size : 9.483E+02 grams  
Facility : Default  
  
Sample Taken On : 4/14/2016 2:15:00PM  
Acquisition Started : 4/20/2016 8:11:08AM  
  
Procedure : 130G 1L Soil Sample  
Operator : JWelch  
Detector Name : P40818B  
Geometry : 130G Soil  
Live Time : 600.0 seconds  
Real Time : 600.9 seconds  
  
Dead Time : 0.14 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 1/5/2015  
Efficiency Calibration Description :  
  
Sample Number : 14680

*J.P. Welch*  
4-20-16  
*du...* 4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 8:21:34AM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*Shom...*  
4-20-16

DATA Validated  
4-25-16  
*CS...*

Analysis Report for 20-Apr-16-10004

L3-10213A-FRGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	186.37	741 -	750	746.16	2.45E+01	18.67	5.50E+01	Ra-226 U-235
2	238.71	948 -	960	955.32	5.88E+01	26.69	9.04E+01	Pb-212
3	295.21	1174 -	1186	1181.18	3.70E+01	20.52	5.20E+01	Pb-214 Eu-152
4	351.97	1402 -	1413	1408.08	7.20E+01	21.13	3.60E+01	Pb-214 Bi-211
5	582.82	2325 -	2338	2331.04	3.54E+01	13.98	1.12E+01	Tl-208
6	609.09	2429 -	2443	2436.11	7.43E+01	17.75	3.31E+00	Bi-214
7	910.82	3637 -	3648	3643.01	1.61E+01	10.87	1.17E+01	Ac-228
8	1460.31	5834 -	5853	5842.22	1.43E+02	24.91	1.05E+01	K-40

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.98	1460.82	*	10.66	9.24E+00	1.80E+00 miss
Tl-208	0.99	583.19	*	85.00	1.54E-01	6.35E-02 miss
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	2.74E-01	1.32E-01 miss
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	6.22E-01	1.66E-01 miss
		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		

Analysis Report for 20-Apr-16-10004

L3-10213A-FRGS-002SS

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty	Coinc Corr
Bi-214	0.99	1509.21	2.13			
		1661.27	1.05			
		1729.59	2.88			
		1764.49	15.30			
		1847.43	2.03			
Pb-214	1.00	2118.51	1.16			
		241.99	7.25			
		295.22 *	18.42	4.66E-01	2.69E-01	miss
		351.93 *	35.60	5.25E-01	1.75E-01	miss
		785.96	1.06			
Ra-226	0.99	186.21 *	3.64	1.22E+00	9.47E-01	miss
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	3.13E-01	2.12E-01	miss
		964.77	4.99			
		968.97	15.80			
		1588.20	3.22			
U-235	0.98	143.76	10.96			
		163.33	5.08			
		185.71 *	57.20	7.74E-02	6.03E-02	miss
		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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

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**INTERFERENCE CORRECTED REPORT**

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Analysis Report for 20-Apr-16-10004

L3-10213A-FRGS-002SS

	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	K-40	0.984	9.24E+00	1.80E+00	
	Tl-208	0.992	1.54E-01	6.35E-02	
X	Bi-211	0.951			
	Pb-212	1.000	2.74E-01	1.32E-01	
	Bi-214	0.999	6.22E-01	1.66E-01	
	Pb-214	1.000	5.07E-01	1.47E-01	
?	Ra-226	0.998	1.22E+00	9.47E-01	
	Ac-228	0.997	3.13E-01	2.12E-01	
?	U-235	0.981	7.74E-02	6.03E-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 2.000sigma

Analysis Report for 20-Apr-16-10004  
L3-10213A-FRGS-002SS

## UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 8:21:34AM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
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All peaks were identified.

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## 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)	Coinc Corr
+	K-40	1460.82	* 10.66	9.24E+00	9.26E-01	9.26E-01	miss
+	Cr-51	320.08	9.91	1.93E-01	6.23E-01	6.23E-01	free
+	Mn-54	834.85	99.98	-2.78E-03	5.72E-02	5.72E-02	miss
+	Co-58	810.76	99.45	-1.09E-03	5.28E-02	5.28E-02	miss
		1674.73	0.52	-1.37E+00		1.15E+01	miss
+	Co-60	1173.23	99.85	1.86E-02	4.74E-02	7.78E-02	miss
		1332.49	99.98	0.00E+00		4.74E-02	miss
+	Nb-94	702.65	99.81	4.90E-03	4.50E-02	5.92E-02	miss
		871.09	99.89	-1.37E-02		4.50E-02	miss
+	Ag-108m	79.13	6.60	-1.60E-01	4.69E-02	2.03E+00	miss
		433.94	90.50	-2.86E-02		4.69E-02	miss
		614.28	89.80	1.62E-02		6.01E-02	miss
		722.94	90.80	1.59E-02		7.84E-02	miss
+	Sn-113	255.13	2.11	1.82E-01	8.98E-02	2.70E+00	free
		391.70	64.97	4.10E-02		8.98E-02	free
+	Cs-134	475.36	1.48	-9.16E-01	5.50E-02	2.35E+00	miss
		563.25	8.34	1.59E-01		6.53E-01	miss
		569.33	15.37	-1.80E-01		3.35E-01	miss
		604.72	97.62	1.30E-02		5.50E-02	miss

Analysis Report for 20-Apr-16-10004

L3-10213A-FRGS-002SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	795.86	85.46	4.33E-02	5.50E-02	8.93E-02	miss
		801.95	8.69	1.26E-01		6.36E-01	miss
		1038.61	0.99	1.02E+00		6.66E+00	miss
		1167.97	1.79	-1.02E+00		3.56E+00	miss
		1365.19	3.02	2.81E-01		2.35E+00	miss
+	Cs-137	661.66	85.10	-7.89E-04	7.88E-02	7.88E-02	miss
+	Eu-152	121.78	28.67	6.26E-02	1.16E-01	1.72E-01	miss
		244.70	7.61	-7.34E-03		5.10E-01	miss
		295.94	0.45	1.14E+00		1.80E+01	miss
		344.28	26.60	-3.08E-02		1.16E-01	miss
		367.79	0.86	-1.37E+00		2.89E+00	miss
		411.12	2.24	-5.19E-01		1.56E+00	miss
		443.96	2.83	1.77E-01		1.88E+00	miss
		488.68	0.42	-6.38E+00		7.23E+00	miss
		563.99	0.49	-3.09E+00		7.92E+00	miss
		586.26	0.46	-1.53E+00		1.40E+01	miss
		678.62	0.47	-2.03E+00		1.04E+01	miss
		688.67	0.86	1.41E+00		6.31E+00	miss
		719.35	0.28	-7.63E-01		2.15E+01	miss
		778.90	12.96	1.39E-01		4.16E-01	miss
		810.45	0.32	6.39E-01		1.55E+01	miss
		867.37	4.26	3.55E-01		1.49E+00	miss
		919.33	0.43	-2.94E+00		8.65E+00	miss
		964.08	14.65	1.89E-01		5.91E-01	miss
		1085.87	10.24	2.75E-02		6.60E-01	miss
		1089.74	1.73	1.02E+00		4.27E+00	miss
		1112.07	13.69	-2.98E-02		4.49E-01	miss
		1212.95	1.43	1.45E-01		5.56E+00	miss
		1249.94	0.19	7.74E+00		4.28E+01	miss
		1299.14	1.63	5.84E-01		4.68E+00	miss
		1408.01	21.07	1.82E-02		2.96E-01	miss
		1457.64	0.50	-1.53E+01		2.76E+01	miss
		1528.10	0.28	7.25E-01		1.87E+01	miss
+	Eu-154	123.07	40.40	8.51E-03	1.11E-01	1.11E-01	miss
		247.93	6.89	-4.76E-02		6.43E-01	miss
		591.76	4.95	-1.36E-01		9.06E-01	miss
		692.42	1.78	6.43E-01		3.30E+00	miss
		723.30	20.06	1.54E-01		3.71E-01	miss
		756.80	4.52	-1.85E-01		1.28E+00	miss
		873.18	12.08	5.36E-02		5.27E-01	miss
		996.29	10.48	5.07E-02		4.71E-01	miss
		1004.76	18.01	3.59E-02		3.57E-01	miss
		1274.43	34.80	2.31E-02		1.67E-01	miss
		1596.48	1.80	-4.12E-01		3.03E+00	miss
+	Eu-155	45.30	1.31	-1.56E+01	3.13E-01	3.44E+01	miss
		60.01	1.22	-1.02E+00		3.66E+01	miss
		86.55	30.70	1.32E-01		3.40E-01	miss
		105.31	21.10	-1.83E-02		3.13E-01	miss
+	Tl-208	583.19	* 85.00	1.54E-01	6.42E-02	6.42E-02	miss
+	Bi-211	351.07	* 13.02	1.44E+00	4.67E-01	4.67E-01	miss
+	Pb-211	404.85	3.78	2.28E-02	1.53E+00	1.53E+00	miss



Analysis Report for 20-Apr-16-10004

L3-10213A-FRGS-002SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Pb-211	427.09	1.76	6.09E-01	1.53E+00	2.95E+00	miss
		832.01	3.52	1.78E-01		1.75E+00	miss
+	Bi-212	39.86	1.06	-8.73E+00	1.02E+00	3.35E+01	miss
		727.33	6.67	3.23E-01		1.02E+00	miss
		785.37	1.10	1.19E+00		5.37E+00	miss
		1620.50	1.47	9.54E-01		5.48E+00	miss
+	Pb-212	115.18	0.60	2.24E-01	1.80E-01	1.09E+01	miss
		238.63	* 43.60	2.74E-01		1.80E-01	miss
		300.09	3.30	8.88E-02		1.56E+00	miss
+	Pb212-XR	74.82	10.28	1.54E+00	1.23E+00	2.26E+00	miss
		77.11	17.10	6.89E-01		1.23E+00	miss
		87.35	3.97	3.58E-01		2.52E+00	miss
		89.78	1.46	-2.39E-01		6.63E+00	miss
+	Bi-214	609.32	* 45.49	6.22E-01	8.06E-02	8.06E-02	miss
		768.36	4.89	2.65E-01		1.44E+00	miss
		806.18	1.26	1.86E+00		5.13E+00	miss
		934.06	3.11	1.04E+00		2.85E+00	miss
		1120.29	14.92	4.76E-01		8.63E-01	miss
		1155.21	1.63	8.85E-01		5.38E+00	miss
		1238.12	5.83	6.75E-01		1.75E+00	miss
		1280.98	1.43	-1.06E+00		5.73E+00	miss
		1377.67	3.99	2.72E-01		1.99E+00	miss
		1385.31	0.79	5.57E-01		9.00E+00	miss
		1401.52	1.33	2.51E+00		6.59E+00	miss
		1407.99	2.39	1.60E-01		2.60E+00	miss
		1509.21	2.13	-1.95E+00		2.44E+00	miss
		1661.27	1.05	-4.55E-01		5.36E+00	miss
		1729.59	2.88	1.09E+00		3.28E+00	miss
		1764.49	15.30	5.94E-01		9.83E-01	miss
		1847.43	2.03	5.08E-02		2.99E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	7.25	8.12E-01	1.71E-01	9.57E-01	miss
		295.22	* 18.42	4.66E-01		3.77E-01	miss
		351.93	* 35.60	5.25E-01		1.71E-01	miss
		785.96	1.06	6.39E-01		5.59E+00	miss
+	Pb214-XR	74.82	5.80	2.73E+00	2.17E+00	4.00E+00	miss
		77.11	9.70	1.22E+00		2.17E+00	miss
		87.35	2.24	6.35E-01		4.47E+00	miss
		89.78	0.82	-4.25E-01		1.18E+01	miss
+	Ra-226	186.21	* 3.64	1.22E+00	1.43E+00	1.43E+00	miss
+	Ac-228	129.07	2.42	-3.58E-01	2.86E-01	2.44E+00	miss
		209.25	3.89	3.37E-01		1.34E+00	miss
		270.24	3.46	5.81E-01		1.68E+00	miss
		328.00	2.95	-9.39E-01		1.19E+00	miss
		338.32	11.27	3.91E-01		5.62E-01	miss
		409.46	1.92	6.62E-01		2.39E+00	miss
		463.00	4.40	5.26E-01		1.25E+00	miss
		794.95	4.25	7.85E-01		1.87E+00	miss
		911.20	* 25.80	3.13E-01		2.86E-01	miss
		964.77	4.99	2.60E-01		1.65E+00	miss
		968.97	15.80	2.90E-01		6.43E-01	miss

Analysis Report for 20-Apr-16-10004

L3-10213A-FRGS-002SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	3.14E-01	2.86E-01	2.46E+00	miss
+	Pa-231	27.36	10.30	6.97E-01	2.08E+00	4.16E+00	miss
		283.69	1.70	-5.66E-01		2.84E+00	miss
		300.07	2.47	1.19E-01		2.08E+00	miss
		302.65	2.20	7.72E-01		2.52E+00	miss
		330.06	1.40	1.87E+00		3.58E+00	miss
+	Th-234	92.38	2.13	-9.02E-01	5.05E+00	5.05E+00	miss
		92.80	2.10	-4.58E-01		5.08E+00	miss
		112.81	0.21	-1.50E+01		3.00E+01	miss
+	U-235	143.76	10.96	-1.61E-02	9.08E-02	4.39E-01	miss
		163.33	5.08	-2.06E-01		9.24E-01	miss
		185.71	* 57.20	7.74E-02		9.08E-02	miss
		202.11	1.08	2.00E+00		4.75E+00	miss
		205.31	5.01	2.15E-01		9.62E-01	miss
+	Am-241	59.54	35.90	2.49E-01	1.28E+00	1.28E+00	miss

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

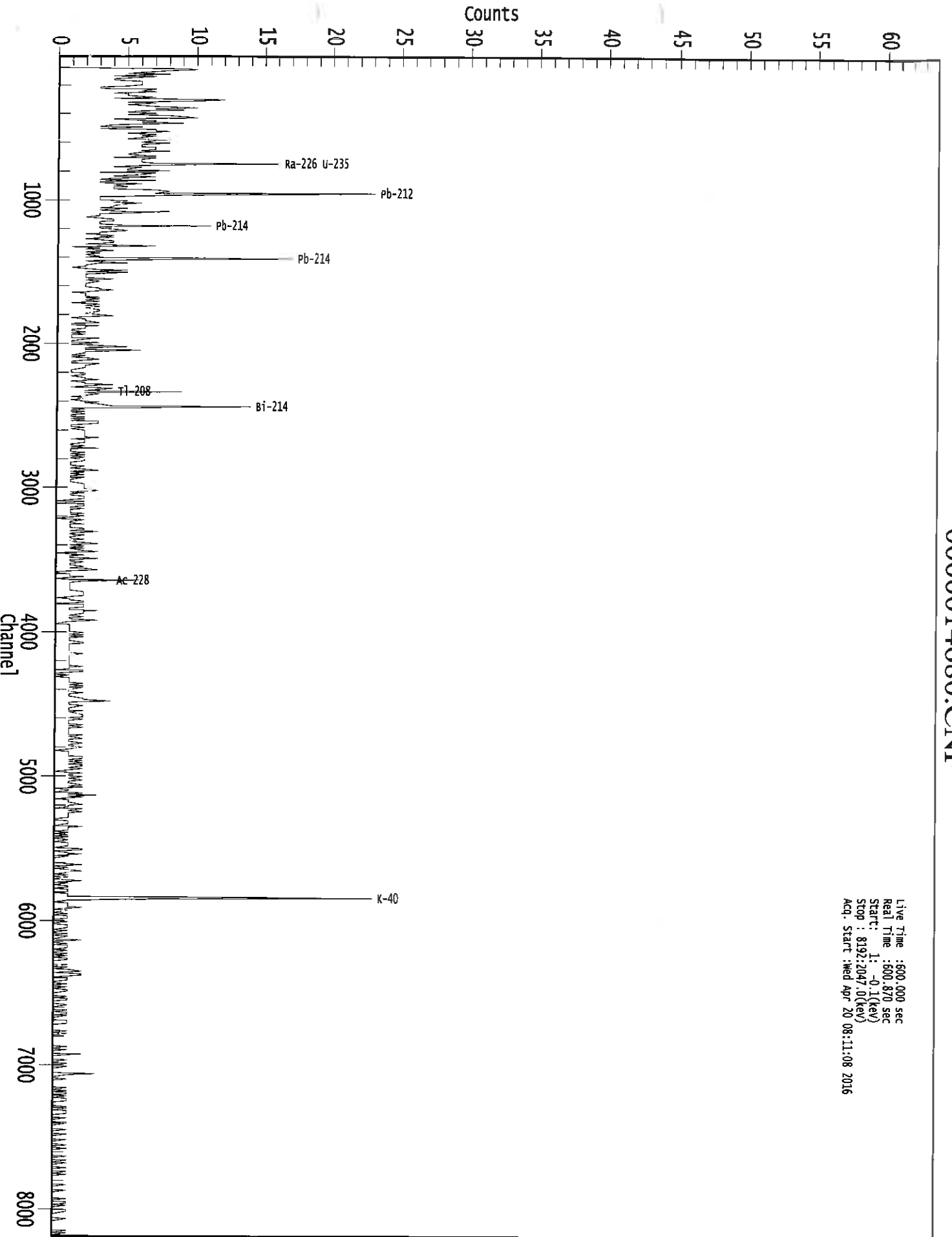
@ = Half-life too short to be able to perform the decay correction

? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.



Live Time : 600.000 sec  
Real Time : 600.870 sec  
Start : 1: -0.1(keV)  
Stop : 8192.2047.0(keV)  
Acq. Start : Wed Apr 20 08:11:08 2016

Analysis Report for 20-Apr-16-10011  
L3-10213A-FQGS-007SS (QC)

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10011  
Sample Description : L3-10213A-FQGS-007SS (QC)  
Sample Type : 1L 130G Soil Sample  
Unit :  
Sample Point :  
  
Sample Size : 1.126E+03 grams  
Facility : Default  
  
Sample Taken On : 4/13/2016 7:45:00AM  
Acquisition Started : 4/20/2016 9:43:56AM  
  
Procedure : 130G 1L Soil Sample  
Operator : HTomlin  
Detector Name : P40818B  
Geometry : 130G Soil  
Live Time : 600.0 seconds  
Real Time : 601.2 seconds  
  
Dead Time : 0.19 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 1/5/2015  
Efficiency Calibration Description :  
  
Sample Number : 14689

*Handwritten:*  
J.P. - H Tomlin  
4-20-16  
mu shu 4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 9:54:29AM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*Handwritten:*  
H Tomlin  
4-20-16  
Data Validated 4-25-16  
Fuller

Analysis Report for 20-Apr-16-10011

L3-10213A-FQGS-007SS (QC)

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	238.79	949 -	961	955.64	5.95E+01	28.22	1.05E+02	Pb-212
2	295.31	1175 -	1185	1181.56	2.91E+01	16.45	3.18E+01	Pb-214 Eu-152
3	338.07	1349 -	1358	1352.49	1.76E+01	13.09	2.48E+01	Ac-228
4	351.89	1399 -	1415	1407.73	6.97E+01	21.16	3.06E+01	Pb-214 Bi-211
5	609.00	2431 -	2443	2435.75	5.78E+01	17.41	1.43E+01	Bi-214
6	661.48	2641 -	2650	2645.63	1.03E+01	9.50	1.33E+01	Cs-137
7	1460.42	5834 -	5851	5842.64	1.29E+02	24.42	1.74E+01	K-40

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.99	1460.82	* 10.66	7.05E+00	1.47E+00	miss
Cs-137	0.99	661.66	* 85.10	4.12E-02	3.82E-02	miss
Pb-212	0.99	115.18	0.60			
		238.63	* 43.60	2.33E-01	1.17E-01	miss
		300.09	3.30			
Bi-214	0.99	609.32	* 45.49	4.07E-01	1.32E-01	miss
		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			

Analysis Report for 20-Apr-16-10011  
L3-10213A-FQGS-007SS (QC)

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty	Coinc Corr
Bi-214	0.99	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	3.09E-01	1.81E-01	miss
		351.93 *	35.60	4.28E-01	1.47E-01	miss
		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	3.33E-01	2.53E-01	miss
		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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

## INTERFERENCE CORRECTED REPORT

Nuclide Name	Nuclide Id Confidence	Wt mean Activity (pCi/grams)	Wt mean Activity Uncertainty	Comments
K-40	0.990	7.05E+00	1.47E+00	
Cs-137	0.998	4.12E-02	3.82E-02	
X Bi-211	0.960			
Pb-212	0.999	2.33E-01	1.17E-01	

Analysis Report for 20-Apr-16-10011

L3-10213A-FQGS-007SS (QC)

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
Bi-214	0.997	4.07E-01	1.32E-01	
Pb-214	1.000	3.81E-01	1.14E-01	
Ac-228	0.999	3.33E-01	2.53E-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 2.000sigma



Analysis Report for 20-Apr-16-10011

L3-10213A-FQGS-007SS (QC)

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 4/20/2016 9:54:29AM  
 Peak Locate From Channel : 120  
 Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
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All peaks were identified.

M = First peak in a multiplet region  
 m = Other peak in a multiplet region  
 F = Fitted singlet  
 Errors quoted at 2.000sigma

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**NUCLIDE MDA REPORT**


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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)	Coinc Corr
+	K-40	1460.82 *	10.66	7.05E+00	9.45E-01	9.45E-01 miss
+	Cr-51	320.08	9.91	1.24E-01	5.14E-01	5.14E-01 free
+	Mn-54	834.85	99.98	1.74E-02	6.39E-02	6.39E-02 miss
+	Co-58	810.76	99.45	-1.81E-02	5.03E-02	5.03E-02 miss
		1674.73	0.52	1.34E+00		9.84E+00 miss
+	Co-60	1173.23	99.85	1.86E-03	5.05E-02	6.56E-02 miss
		1332.49	99.98	-3.10E-03		5.05E-02 miss
+	Nb-94	702.65	99.81	3.39E-03	4.25E-02	4.25E-02 miss
		871.09	99.89	-2.70E-02		4.39E-02 miss
+	Ag-108m	79.13	6.60	-6.63E-01	3.95E-02	1.58E+00 miss
		433.94	90.50	-6.35E-03		3.95E-02 miss
		614.28	89.80	8.97E-03		5.06E-02 miss
		722.94	90.80	1.65E-03		4.76E-02 miss
+	Sn-113	255.13	2.11	1.04E-01	7.14E-02	2.03E+00 free
		391.70	64.97	-4.30E-03		7.14E-02 free
+	Cs-134	475.36	1.48	-8.50E-01	4.94E-02	3.07E+00 miss
		563.25	8.34	-1.17E-01		6.38E-01 miss
		569.33	15.37	-7.61E-02		2.63E-01 miss
		604.72	97.62	8.08E-03		4.94E-02 miss

Analysis Report for 20-Apr-16-10011

L3-10213A-FQGS-007SS (QC)

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	795.86	85.46	1.05E-02	4.94E-02	6.79E-02	miss
		801.95	8.69	9.68E-02		5.37E-01	miss
		1038.61	0.99	5.45E-01		5.03E+00	miss
		1167.97	1.79	-4.39E-01		3.01E+00	miss
		1365.19	3.02	3.60E-01		1.98E+00	miss
+	Cs-137	661.66	85.10	4.12E-02	5.67E-02	5.67E-02	miss
+	Eu-152	121.78	28.67	-5.87E-02	1.39E-01	1.39E-01	miss
		244.70	7.61	5.85E-02		5.37E-01	miss
		295.94	0.45	-3.61E+00		1.36E+01	miss
		344.28	26.60	-3.57E-02		1.41E-01	miss
		367.79	0.86	4.72E-01		4.16E+00	miss
		411.12	2.24	4.15E-01		1.98E+00	miss
		443.96	2.83	-8.74E-02		1.59E+00	miss
		488.68	0.42	2.50E+00		1.23E+01	miss
		563.99	0.49	-3.79E+00		1.03E+01	miss
		586.26	0.46	1.44E+00		1.08E+01	miss
		678.62	0.47	4.51E+00		1.16E+01	miss
		688.67	0.86	6.09E-01		5.32E+00	miss
		719.35	0.28	-4.29E-01		1.93E+01	miss
		778.90	12.96	-1.70E-02		3.51E-01	miss
		810.45	0.32	-5.15E+00		1.45E+01	miss
		867.37	4.26	-8.72E-01		1.25E+00	miss
		919.33	0.43	4.40E-01		1.07E+01	miss
		964.08	14.65	0.00E+00		4.98E-01	miss
		1085.87	10.24	-1.36E-01		5.56E-01	miss
		1089.74	1.73	1.37E-01		2.55E+00	miss
		1112.07	13.69	-1.19E-01		3.78E-01	miss
		1212.95	1.43	9.83E-01		5.67E+00	miss
		1249.94	0.19	-1.49E+01		3.30E+01	miss
		1299.14	1.63	-3.44E-01		3.53E+00	miss
		1408.01	21.07	5.75E-02		3.22E-01	miss
		1457.64	0.50	-1.60E+01		2.77E+01	miss
		1528.10	0.28	0.00E+00		5.78E+00	miss
+	Eu-154	123.07	40.40	1.56E-02	1.04E-01	1.04E-01	miss
		247.93	6.89	-2.07E-01		5.42E-01	miss
		591.76	4.95	1.11E-01		1.01E+00	miss
		692.42	1.78	-3.41E-01		2.58E+00	miss
		723.30	20.06	5.99E-03		2.16E-01	miss
		756.80	4.52	-3.56E-01		8.85E-01	miss
		873.18	12.08	7.56E-02		4.44E-01	miss
		996.29	10.48	-1.21E-01		3.97E-01	miss
		1004.76	18.01	1.25E-02		2.69E-01	miss
		1274.43	34.80	-1.30E-02		1.11E-01	miss
		1596.48	1.80	1.04E+00		3.74E+00	miss
+	Eu-155	45.30	1.31	-3.69E+00	2.87E-01	2.83E+01	miss
		60.01	1.22	2.23E-01		3.21E+01	miss
		86.55	30.70	-6.84E-02		2.99E-01	miss
		105.31	21.10	6.85E-02		2.87E-01	miss
+	Tl-208	583.19	85.00	5.85E-02	9.33E-02	9.33E-02	miss
+	Bi-211	351.07	13.02	1.17E+00	4.05E-01	4.05E-01	miss
+	Pb-211	404.85	3.78	-1.53E-01	9.60E-01	9.60E-01	miss

Analysis Report for 20-Apr-16-10011

L3-10213A-FQGS-007SS (QC)

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Pb-211	427.09	1.76	6.81E-01	9.60E-01	2.58E+00	miss
		832.01	3.52	-4.68E-02		1.35E+00	miss
+	Bi-212	39.86	1.06	-3.63E+00	8.13E-01	3.32E+01	miss
		727.33	6.67	2.44E-01		8.13E-01	miss
		785.37	1.10	2.13E+00		5.18E+00	miss
		1620.50	1.47	8.57E-01		3.98E+00	miss
+	Pb-212	115.18	0.60	1.39E+00	1.63E-01	8.21E+00	miss
		238.63	* 43.60	2.33E-01		1.63E-01	miss
		300.09	3.30	6.46E-01		1.50E+00	miss
+	Pb212-XR	74.82	10.28	3.78E-01	1.16E+00	1.73E+00	miss
		77.11	17.10	1.03E+00		1.16E+00	miss
		87.35	3.97	8.32E-01		2.36E+00	miss
		89.78	1.46	3.51E-01		4.65E+00	miss
+	Bi-214	609.32	* 45.49	4.07E-01	1.17E-01	1.17E-01	miss
		768.36	4.89	-6.24E-02		1.28E+00	miss
		806.18	1.26	-5.00E-01		4.01E+00	miss
		934.06	3.11	1.26E-01		1.66E+00	miss
		1120.29	14.92	1.53E-01		5.37E-01	miss
		1155.21	1.63	-2.16E-01		3.63E+00	miss
		1238.12	5.83	-6.32E-02		9.52E-01	miss
		1280.98	1.43	1.16E-01		4.83E+00	miss
		1377.67	3.99	3.58E-01		1.97E+00	miss
		1385.31	0.79	-3.02E-01		5.18E+00	miss
		1401.52	1.33	5.14E-01		5.09E+00	miss
		1407.99	2.39	5.06E-01		2.84E+00	miss
		1509.21	2.13	4.00E-01		2.60E+00	miss
		1661.27	1.05	0.00E+00		5.70E+00	miss
		1729.59	2.88	7.12E-01		2.76E+00	miss
		1764.49	15.30	1.81E-01		6.20E-01	miss
		1847.43	2.03	-1.28E-01		2.52E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	7.25	2.63E-01	1.48E-01	7.18E-01	miss
		295.22	* 18.42	3.09E-01		2.46E-01	miss
		351.93	* 35.60	4.28E-01		1.48E-01	miss
		785.96	1.06	8.37E-01		5.06E+00	miss
+	Pb214-XR	74.82	5.80	6.70E-01	2.05E+00	3.06E+00	miss
		77.11	9.70	1.81E+00		2.05E+00	miss
		87.35	2.24	1.47E+00		4.18E+00	miss
		89.78	0.82	6.24E-01		8.28E+00	miss
+	Ra-226	186.21	3.64	1.02E+00	1.40E+00	1.40E+00	miss
+	Ac-228	129.07	2.42	-1.79E-01	3.64E-01	1.66E+00	miss
		209.25	3.89	7.38E-01		1.33E+00	miss
		270.24	3.46	1.69E-01		1.44E+00	miss
		328.00	2.95	5.95E-01		1.59E+00	miss
		338.32	* 11.27	3.33E-01		3.64E-01	miss
		409.46	1.92	7.61E-02		2.21E+00	miss
		463.00	4.40	4.82E-01		1.25E+00	miss
		794.95	4.25	5.71E-01		1.57E+00	miss
		911.20	25.80	2.01E-01		3.75E-01	miss
		964.77	4.99	7.31E-02		1.53E+00	miss
		968.97	15.80	2.67E-01		5.59E-01	miss

Analysis Report for 20-Apr-16-10011

L3-10213A-FQGS-007SS (QC)

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	-4.81E-02	3.64E-01	1.42E+00	miss
+	Pa-231	27.36	10.30	-1.40E-01	1.82E+00	3.68E+00	miss
		283.69	1.70	-1.18E+00		1.87E+00	miss
		300.07	2.47	8.63E-01		2.00E+00	miss
		302.65	2.20	-5.80E-02		1.82E+00	miss
		330.06	1.40	-1.11E+00		2.61E+00	miss
+	Th-234	92.38	2.13	2.84E+00	5.37E+00	5.37E+00	miss
		92.80	2.10	4.67E+00		5.61E+00	miss
		112.81	0.21	2.38E+00		2.80E+01	miss
+	U-235	143.76	10.96	-9.83E-02	9.55E-02	3.35E-01	miss
		163.33	5.08	-1.27E-01		8.05E-01	miss
		185.71	57.20	8.40E-02		9.55E-02	miss
		202.11	1.08	5.85E-02		3.44E+00	miss
		205.31	5.01	1.29E-01		7.47E-01	miss
+	Am-241	59.54	35.90	4.47E-01	1.23E+00	1.23E+00	miss

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = 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

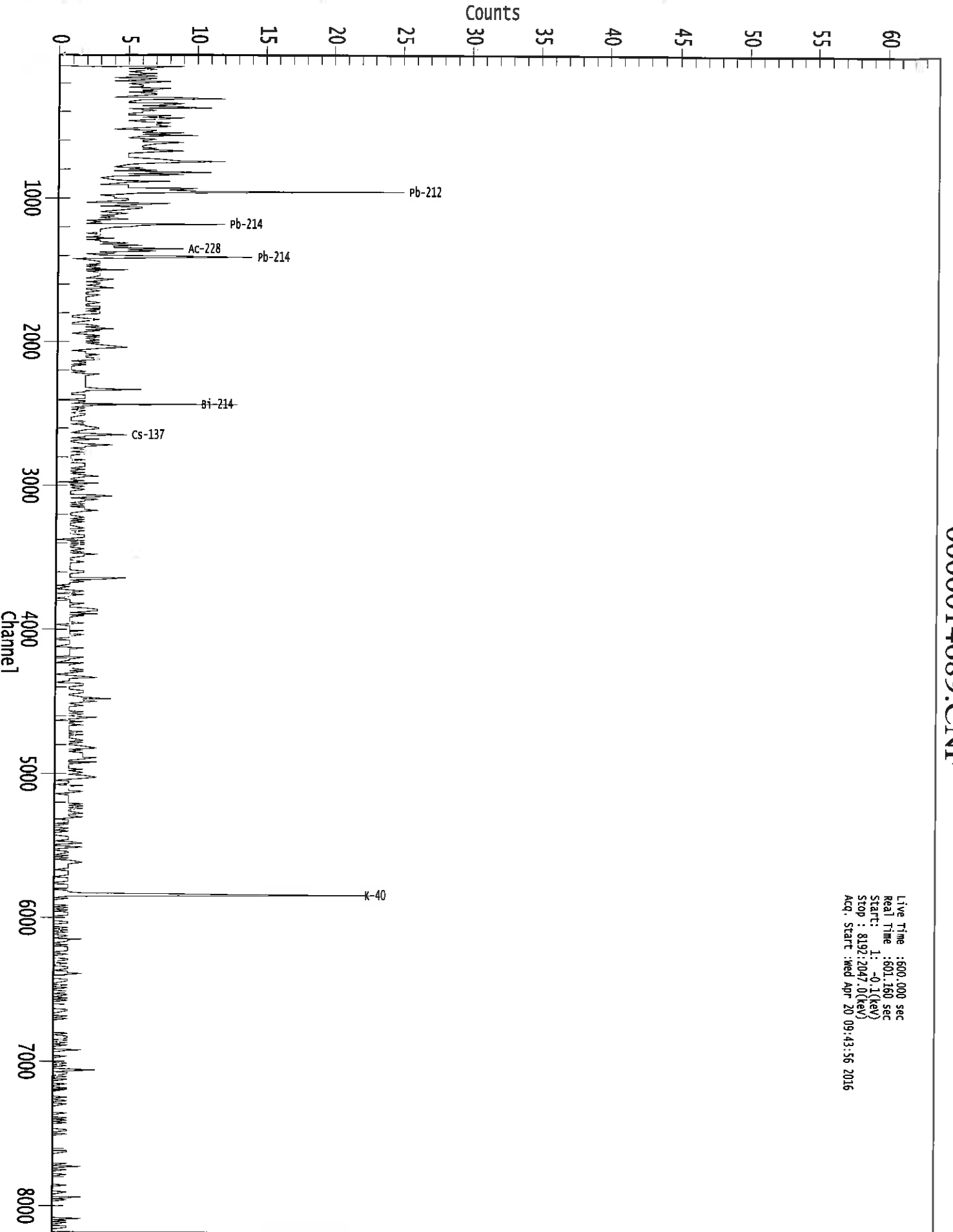
Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

0000014689.CNF

Live Time : 600.000 sec  
Real Time : 601.160 sec  
Start: 1: -0.1(kev)  
Stop : 8192:2047.0(kev)  
Acq. Start : Wed Apr 20 09:43:56 2016



Analysis Report for 20-Apr-16-10006  
L3-10213A-FRGS-003SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10006  
Sample Description : L3-10213A-FRGS-003SS  
Sample Type : 1L 130G Soil Sample  
Unit :  
Sample Point :  
  
Sample Size : 1.120E+03 grams  
Facility : Default  
  
Sample Taken On : 4/14/2016 2:00:00PM  
Acquisition Started : 4/20/2016 8:44:29AM  
  
Procedure : 130G 1L Soil Sample  
Operator : HTomlin  
Detector Name : P11314X2  
Geometry : 130G Soil  
Live Time : 600.0 seconds  
Real Time : 600.4 seconds  
  
Dead Time : 0.07 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 6/28/2012  
Efficiency Calibration Description :  
  
Sample Number : 14683

*H. Tomlin*  
4-20-16  
*Tomlin* 4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 8:54:39AM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*H. Tomlin*  
4-20-16  
DATA Validated  
4/25/16  
*CSULLER*

Analysis Report for 20-Apr-16-10006

L3-10213A-FRGS-003SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	238.70	950 -	960	955.12	8.97E+01	25.98	6.27E+01	Pb-212
2	295.30	1177 -	1187	1181.24	4.78E+01	19.83	4.23E+01	Pb-214
3	338.55	1349 -	1360	1354.06	2.87E+01	13.70	1.65E+01	Eu-152
4	351.97	1401 -	1416	1407.67	1.15E+02	26.79	4.95E+01	Ac-228
5	583.46	2325 -	2338	2332.83	4.16E+01	15.75	1.68E+01	Pb-214
6	609.54	2429 -	2443	2437.10	1.02E+02	22.03	1.50E+01	Bi-211
7	1461.41	5833 -	5854	5844.98	2.20E+02	30.48	9.32E+00	Tl-203
								Bi-214
								K-40

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.97	1460.82 *	10.66	1.09E+01	1.78E+00	miss
Tl-208	0.99	583.19 *	85.00	1.38E-01	5.48E-02	miss
Pb-212	1.00	115.18	0.60			
		238.63 *	43.60	3.13E-01	1.04E-01	miss
		300.09	3.30			
Bi-214	0.79	609.32 *	45.49	6.55E-01	1.61E-01	miss
		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			



Analysis Report for 20-Apr-16-10006  
L3-10213A-FRGS-003SS

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>	<b>Coinc Corr</b>
Bi-214	0.79	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	4.56E-01	2.03E-01	miss
		351.93 *	35.60	6.40E-01	1.80E-01	miss
Ac-228	0.32	785.96	1.06			
		129.07	2.42			
		209.25	3.89			
		270.24	3.46			
		328.00	2.95			
		338.32 *	11.27	4.91E-01	2.47E-01	miss
		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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.979	1.09E+01	1.78E+00	
Tl-208	0.995	1.38E-01	5.48E-02	
X Bi-211	0.951			
Pb-212	1.000	3.13E-01	1.04E-01	

Analysis Report for 20-Apr-16-10006

L3-10213A-FRGS-003SS

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
Bi-214	0.797	6.55E-01	1.61E-01	
Pb-214	1.000	5.59E-01	1.35E-01	
Ac-228	0.320	4.91E-01	2.47E-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 2.000sigma

Analysis Report for 20-Apr-16-10006  
L3-10213A-FRGS-003SS

## UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 8:54:39AM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
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All peaks were identified.

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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)	Coinc Corr
+	K-40	1460.32	* 10.66	1.09E+01	6.94E-01	6.94E-01	miss
+	Cr-51	320.08	9.91	-7.07E-03	4.21E-01	4.21E-01	free
+	Mn-54	834.85	99.98	-1.97E-02	3.38E-02	3.38E-02	miss
+	Co-58	810.76	99.45	6.24E-04	4.50E-02	4.50E-02	miss
		1674.73	0.52	1.49E-01		8.78E+00	miss
+	Co-60	1173.23	99.85	-1.00E-02	4.20E-02	4.20E-02	miss
		1332.49	99.98	-5.44E-03		5.90E-02	miss
+	Nb-94	702.65	99.81	1.07E-03	3.85E-02	3.85E-02	miss
		871.09	99.89	7.77E-03		4.85E-02	miss
+	Ag-108m	79.13	6.60	3.98E-02	4.02E-02	9.67E-01	miss
		433.94	90.50	9.38E-03		4.02E-02	miss
		614.28	89.80	-1.27E-02		4.59E-02	miss
		722.94	90.80	1.50E-02		5.06E-02	miss
+	Sn-113	255.13	2.11	-4.89E-02	5.11E-02	1.67E+00	free
		391.70	64.97	-6.13E-03		5.11E-02	free
+	Cs-134	475.36	1.48	4.24E-01	3.90E-02	2.64E+00	miss
		563.25	8.34	1.05E-01		5.78E-01	miss
		569.33	15.37	-1.81E-03		2.88E-01	miss
		604.72	97.62	1.79E-03		3.90E-02	miss

Analysis Report for 20-Apr-16-10006

L3-10213A-FRGS-003SS

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
Cs-134	795.86	85.46	3.01E-02	3.90E-02	7.97E-02	miss
	801.95	8.69	-3.91E-01		4.35E-01	miss
	1038.61	0.99	-1.41E-01		3.93E+00	miss
	1167.97	1.79	9.92E-01		4.01E+00	miss
	1365.19	3.02	2.97E-01		1.55E+00	miss
+ Cs-137	661.66	85.10	4.90E-02	8.11E-02	8.11E-02	miss
+ Eu-152	121.78	28.67	1.59E-02	1.03E-01	1.18E-01	miss
	244.70	7.61	-1.57E-01		4.90E-01	miss
	295.94	0.45	1.89E+01		1.56E+01	miss
	344.28	26.60	-4.00E-02		1.03E-01	miss
	367.79	0.86	7.89E-02		3.95E+00	miss
	411.12	2.24	-1.58E-01		1.79E+00	miss
	443.96	2.83	-4.53E-01		1.16E+00	miss
	488.68	0.42	-2.02E+00		7.78E+00	miss
	563.99	0.49	1.40E-02		8.90E+00	miss
	586.26	0.46	-9.53E+00		8.07E+00	miss
	678.62	0.47	8.84E-01		8.69E+00	miss
	688.67	0.86	3.59E-01		5.52E+00	miss
	719.35	0.28	2.91E-01		1.40E+01	miss
	778.90	12.96	1.32E-02		3.73E-01	miss
	810.45	0.32	1.87E+00		1.44E+01	miss
	867.37	4.26	-1.88E-01		6.37E-01	miss
	919.33	0.43	-3.14E+00		8.34E+00	miss
	964.03	14.65	4.74E-02		3.82E-01	miss
	1085.87	10.24	9.58E-02		5.91E-01	miss
	1089.74	1.73	-1.35E-01		3.26E+00	miss
	1112.07	13.69	4.55E-02		4.78E-01	miss
1212.95	1.43	-7.85E-01		4.24E+00	miss	
1249.94	0.19	1.35E+01		4.34E+01	miss	
1299.14	1.63	8.91E-01		3.20E+00	miss	
1408.01	21.07	1.21E-01		3.43E-01	miss	
1457.64	0.50	-1.94E+01		1.47E+01	miss	
1528.10	0.28	8.28E-01		1.42E+01	miss	
+ Eu-154	123.07	40.40	-6.25E-02	6.92E-02	6.92E-02	miss
	247.93	6.89	-1.56E-02		5.34E-01	miss
	591.76	4.95	-1.21E-01		6.92E-01	miss
	692.42	1.78	3.36E-01		2.68E+00	miss
	723.30	20.06	6.78E-02		2.30E-01	miss
	756.80	4.52	-3.55E-02		1.12E+00	miss
	873.18	12.08	1.53E-02		4.33E-01	miss
	996.29	10.48	7.53E-02		4.17E-01	miss
	1004.76	18.01	6.29E-02		3.20E-01	miss
	1274.43	34.80	1.80E-02		1.80E-01	miss
	1596.48	1.80	-3.14E-01		2.31E+00	miss
+ Eu-155	45.30	1.31	4.62E+00	1.76E-01	9.31E+00	miss
	60.01	1.22	-2.23E+00		1.16E+01	miss
	86.55	30.70	6.07E-02		1.96E-01	miss
	105.31	21.10	-3.98E-03		1.76E-01	miss
+ Tl-208	583.19	* 85.00	1.38E-01	5.83E-02	5.83E-02	miss
+ Bi-211	351.07	* 13.02	1.75E+00	4.41E-01	4.41E-01	miss
+ Pb-211	404.85	3.78	5.26E-01	1.23E+00	1.23E+00	miss

Analysis Report for 20-Apr-16-10006  
L3-10213A-FRGS-003SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Pb-211	427.09	1.76	9.37E-01	1.23E+00	2.43E+00	miss
		832.01	3.52	3.26E-01		1.33E+00	miss
+	Bi-212	39.86	1.06	-2.58E+00	1.05E+00	1.15E+01	miss
		727.33	6.67	9.44E-01		1.20E+00	miss
		785.37	1.10	9.46E-01		4.70E+00	miss
		1620.50	1.47	0.00E+00		1.05E+00	miss
+	Pb-212	115.18	0.60	-2.23E+00	1.12E-01	5.40E+00	miss
		238.63	* 43.60	3.13E-01		1.12E-01	miss
		300.09	3.30	2.66E-01		1.42E+00	miss
+	Pb212-XR	74.82	10.28	2.08E-01	6.76E-01	1.05E+00	miss
		77.11	17.10	5.74E-01		6.76E-01	miss
		87.35	3.97	9.34E-01		1.58E+00	miss
		89.78	1.46	1.21E+00		4.08E+00	miss
+	Bi-214	609.32	* 45.49	6.55E-01	1.08E-01	1.08E-01	miss
		768.36	4.89	8.72E-01		1.48E+00	miss
		806.18	1.26	-6.48E-01		3.64E+00	miss
		934.06	3.11	-1.25E-01		1.64E+00	miss
		1120.29	14.92	3.85E-01		6.08E-01	miss
		1155.21	1.63	-3.75E-01		3.58E+00	miss
		1238.12	5.83	1.75E-01		1.33E+00	miss
		1280.98	1.43	3.81E-01		3.59E+00	miss
		1377.67	3.99	5.04E-01		1.89E+00	miss
		1385.31	0.79	2.00E+00		8.35E+00	miss
		1401.52	1.33	2.74E-01		3.56E+00	miss
		1407.99	2.39	1.07E+00		3.01E+00	miss
		1509.21	2.13	-1.08E-01		2.35E+00	miss
		1661.27	1.05	6.59E-01		5.15E+00	miss
		1729.59	2.88	6.96E-01		2.50E+00	miss
		1764.49	15.30	7.69E-01		9.35E-01	miss
		1847.43	2.03	4.25E-01		2.87E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	7.25	6.92E-01	1.61E-01	7.96E-01	miss
		295.22	* 18.42	4.56E-01		2.49E-01	miss
		351.93	* 35.60	6.40E-01		1.61E-01	miss
		785.96	1.06	8.44E-01		4.89E+00	miss
+	Pb214-XR	74.82	5.80	3.68E-01	1.19E+00	1.87E+00	miss
		77.11	9.70	1.01E+00		1.19E+00	miss
		87.35	2.24	1.65E+00		2.80E+00	miss
		89.78	0.82	2.16E+00		7.26E+00	miss
+	Ra-226	186.21	3.64	7.29E-01	1.26E+00	1.26E+00	miss
+	Ac-228	129.07	2.42	6.58E-01	2.86E-01	1.60E+00	miss
		209.25	3.89	-5.20E-02		8.59E-01	miss
		270.24	3.46	1.15E-01		1.13E+00	miss
		328.00	2.95	3.69E-02		1.24E+00	miss
		338.32	* 11.27	4.91E-01		2.86E-01	miss
		409.46	1.92	4.71E-01		2.24E+00	miss
		463.00	4.40	7.11E-01		1.25E+00	miss
		794.95	4.25	4.55E-01		1.48E+00	miss
		911.20	25.80	2.49E-01		3.84E-01	miss
		964.77	4.99	3.21E-01		1.26E+00	miss
		968.97	15.80	1.38E-01		4.74E-01	miss

Analysis Report for 20-Apr-16-10006

L3-10213A-FRGS-003SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	-9.95E-02	2.86E-01	1.28E+00	miss
+	Pa-231	27.36	10.30	0.00E+00	1.64E-01	1.64E-01	miss
		283.69	1.70	-4.67E-02		2.02E+00	miss
		300.07	2.47	3.55E-01		1.90E+00	miss
		302.65	2.20	-2.08E-01		1.73E+00	miss
		330.06	1.40	1.16E-01		2.72E+00	miss
+	Th-234	92.38	2.13	-8.99E-04	3.09E+00	3.09E+00	miss
		92.80	2.10	7.05E-01		3.24E+00	miss
		112.81	0.21	-1.34E+00		2.18E+01	miss
+	U-235	143.76	10.96	-3.88E-02	7.66E-02	2.92E-01	miss
		163.33	5.08	1.26E-01		6.56E-01	miss
		185.71	57.20	3.30E-02		7.66E-02	miss
		202.11	1.08	-5.04E-01		2.68E+00	miss
		205.31	5.01	-1.01E-01		5.82E-01	miss
+	Am-241	59.54	35.90	4.11E-02	3.90E-01	3.90E-01	miss

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

@ = Half-life too short to be able to perform the decay correction

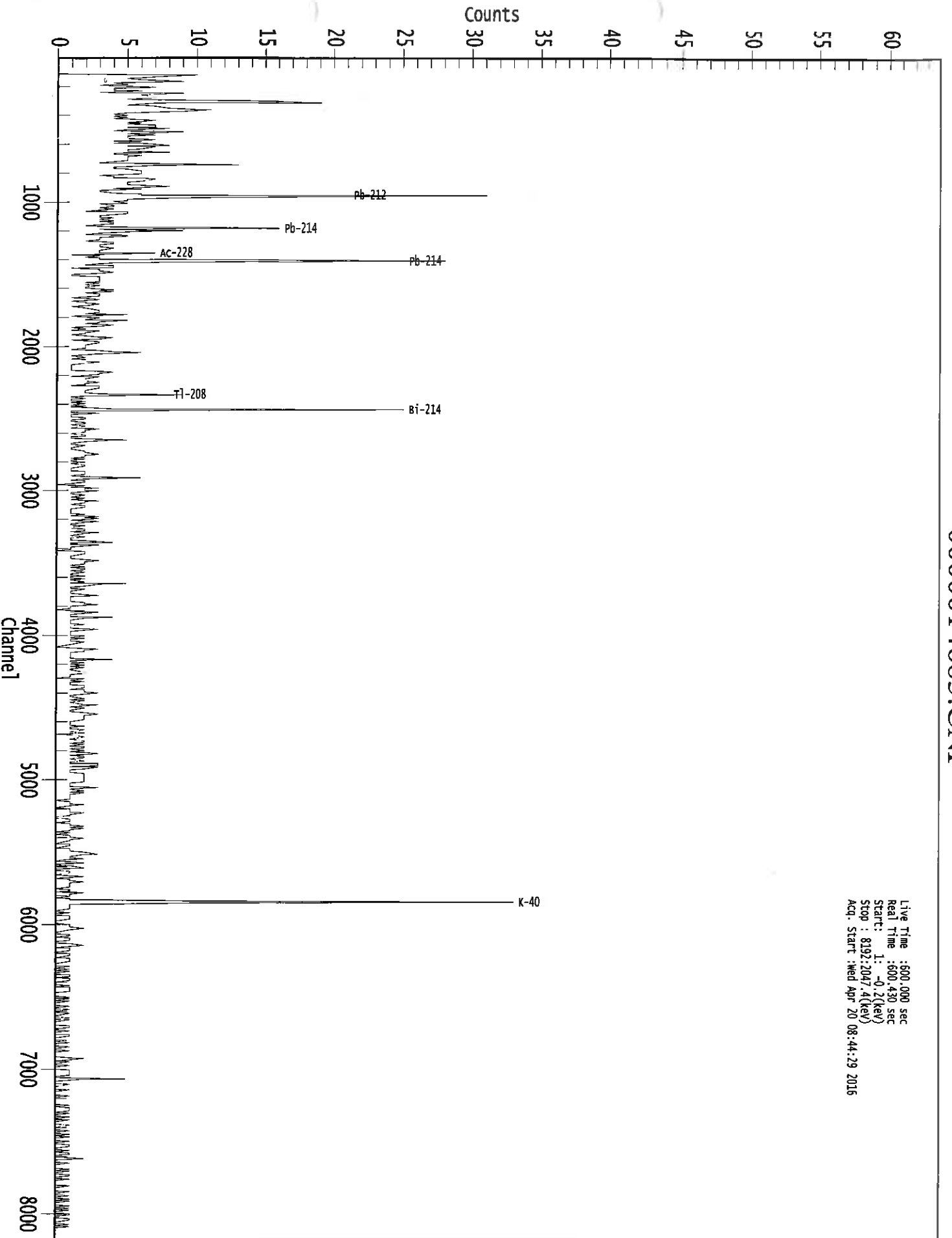
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

0000014683.CNF



Live Time : 600.000 sec  
Real Time : 600.430 sec  
Start : 1: -0.2(kev)  
Stop : 8192.2047 4(kev)  
Acq. Start : Wed Apr 20 08:44:29 2016



Analysis Report for 20-Apr-16-10007  
L3-10213A-FRGS-004SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10007  
Sample Description : L3-10213A-FRGS-004SS  
Sample Type : 1L 130G Soil Sample  
Unit :  
Sample Point :  
  
Sample Size : 1.262E+03 grams  
Facility : Default  
  
Sample Taken On : 4/14/2016 2:45:00PM  
Acquisition Started : 4/20/2016 8:44:46AM  
  
Procedure : 130G 1L Soil Sample  
Operator : HTomlin  
Detector Name : P40818B  
Geometry : 130G Soil  
Live Time : 600.0 seconds  
Real Time : 601.1 seconds  
  
Dead Time : 0.18 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 1/5/2015  
Efficiency Calibration Description :  
  
Sample Number : 14684

*J.P. M. 4-20-16*  
*H Tomlin 4/20/16*

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 8:55:20AM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*H Tomlin*  
*4-20-16*

*Data Validated*  
*CS/165*  
*4/25/16*

Analysis Report for 20-Apr-16-10007

L3-10213A-FRGS-004SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	238.58	950 -	959	954.81	7.39E+01	27.07	9.42E+01	Pb-212
2	295.28	1176 -	1188	1181.44	4.21E+01	19.19	3.79E+01	Pb-214
3	351.83	1402 -	1415	1407.52	8.10E+01	20.92	2.40E+01	Eu-152
4	609.10	2430 -	2444	2436.14	6.81E+01	17.61	7.85E+00	Pb-214
5	911.27	3638 -	3650	3644.77	2.54E+01	11.64	7.24E+00	Bi-211
6	1460.45	5832 -	5853	5842.75	2.02E+02	28.75	3.22E+00	Bi-214
								Ac-228
								K-40

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.99	1460.82	* 10.66	9.84E+00	1.64E+00	miss
Pb-212	1.00	115.18	0.60			
		238.63	* 43.60	2.58E-01	1.03E-01	miss
		300.09	3.30			
Bi-214	0.99	609.32	* 45.49	4.28E-01	1.22E-01	miss
		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			

Analysis Report for 20-Apr-16-10007

L3-10213A-FRGS-004SS

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>	<b>Coinc Corr</b>
Bi-214	0.99	1847.43	2.03			
		2118.51	1.16			
Pb-214	1.00	241.99	7.25			
		295.22 *	18.42	3.98E-01	1.93E-01	miss
		351.93 *	35.60	4.43E-01	1.35E-01	miss
		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	3.70E-01	1.72E-01	miss
		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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

## INTERFERENCE CORRECTED REPORT

	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	K-40	0.991	9.84E+00	1.64E+00	
X	Bi-211	0.965			
	Pb-212	1.000	2.58E-01	1.03E-01	
	Bi-214	0.999	4.28E-01	1.22E-01	
	Pb-214	1.000	4.29E-01	1.10E-01	
	Ac-228	1.000	3.70E-01	1.72E-01	

Analysis Report for 20-Apr-16-10007

L3-10213A-FRGS-004SS

- 
- ? = 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 2.000sigma

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Analysis Report for 20-Apr-16-10007  
L3-10213A-FRGS-004SS

## UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 8:55:20AM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
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All peaks were identified.

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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)	Coinc Corr
+	K-40	1460.82	* 10.66	9.84E+00	4.60E-01	4.60E-01	miss
+	Cr-51	320.08	9.91	2.22E-01	5.35E-01	5.35E-01	free
+	Mn-54	834.85	99.98	4.77E-03	4.69E-02	4.69E-02	miss
+	Co-58	810.76	99.45	-2.46E-03	3.97E-02	3.97E-02	miss
		1674.73	0.52	8.83E-01		8.66E+00	miss
+	Co-60	1173.23	99.85	8.36E-03	5.82E-02	7.07E-02	miss
		1332.49	99.98	1.04E-02		5.82E-02	miss
+	Nb-94	702.65	99.81	-1.63E-02	3.40E-02	3.40E-02	miss
		871.09	99.89	2.79E-03		4.77E-02	miss
+	Ag-108m	79.13	6.60	-9.95E-01	4.16E-02	1.50E+00	miss
		433.94	90.50	2.00E-03		4.16E-02	miss
		614.28	89.80	1.15E-02		5.08E-02	miss
		722.94	90.80	-1.18E-03		4.63E-02	miss
+	Sn-113	255.13	2.11	7.09E-03	6.32E-02	1.91E+00	free
		391.70	64.97	1.28E-02		6.32E-02	free
+	Cs-134	475.36	1.48	-2.01E-01	3.15E-02	2.46E+00	miss
		563.25	8.34	-5.88E-02		3.03E-01	miss
		569.33	15.37	-1.12E-01		1.66E-01	miss
		604.72	97.62	-1.05E-02		3.15E-02	miss

Analysis Report for 20-Apr-16-10007  
 L3-10213A-FRGS-004SS

Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)	Coinc Corr
Cs-134	795.86	85.46	4.16E-03	3.15E-02	5.28E-02	miss
	801.95	8.69	9.29E-02		5.61E-01	miss
	1038.61	0.99	2.31E-02		4.48E+00	miss
	1167.97	1.79	8.67E-01		4.33E+00	miss
	1365.19	3.02	2.89E-01		1.77E+00	miss
+ Cs-137	661.66	85.10	1.85E-02	6.69E-02	6.69E-02	miss
+ Eu-152	121.78	28.67	-3.72E-02	9.48E-02	1.34E-01	miss
	244.70	7.61	1.12E-01		5.56E-01	miss
	295.94	0.45	1.25E+01		1.36E+01	miss
	344.28	26.60	-3.91E-02		9.48E-02	miss
	367.79	0.86	-1.09E-01		4.40E+00	miss
	411.12	2.24	3.90E-01		1.62E+00	miss
	443.96	2.83	-1.71E-01		9.76E-01	miss
	488.68	0.42	-2.34E+00		7.67E+00	miss
	563.99	0.49	9.95E-01		5.95E+00	miss
	586.26	0.46	-2.02E+00		1.01E+01	miss
	678.62	0.47	3.12E+00		9.79E+00	miss
	688.67	0.86	-9.65E-01		3.36E+00	miss
	719.35	0.28	-1.21E+00		1.24E+01	miss
	778.90	12.96	4.34E-03		3.67E-01	miss
	810.45	0.32	-5.04E+00		1.00E+01	miss
	867.37	4.26	0.00E+00		2.30E-01	miss
	919.33	0.43	1.14E+00		1.06E+01	miss
	964.08	14.65	2.08E-01		4.64E-01	miss
	1085.87	10.24	1.02E-01		6.20E-01	miss
	1089.74	1.73	1.05E-01		3.45E+00	miss
	1112.07	13.69	1.15E-01	4.42E-01	miss	
	1212.95	1.43	-2.38E+00	4.18E+00	miss	
	1249.94	0.19	-2.31E+00	3.22E+01	miss	
	1299.14	1.63	-3.60E-01	3.84E+00	miss	
	1408.01	21.07	3.59E-02	2.22E-01	miss	
	1457.64	0.50	0.00E+00	2.20E+01	miss	
	1528.10	0.28	-2.45E+00	1.40E+01	miss	
+ Eu-154	123.07	40.40	1.06E-02	1.05E-01	1.05E-01	miss
	247.93	6.89	-1.45E-02	5.67E-01	miss	
	591.76	4.95	-2.10E-01	5.26E-01	miss	
	692.42	1.78	-1.98E-01	2.79E+00	miss	
	723.30	20.06	-3.74E-02	1.92E-01	miss	
	756.80	4.52	1.20E-01	1.10E+00	miss	
	873.18	12.08	-4.78E-02	3.63E-01	miss	
	996.29	10.48	2.54E-02	4.10E-01	miss	
	1004.76	18.01	1.24E-02	2.40E-01	miss	
	1274.43	34.80	4.63E-03	1.77E-01	miss	
	1596.48	1.80	-1.20E+00	2.28E+00	miss	
+ Eu-155	45.30	1.31	-7.43E+00	2.59E-01	2.65E+01	miss
	60.01	1.22	-1.64E-01	3.13E+01	miss	
	86.55	30.70	-4.69E-02	2.59E-01	miss	
	105.31	21.10	3.21E-03	2.63E-01	miss	
+ Tl-208	583.19	85.00	6.80E-02	9.34E-02	9.34E-02	miss
+ Bi-211	351.07	13.02	1.21E+00	3.03E-01	3.03E-01	miss
+ Pb-211	404.85	3.78	-1.05E-01	9.04E-01	9.04E-01	miss

Analysis Report for 20-Apr-16-10007

L3-10213A-FRGS-004SS

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
Pb-211	427.09	1.76	-3.74E-01	9.04E-01	1.91E+00	miss
	832.01	3.52	2.84E-01		1.41E+00	miss
+ Bi-212	39.86	1.06	9.91E-02	8.42E-01	2.79E+01	miss
	727.33	6.67	2.79E-01		8.42E-01	miss
	785.37	1.10	1.41E-01		4.88E+00	miss
	1620.50	1.47	-2.39E-02		3.55E+00	miss
+ Pb-212	115.18	0.60	-4.49E-01	1.30E-01	7.20E+00	miss
	238.63	* 43.60	2.58E-01		1.30E-01	miss
	300.09	3.30	4.73E-01		1.31E+00	miss
+ Pb212-XR	74.82	10.28	1.29E+00	9.74E-01	1.74E+00	miss
	77.11	17.10	5.65E-01		9.74E-01	miss
	87.35	3.97	1.78E+00		2.08E+00	miss
	89.78	1.46	8.70E-01		4.23E+00	miss
+ Bi-214	609.32	* 45.49	4.28E-01	8.06E-02	8.06E-02	miss
	768.36	4.89	3.19E-01		1.29E+00	miss
	806.18	1.26	9.10E-01		4.10E+00	miss
	934.06	3.11	1.43E-01		1.61E+00	miss
	1120.29	14.92	3.10E-01		6.79E-01	miss
	1155.21	1.63	-4.01E-01		4.04E+00	miss
	1238.12	5.83	4.08E-01		1.81E+00	miss
	1280.98	1.43	5.21E-01		5.72E+00	miss
	1377.67	3.99	1.50E-01		1.87E+00	miss
	1385.31	0.79	3.14E+00		8.23E+00	miss
	1401.52	1.33	1.51E+00		4.54E+00	miss
	1407.99	2.39	3.16E-01		1.96E+00	miss
	1509.21	2.13	-1.43E-01		1.84E+00	miss
	1661.27	1.05	0.00E+00		1.48E+00	miss
	1729.59	2.88	6.16E-01		2.21E+00	miss
	1764.49	15.30	3.47E-01		7.64E-01	miss
	1847.43	2.03	6.10E-01		2.83E+00	miss
>	2118.51	1.16	0.00E+00		0.00E+00	miss
+ Pb-214	241.99	7.25	-1.29E-01	1.11E-01	6.41E-01	miss
	295.22	* 18.42	3.98E-01		2.46E-01	miss
	351.93	* 35.60	4.43E-01		1.11E-01	miss
	785.96	1.06	-1.33E+00		4.20E+00	miss
+ Pb214-XR	74.82	5.80	2.29E+00	1.72E+00	3.09E+00	miss
	77.11	9.70	9.95E-01		1.72E+00	miss
	87.35	2.24	3.16E+00		3.69E+00	miss
	89.78	0.82	1.55E+00		7.54E+00	miss
+ Ra-226	186.21	3.64	4.53E-01	1.16E+00	1.16E+00	miss
+ Ac-228	129.07	2.42	-1.89E-01	1.79E-01	1.68E+00	miss
	209.25	3.89	2.21E-01		1.01E+00	miss
	270.24	3.46	2.41E-01		1.17E+00	miss
	328.00	2.95	1.27E-01		1.45E+00	miss
	338.32	11.27	3.07E-01		4.68E-01	miss
	409.46	1.92	3.62E-01		2.28E+00	miss
	463.00	4.40	2.31E-01		1.01E+00	miss
	794.95	4.25	2.93E-01		1.21E+00	miss
	911.20	* 25.80	3.70E-01		1.79E-01	miss
	964.77	4.99	4.48E-01		1.30E+00	miss
	968.97	15.80	1.91E-01		4.67E-01	miss



Analysis Report for 20-Apr-16-10007

L3-10213A-FRGS-004SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	6.87E-01	1.79E-01	2.06E+00	miss
+	Pa-231	27.36	10.30	5.88E-01	1.57E+00	3.50E+00	miss
		283.69	1.70	1.01E+00		2.40E+00	miss
		300.07	2.47	6.32E-01		1.75E+00	miss
		302.65	2.20	-6.30E-01		1.57E+00	miss
		330.06	1.40	-1.60E-01		2.77E+00	miss
+	Th-234	92.38	2.13	5.64E-01	4.00E+00	4.00E+00	miss
		92.80	2.10	1.07E+00		4.23E+00	miss
		112.81	0.21	-5.37E+00		2.90E+01	miss
+	U-235	143.76	10.96	-3.40E-02	8.04E-02	3.05E-01	miss
		163.33	5.08	1.19E-02		7.30E-01	miss
		185.71	57.20	6.60E-02		8.04E-02	miss
		202.11	1.08	8.68E-01		3.51E+00	miss
		205.31	5.01	5.67E-02		7.09E-01	miss
+	Am-241	59.54	35.90	-4.20E-01	1.02E+00	1.02E+00	miss

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

@ = Half-life too short to be able to perform the decay correction

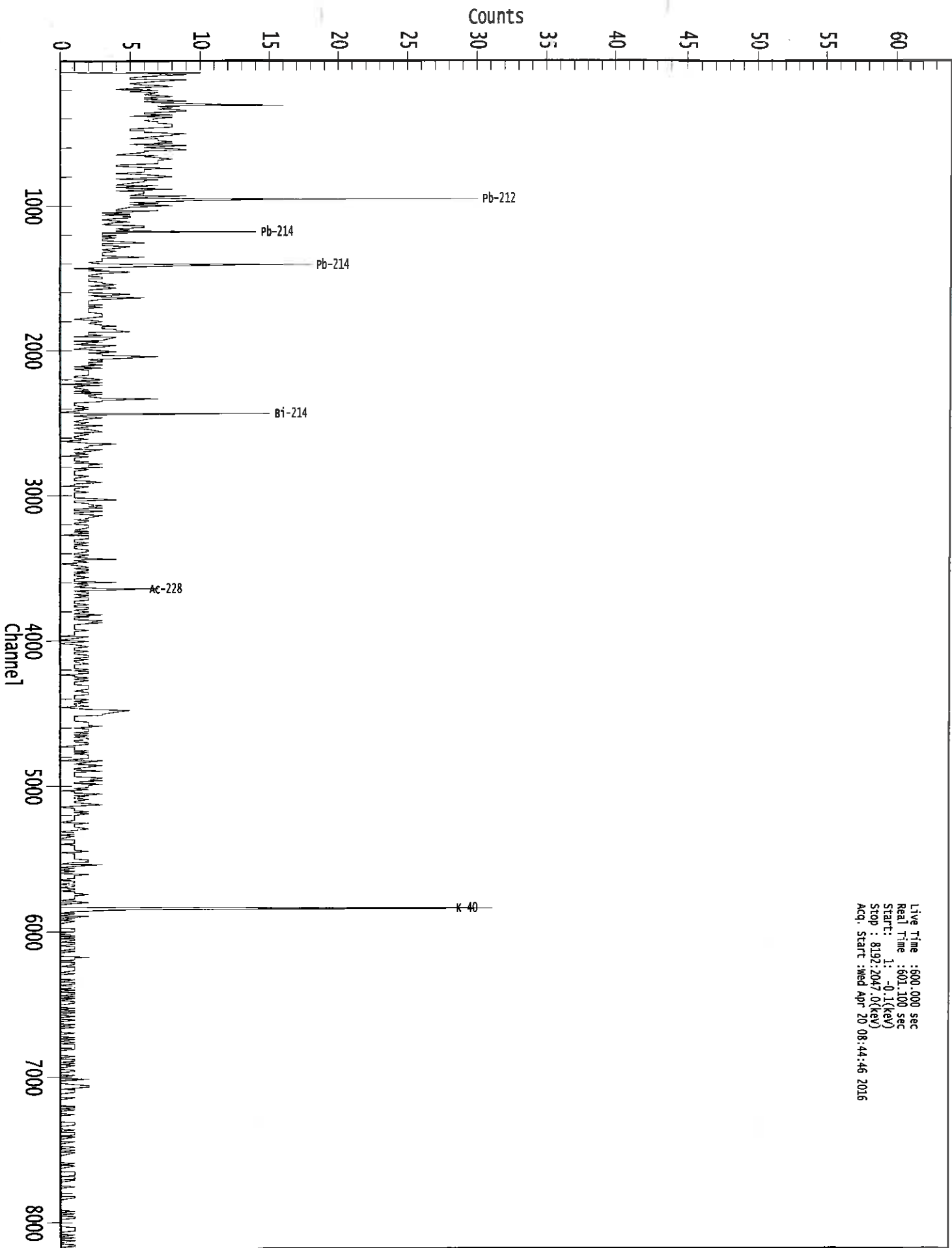
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

0000014684.CNF



Live Time : 600.000 sec  
Real Time : 601.100 sec  
Start: 1: -0.1 (keV)  
Stop : 8197.2047.0 (keV)  
Acq. Start : Wed Apr 20 08:44:46 2016

Analysis Report for 20-Apr-16-10008  
L3-10213A-FRGS-005SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10008  
Sample Description : L3-10213A-FRGS-005SS  
Sample Type : 1L 130G Soil Sample  
Unit :  
Sample Point :  
  
Sample Size : 1.163E+03 grams  
Facility : Default  
  
Sample Taken On : 4/13/2016 3:00:00PM  
Acquisition Started : 4/20/2016 9:02:59AM  
  
Procedure : 130G 1L Soil Sample  
Operator : HTomlin  
Detector Name : P11314X2  
Geometry : 130G Soil  
Live Time : 600.0 seconds  
Real Time : 600.4 seconds  
  
Dead Time : 0.06 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 6/28/2012  
Efficiency Calibration Description :  
  
Sample Number : 14685

*H. Tomlin*  
4-20-16

*M. J. ...* 4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 9:13:14AM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*H. Tomlin*  
4-20-16

DATA Validated  
4-25-16  
CSilva

Analysis Report for 20-Apr-16-10008

L3-10213A-FRGS-005SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	238.65	946 -	960	954.92	1.09E+02	28.44	6.52E+01	Pb-212
2	295.43	1177 -	1187	1181.78	3.96E+01	17.20	2.89E+01	Pb-214
								Eu-152
3	352.16	1402 -	1414	1408.44	8.51E+01	22.50	3.57E+01	Pb-214
								Bi-211
4	583.26	2326 -	2338	2332.03	3.11E+01	12.69	7.87E+00	Tl-208
5	609.36	2430 -	2443	2436.36	8.04E+01	20.16	1.72E+01	Bi-214
6	662.06	2639 -	2652	2647.04	3.61E+01	14.01	1.18E+01	Cs-137
7	911.75	3641 -	3650	3645.50	1.51E+01	9.83	9.70E+00	Ac-228
8	1120.44	4475 -	4486	4480.35	1.93E+01	9.48	3.43E+00	Bi-214
9	1461.18	5833 -	5854	5844.04	1.58E+02	25.75	6.15E+00	K-40

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.99	1460.82	*	10.66	7.51E+00	miss
Cs-137	0.99	661.66	*	85.10	1.26E-01	miss
Tl-208	1.00	583.19	*	85.00	9.92E-02	miss
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	3.68E-01	miss
		300.09		3.30		
Bi-214	1.00	609.32	*	45.49	4.94E-01	miss
		768.36		4.89		
		806.18		1.26		
		934.06		3.11		
		1120.29	*	14.92	5.45E-01	miss
		1155.21		1.63		
		1238.12		5.83		
		1280.98		1.43		
		1377.67		3.99		
		1385.31		0.79		
		1401.52		1.33		

Analysis Report for 20-Apr-16-10008

L3-10213A-FRGS-005SS

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>	<b>Coinc Corr</b>
Bi-214	1.00	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	3.64E-01	1.68E-01	miss
		351.93 *	35.60	4.55E-01	1.41E-01	miss
Ac-228	0.99	785.96	1.06			
		129.07	2.42			
		209.25	3.89			
		270.24	3.46			
		328.00	2.95			
		338.32	11.27			
		409.46	1.92			
		463.00	4.40			
		794.95	4.25			
		911.20 *	25.80	2.16E-01	1.41E-01	miss
		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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.992	7.51E+00	1.39E+00	

Analysis Report for 20-Apr-16-10008

L3-10213A-FRGS-005SS

	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	Cs-137	0.990	1.26E-01	5.11E-02	
	Tl-208	1.000	9.92E-02	4.22E-02	
X	Bi-211	0.929			
	Pb-212	1.000	3.68E-01	1.13E-01	
	Bi-214	1.000	5.05E-01	1.23E-01	
	Pb-214	0.997	4.18E-01	1.08E-01	
	Ac-228	0.994	2.16E-01	1.41E-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 2.000sigma

Analysis Report for 20-Apr-16-10008  
L3-10213A-FRGS-005SS

### UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 9:13:14AM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
All peaks were identified.					
M = First peak in a multiplet region					
m = Other peak in a multiplet region					
F = Fitted singlet					
Errors quoted at 2.000sigma					

### 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)	Coinc Corr
+	K-40	1460.82	* 10.66	7.51E+00	5.67E-01	5.67E-01	miss
+	Cr-51	320.08	9.91	-6.19E-02	3.72E-01	3.72E-01	free
+	Mn-54	834.85	99.98	1.78E-02	4.95E-02	4.95E-02	miss
+	Co-58	810.76	99.45	3.64E-03	4.38E-02	4.38E-02	miss
		1674.73	0.52	0.00E+00		3.14E+00	miss
+	Co-60	1173.23	99.85	-5.98E-03	5.10E-02	5.72E-02	miss
		1332.49	99.98	9.25E-03		5.10E-02	miss
+	Nb-94	702.65	99.81	4.63E-03	4.28E-02	4.64E-02	miss
		871.09	99.89	8.02E-03		4.28E-02	miss
+	Ag-108m	79.13	6.60	-1.03E-01	2.91E-02	8.56E-01	miss
		433.94	90.50	8.96E-03		4.07E-02	miss
		614.28	89.80	-1.38E-02		2.91E-02	miss
		722.94	90.80	-1.21E-02		3.21E-02	miss
+	Sn-113	255.13	2.11	-3.79E-02	5.98E-02	1.20E+00	free
		391.70	64.97	-2.58E-03		5.98E-02	free
+	Cs-134	475.36	1.48	-1.34E-01	4.05E-02	2.91E+00	miss
		563.25	8.34	2.30E-01		5.33E-01	miss
		569.33	15.37	-5.94E-02		2.47E-01	miss
		604.72	97.62	1.11E-02		4.05E-02	miss

Analysis Report for 20-Apr-16-10008

L3-10213A-FRGS-005SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	795.86	85.46	2.56E-02	4.05E-02	6.26E-02	miss
		801.95	8.69	1.73E-01		6.50E-01	miss
		1038.61	0.99	0.00E+00		1.10E+00	miss
		1167.97	1.79	-4.29E-01		3.43E+00	miss
		1365.19	3.02	-1.95E-01		1.49E+00	miss
+	Cs-137	661.66	* 85.10	1.26E-01	5.07E-02	5.07E-02	miss
+	Eu-152	121.78	28.67	-3.34E-02	6.33E-02	7.93E-02	miss
		244.70	7.61	-8.89E-02		4.30E-01	miss
		295.94	0.45	1.41E+01		1.32E+01	miss
		344.28	26.60	-2.35E-02		9.95E-02	miss
		367.79	0.86	-6.85E-02		3.62E+00	miss
		411.12	2.24	5.44E-01		1.73E+00	miss
		443.96	2.83	3.47E-01		1.26E+00	miss
		488.68	0.42	-1.14E+00		8.59E+00	miss
		563.99	0.49	-2.49E+00		6.50E+00	miss
		586.26	0.46	-4.35E+00		9.88E+00	miss
		678.62	0.47	1.64E+00		8.37E+00	miss
		688.67	0.86	-5.32E-01		4.26E+00	miss
		719.35	0.28	1.87E-01		1.04E+01	miss
		778.90	12.96	-1.05E-01		3.06E-01	miss
		810.45	0.32	3.53E-01		1.27E+01	miss
		867.37	4.26	2.54E-01		1.00E+00	miss
		919.33	0.43	3.63E+00		1.13E+01	miss
		964.08	14.65	5.65E-02		3.13E-01	miss
		1085.87	10.24	-1.79E-01		4.35E-01	miss
		1089.74	1.73	-3.08E-01		2.58E+00	miss
		1112.07	13.69	-1.23E-01		4.61E-01	miss
		1212.95	1.43	-1.34E-01		4.68E+00	miss
		1249.94	0.19	4.28E+00		2.23E+01	miss
		1299.14	1.63	4.09E-02		3.44E+00	miss
		1408.01	21.07	0.00E+00		6.33E-02	miss
		1457.64	0.50	-8.38E+00		1.51E+01	miss
		1528.10	0.28	1.86E+00		1.37E+01	miss
+	Eu-154	123.07	40.40	5.63E-03	6.86E-02	6.86E-02	miss
		247.93	6.89	-3.36E-02		4.40E-01	miss
		591.76	4.95	1.55E-01		7.83E-01	miss
		692.42	1.78	9.01E-01		2.58E+00	miss
		723.30	20.06	-1.83E-02		1.69E-01	miss
		756.80	4.52	-3.47E-01		5.28E-01	miss
		873.18	12.08	-7.14E-02		3.55E-01	miss
		996.29	10.48	9.08E-02		4.89E-01	miss
		1004.76	18.01	6.07E-03		2.35E-01	miss
		1274.43	34.80	1.89E-03		1.23E-01	miss
		1596.48	1.80	-2.27E-01		2.23E+00	miss
+	Eu-155	45.30	1.31	-2.67E+00	1.81E-01	8.03E+00	miss
		60.01	1.22	-3.93E-01		1.15E+01	miss
		86.55	30.70	-5.85E-03		1.81E-01	miss
		105.31	21.10	7.29E-02		2.09E-01	miss
+	Tl-208	583.19	* 85.00	9.92E-02	4.05E-02	4.05E-02	miss
+	Bi-211	351.07	* 13.02	1.24E+00	3.49E-01	3.49E-01	miss
+	Pb-211	404.85	3.78	-1.93E-01	7.22E-01	7.86E-01	miss



Analysis Report for 20-Apr-16-10008

L3-10213A-FRGS-005SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Pb-211	427.09	1.76	2.63E-01	7.22E-01	1.86E+00	miss
		832.01	3.52	-5.72E-01		7.22E-01	miss
+	Bi-212	39.86	1.06	6.44E+00	8.58E-01	1.42E+01	miss
		727.33	6.67	1.73E-01		8.58E-01	miss
		785.37	1.10	-1.91E+00		2.22E+00	miss
		1620.50	1.47	0.00E+00		1.01E+00	miss
+	Pb-212	115.18	0.60	1.86E+00	1.16E-01	6.33E+00	miss
		238.63	* 43.60	3.68E-01		1.16E-01	miss
		300.09	3.30	-1.47E-02		1.07E+00	miss
+	Pb212-XR	74.82	10.28	3.81E-01	5.84E-01	1.01E+00	miss
		77.11	17.10	2.43E-01		5.84E-01	miss
		87.35	3.97	3.67E-01		1.40E+00	miss
		89.78	1.46	1.97E+00		3.75E+00	miss
+	Bi-214	609.32	* 45.49	4.94E-01	1.10E-01	1.10E-01	miss
		768.36	4.89	6.20E-01		1.26E+00	miss
		806.18	1.26	1.69E+00		4.66E+00	miss
		934.06	3.11	-2.61E-01		1.45E+00	miss
		1120.29	* 14.92	5.45E-01		2.43E-01	miss
		1155.21	1.63	-5.27E-02		3.45E+00	miss
		1238.12	5.83	3.40E-01		1.40E+00	miss
		1280.98	1.43	4.59E-02		4.53E+00	miss
		1377.67	3.99	3.85E-01		1.59E+00	miss
		1385.31	0.79	8.77E-02		5.70E+00	miss
		1401.52	1.33	-1.58E-01		3.97E+00	miss
		1407.99	2.39	0.00E+00		5.57E-01	miss
		1509.21	2.13	-8.71E-02		2.27E+00	miss
		1661.27	1.05	1.20E+00		5.75E+00	miss
		1729.59	2.88	4.43E-01		2.16E+00	miss
		1764.49	15.30	4.21E-01		7.46E-01	miss
		1847.43	2.03	3.72E-02		2.77E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	7.25	4.20E-01	1.28E-01	6.57E-01	miss
		295.22	* 18.42	3.64E-01		2.02E-01	miss
		351.93	* 35.60	4.55E-01		1.28E-01	miss
		785.96	1.06	-7.31E-01		2.91E+00	miss
+	Pb214-XR	74.82	5.80	6.76E-01	1.03E+00	1.80E+00	miss
		77.11	9.70	4.29E-01		1.03E+00	miss
		87.35	2.24	6.50E-01		2.48E+00	miss
		89.78	0.82	3.52E+00		6.67E+00	miss
+	Ra-226	186.21	3.64	4.07E-01	1.10E+00	1.10E+00	miss
+	Ac-228	129.07	2.42	3.30E-01	1.79E-01	1.45E+00	miss
		209.25	3.89	4.55E-01		9.46E-01	miss
		270.24	3.46	6.63E-01		1.26E+00	miss
		328.00	2.95	8.15E-01		1.48E+00	miss
		338.32	11.27	3.65E-01		4.84E-01	miss
		409.46	1.92	4.30E-01		2.15E+00	miss
		463.00	4.40	5.83E-02		9.53E-01	miss
		794.95	4.25	5.46E-01		1.31E+00	miss
		911.20	* 25.80	2.16E-01		1.79E-01	miss
		964.77	4.99	-1.57E-01		8.24E-01	miss
		968.97	15.80	4.21E-01		5.70E-01	miss

Analysis Report for 20-Apr-16-10008  
L3-10213A-FRGS-005SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	7.19E-02	1.79E-01	1.23E+00	miss
+	Pa-231	27.36	10.30	0.00E+00	1.58E-01	1.58E-01	miss
		283.69	1.70	6.19E-01		2.12E+00	miss
		300.07	2.47	-1.96E-02		1.44E+00	miss
		302.65	2.20	-3.81E-01		1.71E+00	miss
		330.06	1.40	-8.79E-01		2.17E+00	miss
+	Th-234	92.38	2.13	2.47E+00	3.32E+00	3.32E+00	miss
		92.80	2.10	2.67E+00		3.39E+00	miss
		112.81	0.21	4.35E+00		2.00E+01	miss
+	U-235	143.76	10.96	-6.82E-02	7.30E-02	2.64E-01	miss
		163.33	5.08	2.05E-01		6.32E-01	miss
		185.71	57.20	3.42E-02		7.30E-02	miss
		202.11	1.08	-3.27E-01		2.65E+00	miss
		205.31	5.01	-3.42E-01		4.06E-01	miss
+	Am-241	59.54	35.90	1.53E-01	4.34E-01	4.34E-01	miss

+ = 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

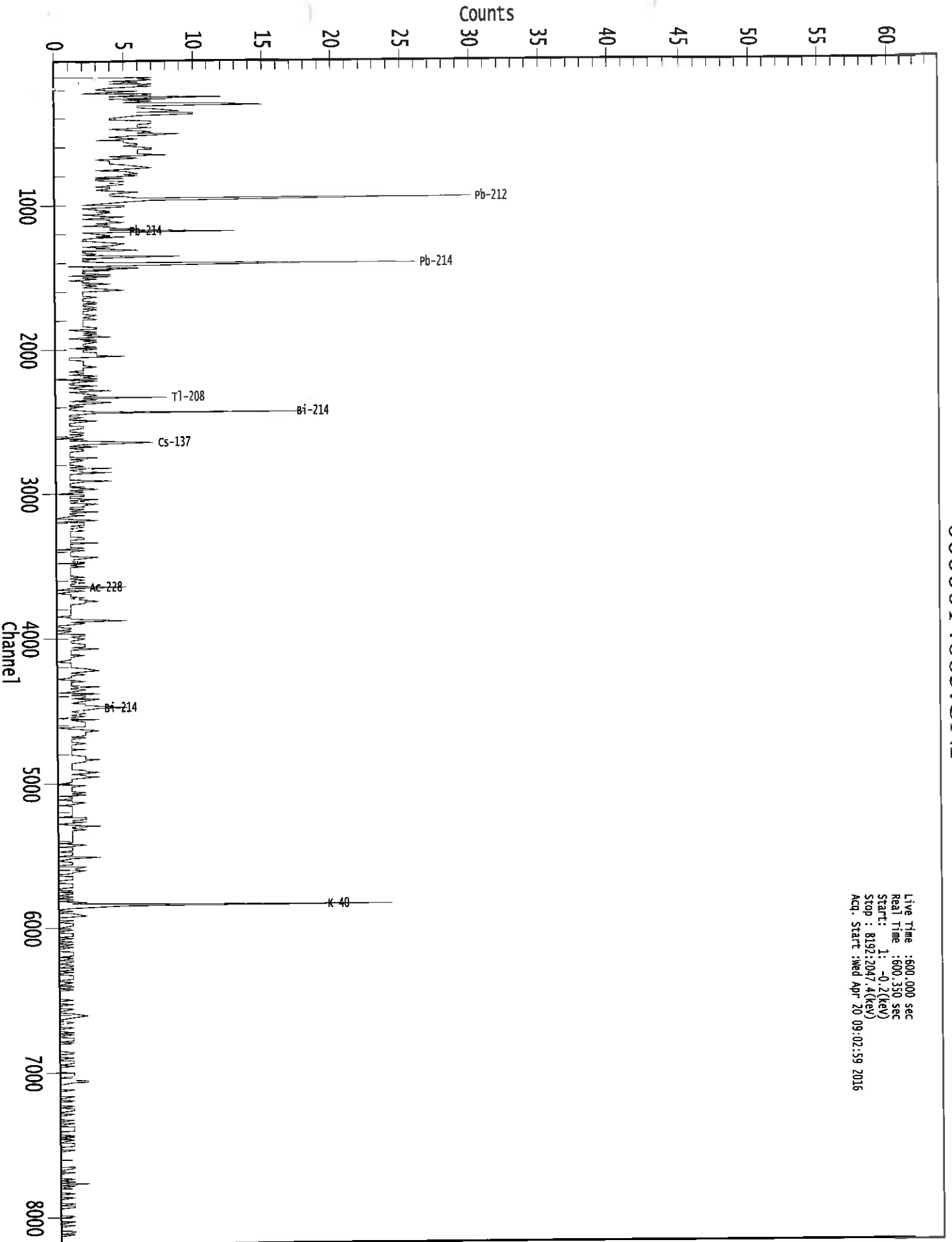
Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

0000014685.CNF

Live Time : 600.000 sec  
Real Time : 600.350 sec  
Start: 1: -0.2(kev)  
Stop : 8192:2047.4(kev)  
Acq. Start :Wed Apr 20 09:02:59 2016



Analysis Report for 20-Apr-16-10009  
L3-10213A-FRGS-006SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10009  
Sample Description : L3-10213A-FRGS-006SS  
Sample Type : 1L 130G Soil Sample  
Unit :  
Sample Point :  
  
Sample Size : 8.375E+02 grams  
Facility : Default  
  
Sample Taken On : 4/13/2016 1:15:00PM  
Acquisition Started : 4/20/2016 9:03:06AM  
  
Procedure : 130G 1L Soil Sample  
Operator : HTomlin  
Detector Name : P40818B  
Geometry : 130G Soil  
Live Time : 600.0 seconds  
Real Time : 601.1 seconds  
  
Dead Time : 0.18 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 1/5/2015  
Efficiency Calibration Description :  
  
Sample Number : 14686

*H. Tomlin*  
4-20-16  
*M. J. Miller* 4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 9:13:52AM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
Tentative NID Library : C:\C Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*H. Tomlin*  
4-20-16

*Data Validated*  
4-25-16 *Miller*

Analysis Report for 20-Apr-16-10009

L3-10213A-FRGS-006SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	129.60	514 -	523	519.28	1.82E+01	20.17	7.16E+01	Ac-228
2	238.60	948 -	960	954.88	7.60E+01	28.28	9.41E+01	Pb-212
3	295.18	1176 -	1186	1181.06	2.92E+01	17.78	3.96E+01	Pb-214 Eu-152
4	351.75	1401 -	1414	1407.17	7.90E+01	21.95	3.41E+01	Pb-214 Bi-211
5	609.00	2427 -	2443	2435.76	6.35E+01	18.62	1.71E+01	Bi-214
6	661.34	2639 -	2652	2645.05	5.83E+01	17.32	1.55E+01	Cs-137
7	911.08	3637 -	3650	3644.01	3.09E+01	12.30	6.29E+00	Ac-228
8	1460.43	5833 -	5852	5842.67	1.41E+02	24.31	5.46E+00	K-40

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.99	1460.82	*	10.66	1.04E+01	miss
Cs-137	0.99	661.66	*	85.10	3.12E-01	miss
Pb-212	1.00	115.18		0.60		
		238.63	*	43.60	4.00E-01	miss
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	6.01E-01	miss
		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		

Analysis Report for 20-Apr-16-10009

L3-10213A-FRGS-006SS

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>	<b>Coinc Corr</b>
Bi-214	0.99	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	4.16E-01	2.62E-01	miss
		351.93 *	35.60	6.52E-01	2.09E-01	miss
Ac-228	0.48	785.96	1.06			
		129.07 *	2.42	1.66E+00	1.87E+00	miss
		209.25	3.89			
		270.24	3.46			
		328.00	2.95			
		338.32	11.27			
		409.46	1.92			
		463.00	4.40			
		794.95	4.25			
		911.20 *	25.80	6.77E-01	2.76E-01	miss
		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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.990	1.04E+01	2.00E+00	
Cs-137	0.994	3.12E-01	1.00E-01	
X Bi-211	0.972			

Analysis Report for 20-Apr-16-10009

L3-10213A-FRGS-006SS

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
Pb-212	1.000	4.00E-01	1.62E-01	
Bi-214	0.997	6.01E-01	1.90E-01	
Pb-214	0.999	5.60E-01	1.63E-01	
Ac-228	0.481	6.98E-01	2.73E-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 2.000sigma

Analysis Report for 20-Apr-16-10009  
L3-10213A-FRGS-006SS

### UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 9:13:52AM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
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All peaks were identified.

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

### NUCLIDE MDA REPORT

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

	Nuclide Name	Energy (keV)	Yield(%)	Activity (pCi/grams)	Nuclide MDA (pCi/grams)	Line MDA (pCi/grams)	Coinc Corr
+	K-40	1460.82	* 10.66	1.04E+01	8.15E-01	8.15E-01	miss
+	Cr-51	320.08	9.91	1.38E-01	6.66E-01	6.66E-01	free
+	Mn-54	834.85	99.98	2.70E-02	9.42E-02	9.42E-02	miss
+	Co-58	810.76	99.45	-6.55E-03	5.21E-02	5.21E-02	miss
		1674.73	0.52	0.00E+00		4.85E+00	miss
+	Co-60	1173.23	99.85	1.85E-02	7.86E-02	1.07E-01	miss
		1332.49	99.98	-1.32E-02		7.86E-02	miss
+	Nb-94	702.65	99.81	2.14E-02	7.19E-02	8.28E-02	miss
		871.09	99.89	7.31E-03		7.19E-02	miss
+	Ag-108m	79.13	6.60	-2.48E-01	4.95E-02	1.98E+00	miss
		433.94	90.50	1.28E-02		5.65E-02	miss
		614.28	89.80	-1.74E-02		5.19E-02	miss
		722.94	90.80	-3.24E-02		4.95E-02	miss
+	Sn-113	255.13	2.11	-2.47E-01	8.87E-02	2.59E+00	free
		391.70	64.97	1.43E-02		8.87E-02	free
+	Cs-134	475.36	1.48	-2.77E+00	4.10E-02	3.24E+00	miss
		563.25	8.34	-2.96E-02		6.95E-01	miss
		569.33	15.37	1.35E-02		4.27E-01	miss
		604.72	97.62	-4.15E-02		4.10E-02	miss



Analysis Report for 20-Apr-16-10009

L3-10213A-FRGS-006SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	795.86	85.46	-1.42E-02	4.10E-02	7.29E-02	miss
		801.95	8.69	1.20E-01		5.58E-01	miss
		1038.61	0.99	1.49E+00		8.24E+00	miss
		1167.97	1.79	2.76E-01		5.63E+00	miss
		1365.19	3.02	0.00E+00		6.70E-01	miss
+	Cs-137	661.66	85.10	3.12E-01	8.65E-02	8.65E-02	miss
+	Eu-152	121.78	28.67	2.70E-02	2.12E-01	2.21E-01	miss
		244.70	7.61	1.21E-01		6.89E-01	miss
		295.94	0.45	-2.13E+00		1.91E+01	miss
		344.28	26.60	-8.39E-03		2.12E-01	miss
		367.79	0.86	4.58E-01		5.59E+00	miss
		411.12	2.24	-1.51E+00		2.33E+00	miss
		443.96	2.83	-6.86E-02		2.13E+00	miss
		488.68	0.42	9.11E-01		1.66E+01	miss
		563.99	0.49	-2.78E-01		1.17E+01	miss
		586.26	0.46	-2.13E+00		1.29E+01	miss
		678.62	0.47	-3.11E+00		1.18E+01	miss
		688.67	0.86	-6.55E-01		7.15E+00	miss
		719.35	0.28	-6.77E+00		1.61E+01	miss
		778.90	12.96	-1.33E-01		5.15E-01	miss
		810.45	0.32	-9.50E-01		1.51E+01	miss
		867.37	4.26	5.71E-02		1.81E+00	miss
		919.33	0.43	0.00E+00		3.60E+00	miss
		964.08	14.65	1.04E-01		4.83E-01	miss
		1085.87	10.24	-2.37E-02		6.70E-01	miss
		1089.74	1.73	1.70E+00		5.20E+00	miss
		1112.07	13.69	6.75E-02		6.66E-01	miss
		1212.95	1.43	-2.16E+00		5.77E+00	miss
		1249.94	0.19	-9.61E+00		4.85E+01	miss
		1299.14	1.63	-1.17E+00		4.10E+00	miss
		1408.01	21.07	2.52E-01		5.73E-01	miss
		1457.64	0.50	-1.59E+01		3.31E+01	miss
		1528.10	0.28	5.74E+00		2.67E+01	miss
+	Eu-154	123.07	40.40	-2.32E-02	1.40E-01	1.40E-01	miss
		247.93	6.89	-1.71E-02		8.04E-01	miss
		591.76	4.95	-3.46E-01		1.03E+00	miss
		692.42	1.78	1.37E+00		3.98E+00	miss
		723.30	20.06	4.70E-02		3.41E-01	miss
		756.80	4.52	4.47E-01		1.75E+00	miss
		873.18	12.08	-8.09E-02		4.90E-01	miss
		996.29	10.48	-7.66E-02		4.23E-01	miss
		1004.76	18.01	1.06E-01		4.41E-01	miss
		1274.43	34.80	-8.72E-02		1.89E-01	miss
		1596.48	1.80	-2.92E-01		3.43E+00	miss
+	Eu-155	45.30	1.31	-1.13E+00	3.90E-01	3.81E+01	miss
		60.01	1.22	2.24E+01		4.72E+01	miss
		86.55	30.70	5.72E-02		3.90E-01	miss
		105.31	21.10	1.74E-01		3.91E-01	miss
+	Tl-208	583.19	85.00	1.37E-01	1.45E-01	1.45E-01	miss
+	Bi-211	351.07	13.02	1.78E+00	5.39E-01	5.39E-01	miss
+	Pb-211	404.85	3.78	1.89E-02	1.50E+00	1.50E+00	miss

Analysis Report for 20-Apr-16-10009

L3-10213A-FRGS-006SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Pb-211	427.09	1.76	2.99E-01	1.50E+00	3.34E+00	miss
		832.01	3.52	4.03E-02		1.98E+00	miss
+	Bi-212	39.86	1.06	8.81E+00	1.32E+00	4.58E+01	miss
		727.33	6.67	2.15E-01		1.32E+00	miss
		785.37	1.10	-1.08E+00		3.41E+00	miss
		1620.50	1.47	1.44E-01		5.35E+00	miss
+	Pb-212	115.18	0.60	4.25E+00	2.07E-01	1.14E+01	miss
		238.63	* 43.60	4.00E-01		2.07E-01	miss
		300.09	3.30	-2.17E-01		1.62E+00	miss
+	Pb212-XR	74.82	10.28	1.19E+00	1.34E+00	2.50E+00	miss
		77.11	17.10	6.98E-01		1.34E+00	miss
		87.35	3.97	1.46E+00		3.13E+00	miss
		89.78	1.46	5.29E-01		7.29E+00	miss
+	Bi-214	609.32	* 45.49	6.01E-01	1.76E-01	1.76E-01	miss
		769.36	4.89	2.40E-01		1.45E+00	miss
		806.18	1.26	6.86E-01		4.43E+00	miss
		934.06	3.11	1.11E+00		2.61E+00	miss
		1120.29	14.92	3.79E-01		8.76E-01	miss
		1155.21	1.63	2.78E+00		6.76E+00	miss
		1238.12	5.83	2.42E-01		1.89E+00	miss
		1280.98	1.43	5.66E-01		5.33E+00	miss
		1377.67	3.99	2.41E-01		2.25E+00	miss
		1385.31	0.79	2.74E+00		1.14E+01	miss
		1401.52	1.33	8.13E-02		5.29E+00	miss
		1407.99	2.39	2.22E+00		5.03E+00	miss
		1509.21	2.13	5.37E-02		3.49E+00	miss
		1661.27	1.05	3.30E+00		9.90E+00	miss
		1729.59	2.88	9.67E-01		3.72E+00	miss
		1764.49	15.30	6.67E-01		1.11E+00	miss
		1847.43	2.03	6.61E-01		4.27E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	7.25	5.27E-01	1.97E-01	9.90E-01	miss
		295.22	* 18.42	4.16E-01		3.70E-01	miss
		351.93	* 35.60	6.52E-01		1.97E-01	miss
		785.96	1.06	-1.29E+00		3.55E+00	miss
+	Pb214-XR	74.82	5.80	2.11E+00	2.37E+00	4.44E+00	miss
		77.11	9.70	1.23E+00		2.37E+00	miss
		87.35	2.24	2.60E+00		5.56E+00	miss
		89.78	0.82	9.42E-01		1.30E+01	miss
+	Ra-226	186.21	3.64	5.42E-01	1.81E+00	1.81E+00	miss
+	Ac-228	129.07	* 2.42	1.66E+00	2.50E-01	2.98E+00	miss
		209.25	3.89	5.25E-01		1.68E+00	miss
		270.24	3.46	1.01E+00		1.96E+00	miss
		328.00	2.95	3.33E-01		2.24E+00	miss
		333.32	11.27	7.12E-01		7.88E-01	miss
		409.46	1.92	1.50E+00		3.73E+00	miss
		463.00	4.40	2.75E-01		1.73E+00	miss
		794.95	4.25	1.01E-01		1.71E+00	miss
		911.20	* 25.80	6.77E-01		2.50E-01	miss
		964.77	4.99	6.03E-01		1.66E+00	miss
		968.97	15.80	4.11E-01		7.51E-01	miss

Analysis Report for 20-Apr-16-10009  
L3-10213A-FRGS-006SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	7.69E-01	2.50E-01	3.11E+00	miss
+	Pa-231	27.36	10.30	-8.49E-01	2.11E+00	4.05E+00	miss
		283.69	1.70	3.26E-01		3.03E+00	miss
		300.07	2.47	-2.90E-01		2.16E+00	miss
		302.65	2.20	-1.52E-01		2.11E+00	miss
		330.06	1.40	1.47E-01		4.41E+00	miss
+	Th-234	92.38	2.13	2.49E+00	6.37E+00	6.37E+00	miss
		92.80	2.10	3.26E+00		6.42E+00	miss
		112.81	0.21	1.94E+00		4.21E+01	miss
+	U-235	143.76	10.96	4.51E-02	1.26E-01	5.23E-01	miss
		163.33	5.08	-3.98E-01		9.47E-01	miss
		185.71	57.20	1.10E-01		1.26E-01	miss
		202.11	1.08	-1.80E+00		4.31E+00	miss
		205.31	5.01	1.29E-01		9.35E-01	miss
+	Am-241	59.54	35.90	7.17E-01	1.68E+00	1.68E+00	miss

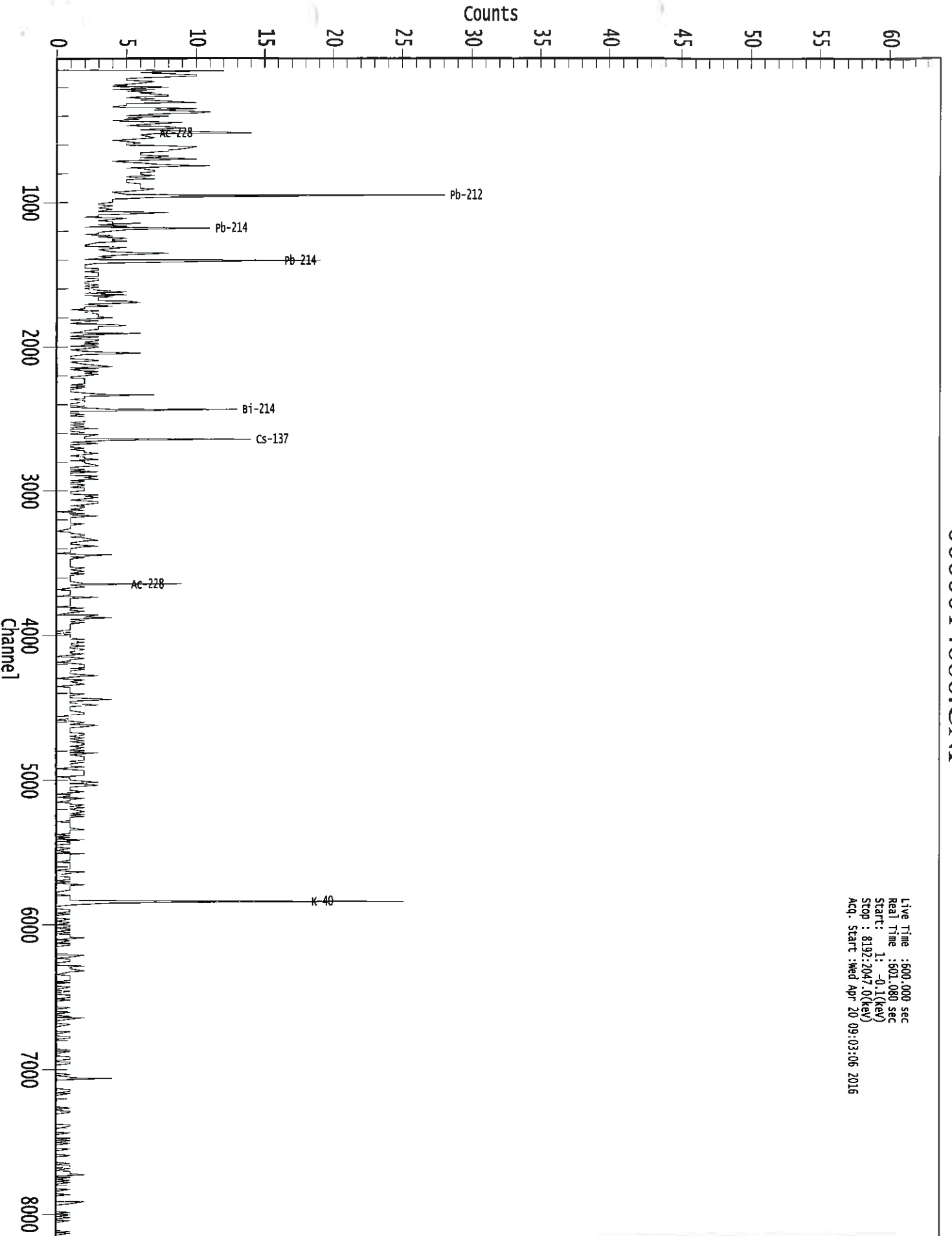
- + = Nuclide identified during the nuclide identification
- \* = Energy line found in the spectrum
- > = MDA value not calculated
- @ = Half-life too short to be able to perform the decay correction
- ? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

# 0000014686.CNF



Live Time : 600.000 sec  
Real Time : 601.080 sec  
Start : 1: -0.1(keV)  
Stop : 8197.2047.0(keV)  
Acq. Start : Wed Apr 20 09:03:06 2016

Analysis Report for 20-Apr-16-10010  
L3-10213A-FRGS-007SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10010  
Sample Description : L3-10213A-FRGS-007SS  
Sample Type : 1L 130G Soil Sample  
Unit :  
Sample Point :  
  
Sample Size : 1.004E+03 grams  
Facility : Default  
  
Sample Taken On : 4/14/2016 7:45:00AM  
Acquisition Started : 4/20/2016 9:43:41AM  
  
Procedure : 130G 1L Soil Sample  
Operator : HTomlin  
Detector Name : P11314X2  
Geometry : 130G Soil  
Live Time : 600.0 seconds  
Real Time : 600.4 seconds  
  
Dead Time : 0.07 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 6/28/2012  
Efficiency Calibration Description :  
  
Sample Number : 14688

*H. Tomlin*  
4-20-16  
*H. Tomlin* 4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 9:53:50AM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*H. Tomlin*  
4-20-16  
Data Validated  
4-25-16 Fuller

Analysis Report for 20-Apr-16-10010

L3-10213A-FRGS-007SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	77.13	306 -	315	309.72	4.38E+01	22.55	6.04E+01	Pb214-XR Pb212-XR
2	238.72	949 -	961	955.21	1.12E+02	30.13	8.32E+01	Pb-212
3	295.37	1176 -	1188	1181.53	5.70E+01	19.11	2.60E+01	Pb-214 Eu-152
4	351.93	1400 -	1415	1407.52	8.12E+01	20.71	1.96E+01	Pb-214 Bi-211
5	511.19	2039 -	2048	2043.96	1.52E+01	13.17	2.76E+01	..... <i>Am-241-511</i>
6	583.43	2326 -	2338	2332.71	3.79E+01	14.10	1.02E+01	Tl-208
7	609.56	2432 -	2444	2437.19	6.76E+01	19.17	2.08E+01	Bi-214
8	969.32	3870 -	3881	3875.78	2.00E+01	9.38	1.92E+00	Ac-228
9	1461.22	5834 -	5854	5844.22	1.57E+02	25.30	2.82E+00	K-40

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

*JPW*  
*4-20-16*

## 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	Coinc Corr
K-40	0.99	1460.82 *	10.66	8.62E+00	1.58E+00	miss
Tl-208	0.99	583.19 *	85.00	1.40E-01	5.49E-02	miss
Pb-212	1.00	115.18	0.60			
		238.63 *	43.60	4.38E-01	1.37E-01	miss
		300.09	3.30			
Pb212-XR	1.00	74.82	10.28			
		77.11 *	17.10	7.83E-01	4.34E-01	miss
		87.35	3.97			
		89.78	1.46			
Bi-214	0.99	609.32 *	45.49	4.82E-01	1.48E-01	miss
		768.36	4.89			
		806.18	1.26			
		934.06	3.11			
		1120.29	14.92			
		1155.21	1.63			
		1238.12	5.83			

Analysis Report for 20-Apr-16-10010

L3-10213A-FRGS-007SS

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>	<b>Coinc Corr</b>
Bi-214	0.99	1280.98	1.43			
		1377.67	3.99			
		1385.31	0.79			
		1401.52	1.33			
		1407.99	2.39			
		1509.21	2.13			
		1661.27	1.05			
		1729.59	2.88			
		1764.49	15.30			
		1847.43	2.03			
		2118.51	1.16			
Pb-214	1.00	241.99	7.25			
		295.22 *	18.42	6.07E-01	2.25E-01	miss
		351.93 *	35.60	5.03E-01	1.51E-01	miss
Pb214-XR	1.00	785.96	1.06			
		74.82	5.80			
Ac-228	0.31	77.11 *	9.70	1.38E+00	7.76E-01	miss
		87.35	2.24			
		39.78	0.82			
		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	5.63E-01	2.68E-01	miss		
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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

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**INTERFERENCE CORRECTED REPORT**

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Analysis Report for 20-Apr-16-10010

L3-10213A-FRGS-007SS

	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	K-40	0.990	8.62E+00	1.58E+00	
	Tl-208	0.996	1.40E-01	5.49E-02	
X	Bi-211	0.955			
	Pb-212	1.000	4.38E-01	1.37E-01	
?	Pb212-XR	1.000	7.83E-01	4.34E-01	
	Bi-214	0.999	4.82E-01	1.48E-01	
	Pb-214	1.000	5.35E-01	1.26E-01	
?	Pb214-XR	1.000	1.38E+00	7.76E-01	
	Ac-228	0.312	5.63E-01	2.68E-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 2.000sigma



Analysis Report for 20-Apr-16-10010  
L3-10213A-FRGS-007SS

**UNIDENTIFIED PEAKS**

Peak Locate Performed on : 4/20/2016 9:53:50AM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
5	511.19	2.53678E-02	43.25		AWH-561

JPN  
4-20-16

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

**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)	Coinc Corr
+ K-40	1460.82	* 10.66	8.62E+00	4.83E-01	4.83E-01	miss
+ Cr-51	320.08	9.91	1.10E-01	4.23E-01	4.23E-01	free
+ Mn-54	834.85	99.98	3.39E-04	4.88E-02	4.88E-02	miss
+ Co-58	810.76	99.45	4.89E-03	4.51E-02	4.51E-02	miss
	1674.73	0.52	0.00E+00		3.61E+00	miss
+ Co-60	1173.23	99.85	1.44E-03	1.48E-02	6.06E-02	miss
	1332.49	99.98	0.00E+00		1.48E-02	miss
+ Nb-94	702.65	99.81	-2.18E-02	3.04E-02	4.30E-02	miss
	871.09	99.89	-3.78E-02		3.04E-02	miss
+ Ag-108m	79.13	6.60	-1.51E-01	3.91E-02	9.91E-01	miss
	433.94	90.50	9.28E-03		4.93E-02	miss
	614.28	89.80	-1.48E-02		3.91E-02	miss
	722.94	90.80	-2.34E-03		4.81E-02	miss
+ Sn-113	255.13	2.11	-1.09E-02	6.34E-02	1.65E+00	free
	391.70	64.97	1.59E-02		6.34E-02	free
+ Cs-134	475.36	1.48	4.46E-01	3.99E-02	2.62E+00	miss
	563.25	8.34	-2.96E-02		2.72E-01	miss
	569.33	15.37	1.62E-02		2.85E-01	miss

Analysis Report for 20-Apr-16-10010  
L3-10213A-FRGS-007SS

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>	
Cs-134	604.72	97.62	-1.16E-03	3.99E-02	3.99E-02	miss	
	795.86	85.46	-3.23E-03		5.48E-02	miss	
	801.95	8.69	6.40E-02		5.42E-01	miss	
	1038.61	0.99	1.57E-01		5.67E+00	miss	
	1167.97	1.79	8.05E-02		3.69E+00	miss	
	1365.19	3.02	1.86E-01		1.37E+00	miss	
+ Cs-137	661.66	85.10	7.43E-02	1.01E-01	1.01E-01	miss	
+ Eu-152	121.78	28.67	-1.31E-02	1.09E-01	1.09E-01	miss	
	244.70	7.61	5.68E-03		4.85E-01	miss	
	295.94	0.45	2.22E+01		1.73E+01	miss	
	344.28	26.60	-7.35E-03		1.30E-01	miss	
	367.79	0.86	-7.40E-01		4.19E+00	miss	
	411.12	2.24	6.62E-02		1.56E+00	miss	
	443.96	2.83	-6.25E-01		9.90E-01	miss	
	488.68	0.42	-4.08E+00		8.69E+00	miss	
	563.99	0.49	-8.77E-01		4.61E+00	miss	
	586.26	0.46	-8.45E+00		6.38E+00	miss	
	678.62	0.47	3.15E+00		1.11E+01	miss	
	688.67	0.86	6.25E-01		6.16E+00	miss	
	719.35	0.28	6.59E+00		2.06E+01	miss	
	778.90	12.96	2.63E-02		3.18E-01	miss	
	810.45	0.32	-1.12E+00		1.14E+01	miss	
	867.37	4.26	-4.43E-01		8.97E-01	miss	
	919.33	0.43	-6.01E+00		7.37E+00	miss	
	964.08	14.65	4.36E-02		4.26E-01	miss	
	1085.87	10.24	-3.01E-01		4.34E-01	miss	
	1089.74	1.73	-1.19E-01		3.33E+00	miss	
	1112.07	13.69	6.90E-02		4.66E-01	miss	
	1212.95	1.43	2.22E+00		5.73E+00	miss	
	1249.94	0.19	6.74E+00		2.99E+01	miss	
1299.14	1.63	-2.84E-01	2.44E+00	miss			
1403.01	21.07	6.58E-02	2.92E-01	miss			
1457.64	0.50	-1.93E+01	1.64E+01	miss			
1528.10	0.28	0.00E+00	5.83E+00	miss			
+ Eu-154	123.07	40.40	-1.91E-02	7.26E-02	7.26E-02	miss	
247.93	6.89	-4.00E-02	4.94E-01		miss		
591.76	4.95	-1.54E-01	8.42E-01		miss		
692.42	1.78	-8.55E-01	2.39E+00		miss		
723.30	20.06	-2.73E-02	2.18E-01		miss		
756.80	4.52	2.77E-01	9.98E-01		miss		
873.18	12.08	3.99E-02	5.14E-01		miss		
996.29	10.48	0.00E+00	1.17E-01		miss		
1004.76	18.01	4.21E-03	2.35E-01		miss		
1274.43	34.80	-4.26E-02	1.84E-01		miss		
1596.48	1.80	5.47E-01	3.25E+00		miss		
+ Eu-155	45.30	1.31	-2.41E-01		1.84E-01	1.17E+01	miss
60.01	1.22	2.81E+00	1.38E+01			miss	
86.55	30.70	2.46E-02	1.84E-01	miss			
105.31	21.10	1.25E-01	2.28E-01	miss			
+ Tl-208	583.19	*	85.00	1.40E-01	5.19E-02	miss	
+ Bi-211	351.07	*	13.02	1.37E+00	3.30E-01	miss	

Analysis Report for 20-Apr-16-10010

L3-10213A-FRGS-007SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
+	Pb-211	404.85	3.78	-1.94E-01	9.69E-01	9.69E-01	miss
		427.09	1.76	6.62E-01		2.51E+00	miss
		832.01	3.52	5.05E-02		1.22E+00	miss
+	Bi-212	39.86	1.06	2.19E-01	9.93E-01	1.15E+01	miss
		727.33	6.67	3.01E-01		9.93E-01	miss
		785.37	1.10	7.45E-01		4.58E+00	miss
		1620.50	1.47	8.65E-01		4.02E+00	miss
+	Pb-212	115.18	0.60	-2.85E-01	1.48E-01	5.72E+00	miss
		238.63	* 43.60	4.38E-01		1.48E-01	miss
		300.09	3.30	5.29E-01		1.35E+00	miss
+	Pb212-XR	74.82	10.28	7.62E-01	5.85E-01	1.18E+00	miss
		77.11	* 17.10	7.83E-01		5.85E-01	miss
		87.35	3.97	3.98E-01		1.44E+00	miss
		89.78	1.46	2.50E+00		4.05E+00	miss
+	Bi-214	609.32	* 45.49	4.82E-01	1.35E-01	1.35E-01	miss
		768.36	4.89	4.85E-01		1.29E+00	miss
		806.18	1.26	1.29E+00		4.37E+00	miss
		934.06	3.11	-9.76E-01		1.03E+00	miss
		1120.29	14.92	6.31E-01		8.34E-01	miss
		1155.21	1.63	2.18E-01		4.58E+00	miss
		1238.12	5.83	4.59E-02		1.56E+00	miss
		1280.98	1.43	2.65E-01		4.00E+00	miss
		1377.67	3.99	5.63E-01		1.69E+00	miss
		1385.31	0.79	1.85E+00		8.54E+00	miss
		1401.52	1.33	1.71E+00		5.13E+00	miss
		1407.99	2.39	5.79E-01		2.57E+00	miss
		1509.21	2.13	1.71E+00		4.24E+00	miss
		1661.27	1.05	1.01E+00		5.75E+00	miss
		1729.59	2.88	7.26E-01		3.04E+00	miss
		1764.49	15.30	5.38E-01		8.92E-01	miss
		1847.43	2.03	3.45E-01		2.54E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	7.25	4.47E-01	1.21E-01	7.25E-01	miss
		295.22	* 18.42	6.07E-01		2.34E-01	miss
		351.93	* 35.60	5.03E-01		1.21E-01	miss
		785.96	1.06	-2.42E-01		4.76E+00	miss
+	Pb214-XR	74.82	5.80	1.35E+00	1.03E+00	2.10E+00	miss
		77.11	* 9.70	1.38E+00		1.03E+00	miss
		87.35	2.24	7.06E-01		2.54E+00	miss
		89.78	0.82	4.46E+00		7.22E+00	miss
+	Ra-226	186.21	3.64	8.27E-01	1.27E+00	1.27E+00	miss
+	Ac-228	129.07	2.42	1.27E-01	2.05E-01	1.73E+00	miss
		209.25	3.89	-2.87E-01		8.44E-01	miss
		270.24	3.46	1.33E-02		1.14E+00	miss
		328.00	2.95	-5.81E-01		1.34E+00	miss
		338.32	11.27	3.01E-01		4.95E-01	miss
		409.46	1.92	3.26E-01		2.03E+00	miss
		463.00	4.40	7.51E-02		1.15E+00	miss
		794.95	4.25	1.18E-01		1.10E+00	miss
		911.20	25.80	2.41E-01		4.13E-01	miss
		964.77	4.99	6.36E-01		1.48E+00	miss

Analysis Report for 20-Apr-16-10010

L3-10213A-FRGS-007SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	968.97	*	15.80	5.63E-01	2.05E-01	2.05E-01	miss
		1588.20		3.22	1.53E-01		1.80E+00	miss
+	Pa-231	27.36		10.30	0.00E+00	1.83E-01	1.83E-01	miss
		283.69		1.70	4.49E-01		2.19E+00	miss
		300.07		2.47	7.06E-01		1.80E+00	miss
		302.65		2.20	-5.01E-01		1.36E+00	miss
		330.06		1.40	-5.49E-01		2.51E+00	miss
+	Th-234	92.38		2.13	1.89E+00	3.52E+00	3.53E+00	miss
		92.80		2.10	1.39E+00		3.52E+00	miss
		112.81		0.21	-7.93E+00		1.98E+01	miss
+	U-235	143.76		10.96	1.08E-01	7.44E-02	3.45E-01	miss
		163.33		5.08	2.01E-01		7.04E-01	miss
		185.71		57.20	2.56E-02		7.44E-02	miss
		202.11		1.08	-6.10E-01		2.81E+00	miss
		205.31		5.01	-1.41E-01		6.10E-01	miss
+	Am-241	59.54		35.90	-1.14E-01	4.13E-01	4.13E-01	miss

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

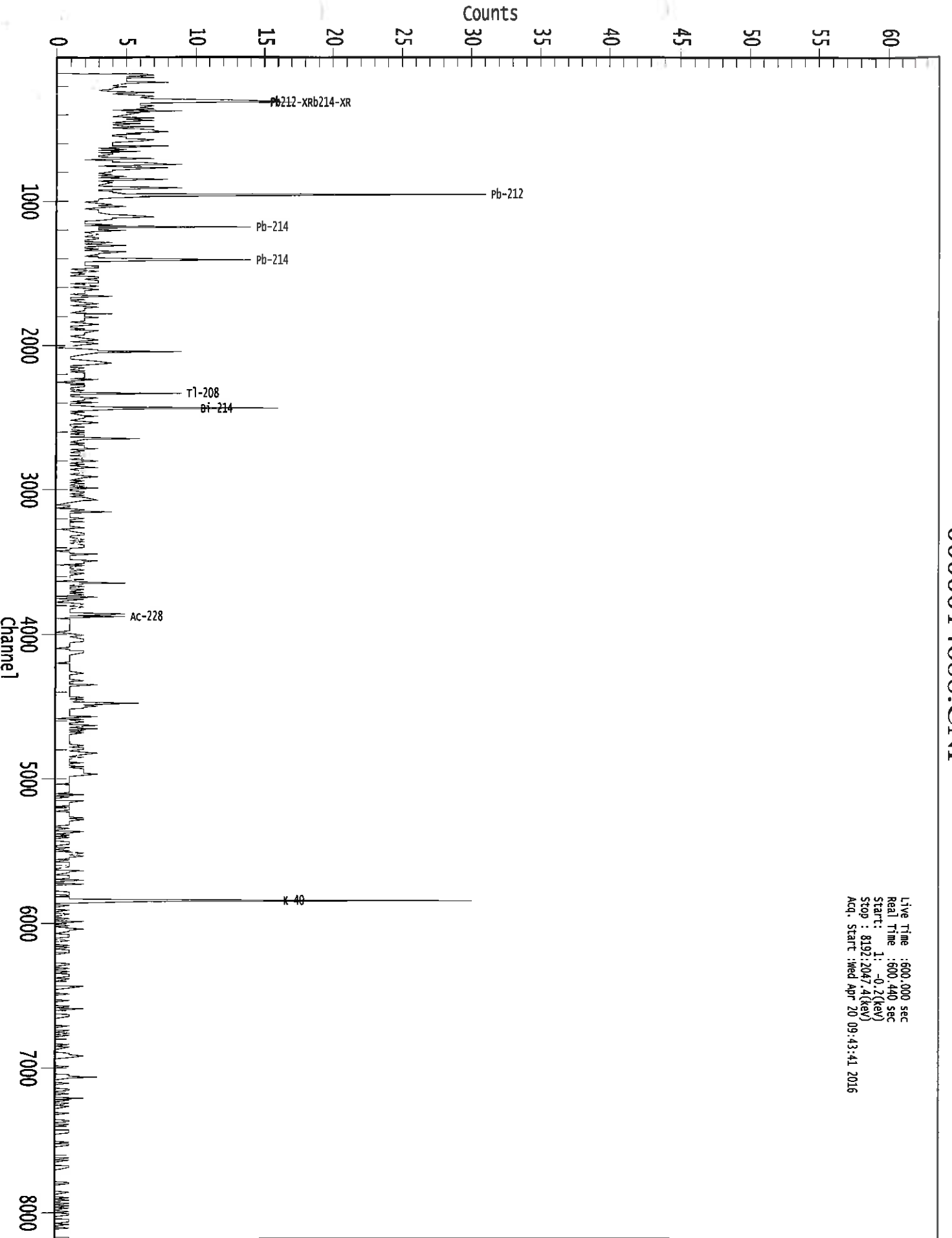
@ = Half-life too short to be able to perform the decay correction

? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.



Live Time : 600.000 sec  
Real Time : 600.440 sec  
Start: 1: -0.2(kev)  
Stop : 8192.2047.4(kev)  
Acq. Start : Wed Apr 20 09:43:41 2016

Analysis Report for 20-Apr-16-10013  
L3-10213A-FRGS-008SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10013  
Sample Description : L3-10213A-FRGS-008SS  
Sample Type : 1L 130G Soil Sample  
Unit :  
Sample Point :  
  
Sample Size : 1.158E+03 grams  
Facility : Default  
  
Sample Taken On : 4/14/2016 8:00:00AM  
Acquisition Started : 4/20/2016 10:11:09AM  
  
Procedure : 130G 1L Soil Sample  
Operator : HTomlin  
Detector Name : P11314X2  
Geometry : 130G Soil  
Live Time : 600.0 seconds  
Real Time : 600.4 seconds  
  
Dead Time : 0.07 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 6/28/2012  
Efficiency Calibration Description :  
  
Sample Number : 14691

*JP. W. 4/20/16*  
*4-20-16*  
*4/20/16*

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 10:21:25AM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*Data Validated*  
*4-20-16*

Analysis Report for 20-Apr-16-10013

L3-10213A-FRGS-008SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	76.92	305 -	313	308.90	2.89E+01	20.07	5.61E+01	Pb214-XR Pb212-XR
2	186.60	740 -	752	746.99	3.84E+01	18.70	3.72E+01	Ra-226 U-235
3	238.71	948 -	961	955.16	1.23E+02	31.47	9.10E+01	Pb-212
4	295.28	1176 -	1187	1181.17	4.03E+01	17.55	2.93E+01	Pb-214 Eu-152
5	338.35	1347 -	1360	1353.25	3.43E+01	16.14	2.54E+01	Ac-228
6	352.03	1401 -	1414	1407.91	8.10E+01	22.28	3.59E+01	Pb-214 Bi-211
7	583.23	2327 -	2338	2331.92	4.28E+01	15.61	1.64E+01	Tl-208
8	609.26	2428 -	2443	2435.96	5.20E+01	17.07	1.60E+01	Bi-214
9	661.80	2639 -	2652	2646.01	9.99E+01	21.67	1.62E+01	Cs-137
10	911.43	3638 -	3650	3644.21	2.97E+01	12.44	8.67E+00	Ac-228
11	969.20	3870 -	3881	3875.30	1.18E+01	9.98	1.25E+01	Ac-228
12	1461.40	5835 -	5854	5844.94	1.23E+02	22.78	5.42E+00	K-40

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.97	1460.82 *	10.66	5.89E+00	1.20E+00	miss
Cs-137	0.99	661.66 *	85.10	3.49E-01	8.66E-02	miss
Tl-208	1.00	583.19 *	85.00	1.37E-01	5.27E-02	miss
Pb-212	1.00	115.18	0.60			
		238.63 *	43.60	4.14E-01	1.26E-01	miss
		300.09	3.30			
Pb212-XR	0.99	74.82	10.28			
		77.11 *	17.10	4.52E-01	3.27E-01	miss
		87.35	3.97			
		89.78	1.46			
Bi-214	1.00	609.32 *	45.49	3.21E-01	1.12E-01	miss
		768.36	4.89			

Analysis Report for 20-Apr-16-10013  
L3-10213A-FRGS-008SS

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty	Coinc Corr
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			
Pb-214	1.00	2118.51	1.16			
		241.99	7.25			
		295.22 *	18.42	3.72E-01	1.73E-01	miss
Pb214-XR	0.99	351.93 *	35.60	4.35E-01	1.38E-01	miss
		785.96	1.06			
		74.82	5.80			
Ra-226	0.99	77.11 *	9.70	7.97E-01	5.81E-01	miss
		87.35	2.24			
		89.78	0.82			
Ac-228	0.99	186.21 *	3.64	1.36E+00	7.00E-01	miss
		129.07	2.42			
		209.25	3.89			
		270.24	3.46			
		328.00	2.95			
		338.32 *	11.27	5.66E-01	2.82E-01	miss
		409.46	1.92			
		463.00	4.40			
		794.95	4.25			
		911.20 *	25.80	4.25E-01	1.82E-01	miss
		964.77	4.99			
		968.97 *	15.80	2.86E-01	2.44E-01	miss
U-235	0.96	1588.20	3.22			
		143.76	10.96			
		163.33	5.08			
		185.71 *	57.20	8.68E-02	4.46E-02	miss
		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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma



Analysis Report for 20-Apr-16-10013

L3-10213A-FRGS-008SS

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

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## INTERFERENCE CORRECTED REPORT

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<i>Nuclide Name</i>	<i>Nuclide Id Confidence</i>	<i>Wt mean Activity (pCi/grams)</i>	<i>Wt mean Activity Uncertainty</i>	<i>Comments</i>
	0.979	5.89E+00	1.20E+00	
	0.999	3.49E-01	8.66E-02	
	1.000	1.37E-01	5.27E-02	
X	0.945			
	1.000	4.14E-01	1.26E-01	
?	0.999	4.52E-01	3.27E-01	
	1.000	3.21E-01	1.12E-01	
	1.000	4.10E-01	1.08E-01	
?	0.999	7.97E-01	5.81E-01	
?	0.991	1.36E+00	7.00E-01	
	0.998	4.16E-01	1.30E-01	
?	0.966	8.68E-02	4.46E-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 2.000sigma

Analysis Report for 20-Apr-16-10013  
L3-10213A-FRGS-008SS

## UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 10:21:25AM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
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All peaks were identified.

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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)	Coinc Corr
+	K-40	1460.82	*	10.66	5.89E+00	5.29E-01	5.29E-01 miss
+	Cr-51	320.08		9.91	-1.01E-01	3.82E-01	3.82E-01 free
+	Mn-54	834.85		99.98	0.00E+00	3.27E-02	3.27E-02 miss
+	Co-58	810.76		99.45	-1.12E-02	3.38E-02	3.38E-02 miss
		1674.73		0.52	1.16E+00		8.52E+00 miss
+	Co-60	1173.23		99.85	-1.71E-02	3.50E-02	5.74E-02 miss
		1332.49		99.98	-1.29E-02		3.50E-02 miss
+	Nb-94	702.65		99.81	4.13E-03	3.85E-02	4.07E-02 miss
		871.09		99.89	4.18E-03		3.85E-02 miss
+	Ag-108m	79.13		6.60	3.99E-01	3.74E-02	9.53E-01 miss
		433.94		90.50	-6.13E-05		3.89E-02 miss
		614.28		89.80	8.18E-03		4.72E-02 miss
		722.94		90.80	-2.12E-03		3.74E-02 miss
+	Sn-113	255.13		2.11	-1.53E-01	5.50E-02	1.48E+00 free
		391.70		64.97	-5.94E-03		5.50E-02 free
+	Cs-134	475.36		1.48	-3.04E-01	3.10E-02	2.42E+00 miss
		563.25		8.34	-1.71E-02		5.35E-01 miss
		569.33		15.37	-2.46E-02		2.30E-01 miss
		604.72		97.62	-8.64E-03		3.10E-02 miss

Analysis Report for 20-Apr-16-10013  
L3-10213A-FRGS-008SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	795.86	85.46	1.32E-03	3.10E-02	5.58E-02	miss
		801.95	8.69	9.39E-02		5.13E-01	miss
		1038.61	0.99	8.19E-01		4.41E+00	miss
		1167.97	1.79	2.79E-01		3.45E+00	miss
		1365.19	3.02	4.83E-01		1.73E+00	miss
+	Cs-137	661.66	* 85.10	3.49E-01	5.76E-02	5.76E-02	miss
+	Eu-152	121.78	28.67	-5.33E-02	9.19E-02	9.19E-02	miss
		244.70	7.61	4.76E-02		4.32E-01	miss
		295.94	0.45	1.29E+01		1.29E+01	miss
		344.28	26.60	2.98E-02		1.43E-01	miss
		367.79	0.86	1.37E+00		3.99E+00	miss
		411.12	2.24	-3.95E-01		1.59E+00	miss
		443.96	2.83	-3.27E-01		1.12E+00	miss
		488.68	0.42	-3.22E+00		5.33E+00	miss
		563.99	0.49	2.56E+00		9.46E+00	miss
		586.26	0.46	-7.03E+00		8.40E+00	miss
		678.62	0.47	5.61E-01		7.70E+00	miss
		688.67	0.86	-2.67E+00		2.62E+00	miss
		719.35	0.28	-1.88E-01		1.21E+01	miss
		778.90	12.96	2.88E-02		3.08E-01	miss
		810.45	0.32	-2.12E+00		1.14E+01	miss
		867.37	4.26	1.40E-02		7.78E-01	miss
		919.33	0.43	-2.61E+00		6.39E+00	miss
		964.08	14.65	3.24E-02		3.93E-01	miss
		1085.87	10.24	1.74E-02		2.98E-01	miss
		1089.74	1.73	-6.53E-01		1.77E+00	miss
		1112.07	13.69	-5.28E-02		3.70E-01	miss
		1212.95	1.43	8.94E-01		4.41E+00	miss
		1249.94	0.19	5.78E+00		3.16E+01	miss
		1299.14	1.63	3.49E-01		2.67E+00	miss
		1408.01	21.07	1.20E-01		3.31E-01	miss
		1457.64	0.50	-1.12E+01		1.09E+01	miss
		1528.10	0.28	1.87E+00		1.38E+01	miss
+	Eu-154	123.07	40.40	2.81E-02	8.08E-02	8.08E-02	miss
		247.93	6.89	6.59E-03		4.56E-01	miss
		591.76	4.95	0.00E+00		8.37E-01	miss
		692.42	1.78	3.02E-01		2.07E+00	miss
		723.30	20.06	-1.05E-02		1.70E-01	miss
		756.80	4.52	4.50E-02		8.66E-01	miss
		873.18	12.08	-1.98E-02		3.20E-01	miss
		996.29	10.48	-2.29E-02		4.03E-01	miss
		1004.76	18.01	2.56E-02		2.36E-01	miss
		1274.43	34.80	2.20E-02		1.74E-01	miss
		1596.48	1.80	3.04E-01		2.23E+00	miss
+	Eu-155	45.30	1.31	1.31E+00	1.74E-01	1.06E+01	miss
		60.01	1.22	-5.42E-01		1.13E+01	miss
		86.55	30.70	4.16E-02		2.10E-01	miss
		105.31	21.10	-9.18E-03		1.74E-01	miss
+	Tl-208	583.19	* 85.00	1.37E-01	5.36E-02	5.36E-02	miss
+	Bi-211	351.07	* 13.02	1.19E+00	3.57E-01	3.57E-01	miss
+	Pb-211	404.85	3.78	4.25E-01	1.06E+00	1.09E+00	miss

Analysis Report for 20-Apr-16-10013  
L3-10213A-FRGS-008SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Pb-211	427.09	1.76	6.24E-01	1.06E+00	2.26E+00	miss
		832.01	3.52	-9.85E-02		1.06E+00	miss
+	Bi-212	39.86	1.06	3.66E+00	8.61E-01	1.22E+01	miss
		727.33	6.67	3.36E-01		8.61E-01	miss
		785.37	1.10	-6.72E-02		3.26E+00	miss
		1620.50	1.47	7.81E-01		4.04E+00	miss
+	Pb-212	115.18	0.60	5.43E-01	1.34E-01	5.59E+00	miss
		238.63	*	43.60		1.34E-01	miss
		300.09		3.30		1.17E+00	miss
+	Pb212-XR	74.82	10.28	8.50E-01	4.78E-01	1.07E+00	miss
		77.11	*	17.10		4.78E-01	miss
		87.35		3.97		1.63E+00	miss
		89.78		1.46		3.41E+00	miss
+	Bi-214	609.32	*	45.49	1.10E-01	1.10E-01	miss
		768.36		4.89		9.47E-01	miss
		806.18		1.26		3.23E+00	miss
		934.06		3.11		1.92E+00	miss
		1120.29	14.92	4.82E-01		6.37E-01	miss
		1155.21		1.63		2.46E+00	miss
		1238.12		5.83		1.40E+00	miss
		1280.98		1.43		3.47E+00	miss
		1377.67		3.99		1.72E+00	miss
		1385.31		0.79		4.53E+00	miss
		1401.52		1.33		4.86E+00	miss
		1407.99		2.39		2.91E+00	miss
		1509.21		2.13		2.27E+00	miss
		1661.27		1.05		3.95E+00	miss
		1729.59		2.88		1.48E+00	miss
		1764.49	15.30	2.02E-01		5.42E-01	miss
		1847.43		2.03		2.20E+00	miss
>		2118.51		1.16		0.00E+00	miss
+	Pb-214	241.99	7.25	6.80E-01	1.30E-01	6.74E-01	miss
		295.22	*	18.42		2.09E-01	miss
		351.93	*	35.60		1.30E-01	miss
		785.96		1.06		3.39E+00	miss
+	Pb214-XR	74.82	5.80	1.51E+00	8.42E-01	1.90E+00	miss
		77.11	*	9.70		8.42E-01	miss
		87.35		2.24		2.89E+00	miss
		89.78		0.82		6.07E+00	miss
+	Ra-226	186.21	*	3.64	9.14E-01	9.14E-01	miss
+	Ac-228	129.07		2.42	1.80E-01	1.55E+00	miss
		209.25		3.89		8.84E-01	miss
		270.24		3.46		1.36E+00	miss
		328.00		2.95		1.24E+00	miss
		338.32	*	11.27		3.46E-01	miss
		409.46		1.92		2.43E+00	miss
		463.00		4.40		1.27E+00	miss
		794.95		4.25		1.19E+00	miss
		911.20	*	25.80		1.80E-01	miss
		964.77		4.99		1.08E+00	miss
		968.97	*	15.80		3.56E-01	miss

Analysis Report for 20-Apr-16-10013  
L3-10213A-FRGS-008SS

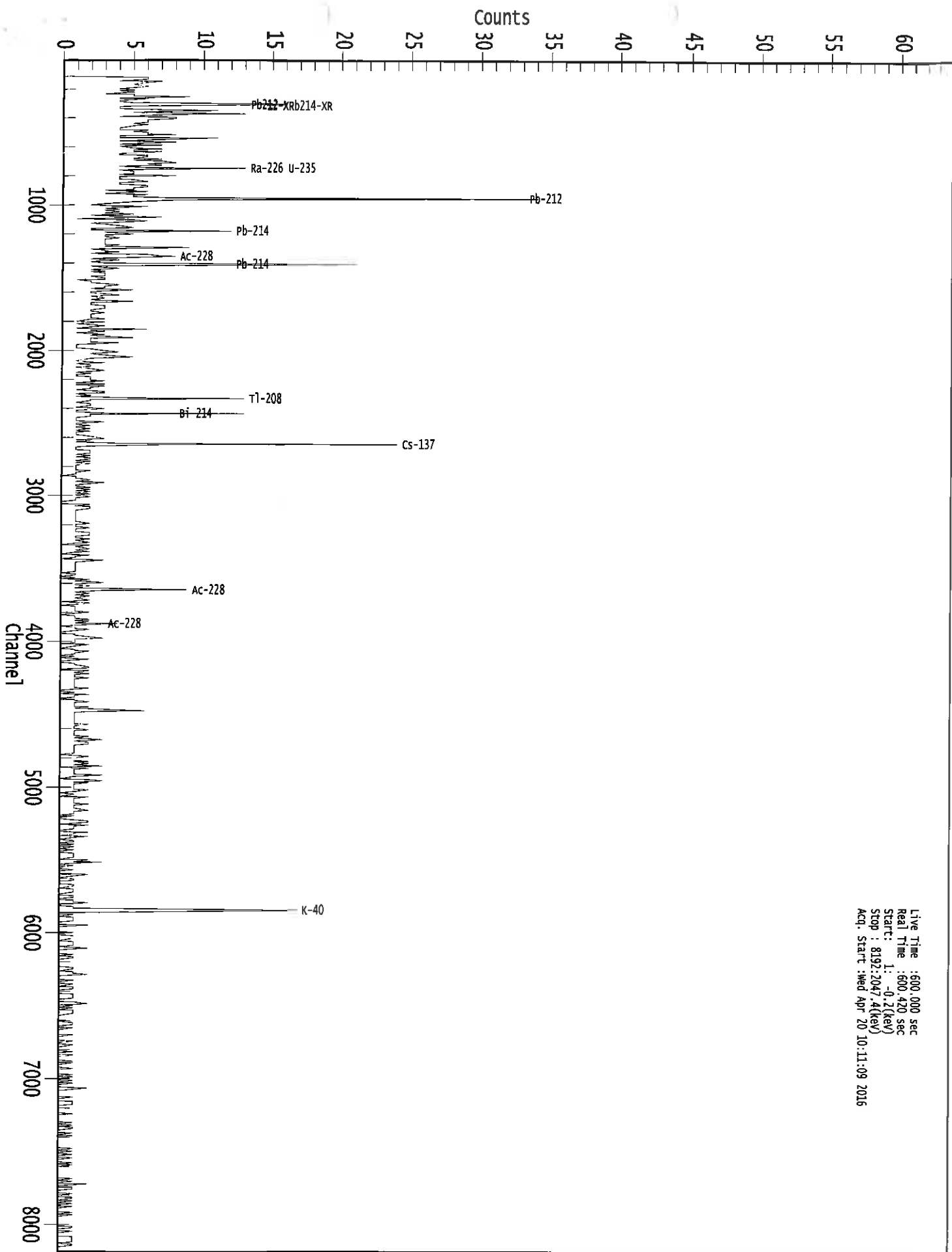
	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	3.37E-01	1.80E-01	1.56E+00	miss
+	Pa-231	27.36	10.30	0.00E+00	1.59E-01	1.59E-01	miss
		283.69	1.70	-6.08E-01		1.70E+00	miss
		300.07	2.47	4.29E-01		1.56E+00	miss
		302.65	2.20	-3.73E-01		1.42E+00	miss
		330.06	1.40	-1.23E-02		2.79E+00	miss
+	Th-234	92.38	2.13	4.22E-01	3.30E+00	3.30E+00	miss
		92.80	2.10	2.27E+00		3.60E+00	miss
		112.81	0.21	1.75E+00		2.09E+01	miss
+	U-235	143.76	10.96	1.60E-02	5.82E-02	2.83E-01	miss
		163.33	5.08	-1.10E-01		5.58E-01	miss
		185.71	* 57.20	8.68E-02		5.82E-02	miss
		202.11	1.08	-8.20E-01		2.35E+00	miss
		205.31	5.01	-6.19E-02		5.79E-01	miss
+	Am-241	59.54	35.90	-5.04E-02	3.77E-01	3.77E-01	miss

- + = 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

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.



Live Time : 600.000 sec  
Real Time : 600.420 sec  
Start : 1 -0.7(kev)  
Stop : 8192.2047.4(kev)  
Acq. Start : Wed Apr 20 10:11:09 2016

Analysis Report for 20-Apr-16-10014  
L3-10213A-FRGS-009SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10014  
Sample Description : L3-10213A-FRGS-009SS  
Sample Type : 1L 130G Soil Sample  
Unit :  
Sample Point :  
  
Sample Size : 1.209E+03 grams  
Facility : Default  
  
Sample Taken On : 4/13/2016 1:30:00PM  
Acquisition Started : 4/20/2016 10:11:43AM  
  
Procedure : 130G 1L Soil Sample  
Operator : HTomlin  
Detector Name : P40818B  
Geometry : 130G Soil  
Live Time : 600.0 seconds  
Real Time : 601.1 seconds  
  
Dead Time : 0.18 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 1/5/2015  
Efficiency Calibration Description :  
  
Sample Number : 14692

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4-20-16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 10:22:05AM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*Handwritten notes:*  
Dated ch. data  
4-25-16 C Fuller

Analysis Report for 20-Apr-16-10014

L3-10213A-FRGS-009SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	238.51	949 -	961	954.55	9.14E+01	27.10	6.91E+01	Pb-212
2	295.20	1176 -	1186	1181.12	2.63E+01	18.47	4.95E+01	Pb-214
3	351.88	1400 -	1416	1407.72	4.66E+01	22.02	5.48E+01	Eu-152
4	582.78	2325 -	2336	2330.91	2.02E+01	11.09	9.60E+00	Pb-214
5	609.37	2428 -	2444	2437.22	5.63E+01	17.31	1.33E+01	Bi-211
6	661.37	2639 -	2652	2645.16	4.97E+01	16.74	1.87E+01	Tl-208
7	910.76	3638 -	3649	3642.74	1.97E+01	10.74	8.53E+00	Bi-214
8	1460.44	5833 -	5851	5842.74	1.45E+02	24.86	8.08E+00	Cs-137
								Ac-228
								K-40

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.99	1460.82 *	10.66	7.36E+00	1.41E+00	miss
Cs-137	0.99	661.66 *	85.10	1.84E-01	6.59E-02	miss
Tl-208	0.99	583.19 *	85.00	6.88E-02	3.87E-02	miss
Pb-212	0.99	115.18 *	0.60			
		238.63 *	43.60	3.33E-01	1.13E-01	miss
		300.09 *	3.30			
Bi-214	1.00	609.32 *	45.49	3.70E-01	1.22E-01	miss
		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			



Analysis Report for 20-Apr-16-10014

L3-10213A-FRGS-009SS

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>	<b>Coinc Corr</b>
Bi-214	1.00	1509.21	2.13			
		1661.27	1.05			
		1729.59	2.88			
		1764.49	15.30			
		1847.43	2.03			
Pb-214	1.00	2118.51	1.16			
		241.99	7.25			
		295.22 *	18.42	2.59E-01	1.87E-01	miss
		351.93 *	35.60	2.66E-01	1.33E-01	miss
		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	3.00E-01	1.65E-01	miss
		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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.991	7.36E+00	1.41E+00	
Cs-137	0.995	1.84E-01	6.59E-02	

Analysis Report for 20-Apr-16-10014

L3-10213A-FRGS-009SS

	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	Tl-208	0.990	6.88E-02	3.87E-02	
X	Bi-211	0.960			
	Pb-212	0.999	3.33E-01	1.13E-01	
	Bi-214	1.000	3.70E-01	1.22E-01	
	Pb-214	1.000	2.64E-01	1.08E-01	
	Ac-228	0.996	3.00E-01	1.65E-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 2.000sigma

Analysis Report for 20-Apr-16-10014  
L3-10213A-FRGS-009SS

## UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 10:22:05AM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
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All peaks were identified.

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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)	Coinc Corr
+	K-40	1460.82	* 10.66	7.36E+00	6.52E-01	6.52E-01	miss
+	Cr-51	320.08	9.91	-1.56E-01	3.64E-01	3.64E-01	free
+	Mn-54	834.85	99.98	5.15E-03	4.50E-02	4.50E-02	miss
+	Co-58	810.76	99.45	4.05E-03	4.67E-02	4.67E-02	miss
		1674.73	0.52	0.00E+00		3.36E+00	miss
+	Co-60	1173.23	99.85	5.32E-03	3.72E-02	5.01E-02	miss
		1332.49	99.98	-3.61E-03		3.72E-02	miss
+	Nb-94	702.65	99.81	-8.78E-03	2.42E-02	2.42E-02	miss
		871.09	99.89	1.58E-02		5.36E-02	miss
+	Ag-108m	79.13	6.60	8.01E-01	1.92E-02	1.76E+00	miss
		433.94	90.50	-1.30E-02		1.92E-02	miss
		614.28	89.80	7.57E-03		3.60E-02	miss
		722.94	90.80	-3.38E-03		3.43E-02	miss
+	Sn-113	255.13	2.11	-3.93E-01	5.30E-02	1.70E+00	free
		391.70	64.97	-1.97E-02		5.30E-02	free
+	Cs-134	475.36	1.48	-5.37E-01	5.33E-02	2.42E+00	miss
		563.25	8.34	6.69E-02		4.47E-01	miss
		569.33	15.37	5.97E-02		2.63E-01	miss
		604.72	97.62	-3.06E-03		5.33E-02	miss

Analysis Report for 20-Apr-16-10014

L3-10213A-FRGS-009SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	795.86	85.46	-6.59E-03	5.33E-02	5.52E-02	miss
		801.95	8.69	9.70E-02		5.00E-01	miss
		1038.61	0.99	-1.38E+00		4.04E+00	miss
		1167.97	1.79	-2.78E-02		3.12E+00	miss
		1365.19	3.02	2.45E-02		1.59E+00	miss
+	Cs-137	661.66	85.10	1.84E-01	6.52E-02	6.52E-02	miss
+	Eu-152	121.78	28.67	5.00E-03	1.35E-01	1.35E-01	miss
		244.70	7.61	1.30E-01		5.00E-01	miss
		295.94	0.45	1.40E+00		1.40E+01	miss
		344.28	26.60	4.23E-02		1.37E-01	miss
		367.79	0.86	-6.13E-01		3.66E+00	miss
		411.12	2.24	-3.62E-01		1.70E+00	miss
		443.96	2.83	-2.37E-01		1.27E+00	miss
		488.68	0.42	1.95E+00		8.01E+00	miss
		563.99	0.49	1.08E+00		7.56E+00	miss
		586.26	0.46	-8.43E-02		6.81E+00	miss
		678.62	0.47	-7.72E+00		6.32E+00	miss
		688.67	0.86	1.17E+00		5.99E+00	miss
		719.35	0.28	1.32E+00		1.57E+01	miss
		779.90	12.96	-1.09E-01		2.00E-01	miss
		810.45	0.32	6.26E-02		1.21E+01	miss
		867.37	4.26	-1.48E-01		8.26E-01	miss
		919.33	0.43	1.77E+00		8.57E+00	miss
		964.08	14.65	3.06E-01		5.05E-01	miss
		1085.87	10.24	3.02E-01		6.47E-01	miss
		1089.74	1.73	0.00E+00		6.92E-01	miss
		1112.07	13.69	9.35E-03		3.04E-01	miss
		1212.95	1.43	-8.08E-01		4.36E+00	miss
		1249.94	0.19	5.49E+00		3.08E+01	miss
		1299.14	1.63	-8.30E-01		2.25E+00	miss
		1408.01	21.07	1.00E-01		3.00E-01	miss
		1457.64	0.50	-7.68E+00		2.23E+01	miss
		1528.10	0.28	1.99E+00		1.46E+01	miss
+	Eu-154	123.07	40.40	-3.88E-03	6.30E-02	9.11E-02	miss
		247.93	6.89	-8.29E-03		5.57E-01	miss
		591.76	4.95	-2.37E-02		7.11E-01	miss
		692.42	1.78	1.10E+00		3.06E+00	miss
		723.30	20.06	3.25E-02		1.80E-01	miss
		756.80	4.52	-3.95E-01		7.11E-01	miss
		873.18	12.08	-1.89E-01		2.93E-01	miss
		996.29	10.48	-3.76E-02		4.28E-01	miss
		1004.76	18.01	0.00E+00		6.30E-02	miss
		1274.43	34.80	-1.61E-02		1.04E-01	miss
		1596.48	1.80	1.21E-01		2.38E+00	miss
+	Eu-155	45.30	1.31	1.02E+01	2.33E-01	3.00E+01	miss
		60.01	1.22	5.38E-01		2.81E+01	miss
		86.55	30.70	8.39E-02		2.33E-01	miss
		105.31	21.10	-9.15E-02		2.41E-01	miss
+	Tl-208	583.19	85.00	6.88E-02	4.56E-02	4.56E-02	miss
+	Bi-211	351.07	13.02	7.29E-01	4.86E-01	4.86E-01	miss
+	Pb-211	404.85	3.78	1.41E-01	9.92E-01	9.92E-01	miss

Analysis Report for 20-Apr-16-10014

L3-10213A-FRGS-009SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Pb-211	427.09	1.76	-3.18E-01	9.92E-01	2.50E+00	miss
		832.01	3.52	-4.07E-02		1.13E+00	miss
+	Bi-212	39.86	1.06	2.66E+00	6.61E-01	3.09E+01	miss
		727.33	6.67	1.28E-01		6.61E-01	miss
		785.37	1.10	-4.11E-01		3.46E+00	miss
		1620.50	1.47	3.99E-01		2.94E+00	miss
+	Pb-212	115.18	0.60	3.87E+00	1.25E-01	8.52E+00	miss
		238.63	* 43.60	3.33E-01		1.25E-01	miss
		300.09	3.30	3.49E-01		1.12E+00	miss
+	Pb212-XR	74.82	10.28	3.88E-01	8.02E-01	1.43E+00	miss
		77.11	17.10	1.61E-01		8.02E-01	miss
		87.35	3.97	6.23E-01		1.73E+00	miss
		89.78	1.46	1.77E+00		4.90E+00	miss
+	Bi-214	609.32	* 45.49	3.70E-01	1.11E-01	1.11E-01	miss
		768.36	4.89	1.11E-01		1.01E+00	miss
		806.18	1.26	1.05E+00		4.02E+00	miss
		934.06	3.11	5.35E-01		1.81E+00	miss
		1120.29	14.92	9.97E-02		4.53E-01	miss
		1155.21	1.63	7.63E-01		3.96E+00	miss
		1238.12	5.83	5.06E-01		1.37E+00	miss
		1280.98	1.43	6.86E-01		3.18E+00	miss
		1377.67	3.99	5.28E-01		1.83E+00	miss
		1385.31	0.79	9.36E-02		6.09E+00	miss
		1401.52	1.33	7.89E-01		3.66E+00	miss
		1407.99	2.39	8.79E-01		2.64E+00	miss
		1509.21	2.13	2.61E-01		1.92E+00	miss
		1661.27	1.05	0.00E+00		1.55E+00	miss
		1729.59	2.88	-1.07E-01		1.99E+00	miss
		1764.49	15.30	1.75E-01		5.37E-01	miss
		1847.43	2.03	3.18E-01		2.34E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	7.25	5.34E-01	1.78E-01	7.27E-01	miss
		295.22	* 18.42	2.59E-01		2.77E-01	miss
		351.93	* 35.60	2.66E-01		1.78E-01	miss
		785.96	1.06	7.52E-01		4.01E+00	miss
+	Pb214-XR	74.82	5.80	6.88E-01	1.41E+00	2.53E+00	miss
		77.11	9.70	2.84E-01		1.41E+00	miss
		87.35	2.24	1.10E+00		3.07E+00	miss
		89.78	0.82	3.16E+00		8.73E+00	miss
+	Ra-226	186.21	3.64	7.97E-01	1.25E+00	1.25E+00	miss
+	Ac-228	129.07	2.42	1.68E-01	1.92E-01	1.78E+00	miss
		209.25	3.89	6.66E-01		1.15E+00	miss
		270.24	3.46	2.22E-01		1.20E+00	miss
		328.00	2.95	-1.41E-01		1.37E+00	miss
		338.32	11.27	3.21E-01		4.81E-01	miss
		409.46	1.92	-3.62E-01		1.67E+00	miss
		463.00	4.40	1.57E-01		9.35E-01	miss
		794.95	4.25	2.24E-01		1.33E+00	miss
		911.20	* 25.80	3.00E-01		1.92E-01	miss
		964.77	4.99	4.36E-01		1.36E+00	miss
		968.97	15.80	3.16E-01		5.66E-01	miss

Analysis Report for 20-Apr-16-10014  
L3-10213A-FRGS-009SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	0.00E+00	1.92E-01	4.85E-01	miss
+	Pa-231	27.36	10.30	2.27E-01	1.46E+00	3.43E+00	miss
		283.69	1.70	3.83E-01		2.34E+00	miss
		300.07	2.47	4.67E-01		1.50E+00	miss
		302.65	2.20	-1.05E-01		1.46E+00	miss
		330.06	1.40	1.59E-01		2.72E+00	miss
+	Th-234	92.38	2.13	4.22E-01	4.06E+00	4.14E+00	miss
		92.80	2.10	4.42E-01		4.06E+00	miss
		112.81	0.21	-3.88E+00		2.21E+01	miss
+	U-235	143.76	10.96	-1.18E-01	8.30E-02	3.05E-01	miss
		163.33	5.08	1.42E-01		6.98E-01	miss
		185.71	57.20	6.63E-02		8.30E-02	miss
		202.11	1.08	-2.85E-01		2.98E+00	miss
		205.31	5.01	2.96E-02		6.96E-01	miss
+	Am-241	59.54	35.90	3.26E-01	1.07E+00	1.07E+00	miss

+ = 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

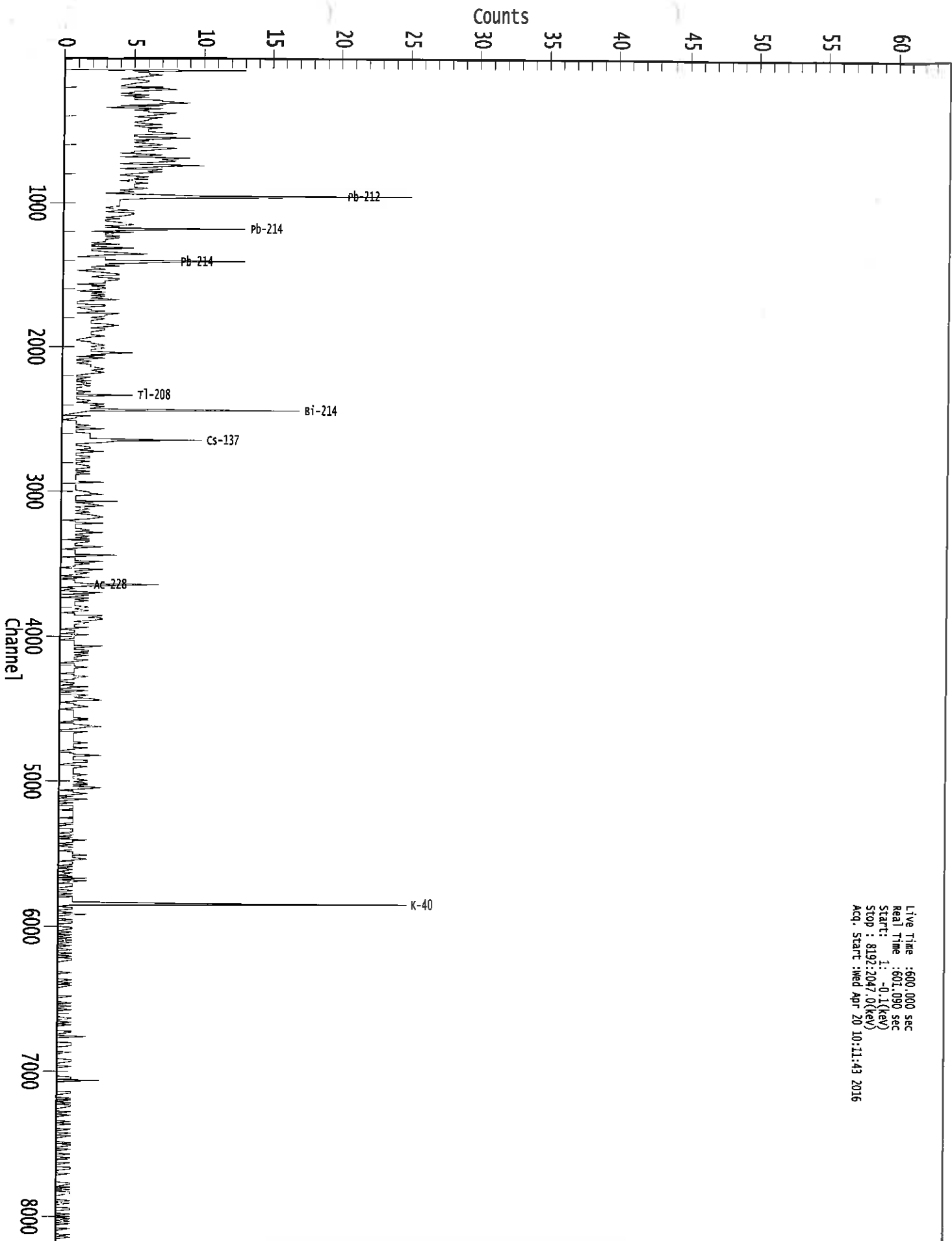
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

0000014692.CNF



Live Time : 600.000 sec  
Real Time : 601.090 sec  
Start: 1: -0.1(keV)  
Stop : 8192:2047.0(keV)  
Acq. Start : Wed Apr 20 10:11:43 2016

Analysis Report for 20-Apr-16-10015  
L3-10213A-FRGS-010SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10015  
Sample Description : L3-10213A-FRGS-010SS  
Sample Type : Miscellaneous  
Unit :  
Sample Point :  
  
Sample Size : 1.214E+03 grams  
Facility : Default  
  
Sample Taken On : 4/14/2016 8:30:00AM  
Acquisition Started : 4/20/2016 12:15:17PM  
  
Procedure : 130G 1L Sand Sample  
Operator : HTomlin  
Detector Name : P40818B  
Geometry : 130G Sand  
Live Time : 600.0 seconds  
Real Time : 601.0 seconds  
  
Dead Time : 0.17 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 1/5/2015  
Efficiency Calibration Description :  
  
Sample Number : 14693

*J.P. Weld*  
4-20-16

*[Signature]* 4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 12:26:05PM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*Dora Velidatos*  
4-25-16 C.Filer



Analysis Report for 20-Apr-16-10015

L3-10213A-FRGS-010SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	185.95	739 -	748	744.45	1.77E+01	21.06	8.26E+01	U-235
2	238.51	949 -	958	954.53	1.06E+02	26.76	6.50E+01	Ra-226
3	295.14	1176 -	1187	1180.90	4.71E+01	21.90	5.78E+01	Pb-212
4	333.10	1348 -	1357	1352.61	1.59E+01	15.29	4.22E+01	Pb-214
5	351.72	1401 -	1415	1407.06	9.88E+01	24.42	4.04E+01	Eu-152
6	409.54	1635 -	1642	1638.23	1.39E+01	9.72	1.01E+01	Ac-228
7	583.00	2326 -	2338	2331.77	3.04E+01	13.51	1.31E+01	Cs-138
8	609.13	2429 -	2443	2436.26	5.79E+01	17.15	1.23E+01	Tl-208
9	968.62	3869 -	3880	3874.23	1.19E+01	8.53	6.11E+00	Bi-214
10	1460.57	5833 -	5853	5843.25	1.97E+02	29.26	1.40E+01	Ac-228
								K-40

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.99	1460.82 *	10.66	1.00E+01	1.73E+00	miss
Tl-208	0.99	583.19 *	85.00	1.05E-01	4.81E-02	miss
Pb-212	0.99	115.18	0.60			
		238.63 *	43.60	3.89E-01	1.17E-01	miss
		300.09	3.30			
Bi-214	0.99	609.32 *	45.49	3.83E-01	1.22E-01	miss
		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			

Analysis Report for 20-Apr-16-10015

L3-10213A-FRGS-010SS

Nuclide Name	Id Confidence	Energy (keV)	Yield(%)	Activity (pCi/grams)	Activity Uncertainty	Coinc Corr
Bi-214	0.99	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			
Pb-214	0.99	2118.51	1.16			
		241.99	7.25			
		295.22 *	18.42	4.71E-01	2.31E-01	miss
		351.93 *	35.60	5.71E-01	1.68E-01	miss
Ra-226	0.99	785.96	1.06			
		186.21 *	3.64	6.96E-01	8.36E-01	miss
Ac-228	0.99	129.07	2.42			
		209.25	3.89			
		270.24	3.46			
		328.00	2.95			
		338.32 *	11.27	2.83E-01	2.76E-01	miss
		409.46 *	1.92	1.66E+00	1.19E+00	miss
		463.00	4.40			
		794.95	4.25			
		911.20	25.80			
		964.77	4.99			
		968.97 *	15.80	3.11E-01	2.24E-01	miss
U-235	0.99	1588.20	3.22			
		143.76	10.96			
		163.33	5.08			
		185.71 *	57.20	4.43E-02	5.32E-02	miss
		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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

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**INTERFERENCE CORRECTED REPORT**

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Analysis Report for 20-Apr-16-10015

L3-10213A-FRGS-010SS

	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	K-40	0.996	1.00E+01	1.73E+00	
	Tl-208	0.998	1.05E-01	4.81E-02	
X	Bi-211	0.975			
	Pb-212	0.999	3.89E-01	1.17E-01	
	Bi-214	0.999	3.83E-01	1.22E-01	
	Pb-214	0.998	5.36E-01	1.36E-01	
?	Ra-226	0.996	6.96E-01	8.36E-01	
	Ac-228	0.998	3.28E-01	1.72E-01	
?	U-235	0.998	4.43E-02	5.32E-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 2.000sigma

Analysis Report for 20-Apr-16-10015  
L3-10213A-FRGS-010SS

## UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 12:26:05PM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
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All peaks were identified.

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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)	Coinc Corr
+	K-40	1460.82 *	10.66	1.00E+01	8.31E-01	8.31E-01 miss
+	Cr-51	320.08	9.91	-5.91E-02	4.14E-01	4.14E-01 free
+	Mn-54	834.85	99.98	2.09E-03	4.06E-02	4.06E-02 miss
+	Co-58	810.76	99.45	-6.48E-03	3.61E-02	3.61E-02 miss
		1674.73	0.52	0.00E+00		3.35E+00 miss
+	Co-60	1173.23	99.85	1.02E-02	7.03E-02	7.03E-02 miss
		1332.49	99.98	2.49E-02		8.06E-02 miss
+	Nb-94	702.65	99.81	-1.71E-02	3.08E-02	3.08E-02 miss
		871.09	99.89	3.19E-04		4.60E-02 miss
+	Ag-108m	79.13	6.60	7.94E-02	4.42E-02	1.58E+00 miss
		433.94	90.50	5.27E-04		4.59E-02 miss
		614.28	89.80	-1.85E-02		4.42E-02 miss
		722.94	90.80	1.66E-02		6.74E-02 miss
+	Sn-113	255.13	2.11	3.47E-02	5.33E-02	2.02E+00 free
		391.70	64.97	-1.96E-02		5.33E-02 free
+	Cs-134	475.36	1.48	-6.22E-01	4.35E-02	2.74E+00 miss
		563.25	8.34	-1.22E-02		5.73E-01 miss
		569.33	15.37	-9.77E-02		2.98E-01 miss
		604.72	97.62	8.53E-03		4.35E-02 miss

Analysis Report for 20-Apr-16-10015

L3-10213A-FRGS-010SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	795.86	85.46	8.47E-03	4.35E-02	6.72E-02	miss
		301.95	8.69	-7.12E-02		5.49E-01	miss
		1038.61	0.99	3.65E-02		5.26E+00	miss
		1167.97	1.79	-8.96E-01		2.43E+00	miss
		1365.19	3.02	0.00E+00		1.27E+00	miss
+	Cs-137	661.66	85.10	6.44E-02	9.54E-02	9.54E-02	miss
+	Eu-152	121.78	28.67	6.74E-03	1.15E-01	1.63E-01	miss
		244.70	7.61	1.56E-01		5.48E-01	miss
		295.94	0.45	1.83E+01		1.63E+01	miss
		344.28	26.60	-4.27E-02		1.15E-01	miss
		367.79	0.86	6.60E-01		4.80E+00	miss
		411.12	2.24	-5.34E-01		1.45E+00	miss
		443.96	2.83	1.03E-01		1.61E+00	miss
		488.68	0.42	-2.34E+00		7.40E+00	miss
		563.99	0.49	-1.32E+00		9.23E+00	miss
		586.26	0.46	-8.55E+00		7.66E+00	miss
		678.62	0.47	-2.63E+00		6.37E+00	miss
		688.67	0.86	1.63E+00		5.37E+00	miss
		719.35	0.28	-1.61E+00		1.30E+01	miss
		778.90	12.96	9.13E-02		4.57E-01	miss
		810.45	0.32	-1.51E+00		1.05E+01	miss
		867.37	4.26	5.97E-02		1.17E+00	miss
		919.33	0.43	1.91E+00		1.00E+01	miss
		964.08	14.65	-2.99E-02		3.67E-01	miss
		1085.87	10.24	-6.81E-02		5.21E-01	miss
		1089.74	1.73	3.67E-01		4.08E+00	miss
		1112.07	13.69	1.04E-01		4.64E-01	miss
		1212.95	1.43	-9.08E-01		3.60E+00	miss
		1249.94	0.19	-1.84E+00		2.77E+01	miss
		1299.14	1.63	-4.83E-01		4.03E+00	miss
		1408.01	21.07	3.77E-02		2.33E-01	miss
		1457.64	0.50	-1.82E+01		2.85E+01	miss
		1528.10	0.28	4.00E+00		1.86E+01	miss
+	Eu-154	123.07	40.40	2.51E-02	1.15E-01	1.15E-01	miss
		247.93	6.89	3.17E-01		6.65E-01	miss
		591.76	4.95	4.77E-02		8.42E-01	miss
		692.42	1.78	-7.50E-01		1.99E+00	miss
		723.30	20.06	3.09E-02		3.06E-01	miss
		756.80	4.52	-6.94E-02		1.01E+00	miss
		873.18	12.08	-7.93E-03		3.81E-01	miss
		996.29	10.48	1.03E-01		4.81E-01	miss
		1004.76	18.01	9.37E-02		2.81E-01	miss
		1274.43	34.80	4.05E-03		1.70E-01	miss
		1596.48	1.80	0.00E+00		8.78E-01	miss
+	Eu-155	45.30	1.31	-4.62E+00	2.87E-01	2.62E+01	miss
		60.01	1.22	-3.12E+00		2.56E+01	miss
		86.55	30.70	8.41E-02		2.87E-01	miss
		105.31	21.10	1.02E-01		3.23E-01	miss
+	Tl-208	583.19	* 85.00	1.05E-01	5.34E-02	5.34E-02	miss
+	Bi-211	351.07	* 13.02	1.56E+00	4.11E-01	4.11E-01	miss
+	Pb-211	404.85	3.78	-2.30E-01	1.00E+00	1.00E+00	miss

Analysis Report for 20-Apr-16-10015  
 L3-10213A-FRGS-010SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Pb-211	427.09	1.76	-1.29E+00	1.00E+00	1.61E+00	miss
		832.01	3.52	-1.17E-02		1.13E+00	miss
+	Bi-212	39.86	1.06	-7.84E-01	9.22E-01	2.87E+01	miss
		727.33	6.67	2.16E-01		9.22E-01	miss
		785.37	1.10	4.86E-01		4.86E+00	miss
		1620.50	1.47	-1.50E+00		2.95E+00	miss
+	Pb-212	115.18	0.60	4.19E+00	1.14E-01	9.09E+00	miss
		238.63	* 43.60	3.89E-01		1.14E-01	miss
		300.09	3.30	7.24E-01		1.54E+00	miss
+	Pb212-XR	74.82	10.28	7.23E-01	9.51E-01	1.60E+00	miss
		77.11	17.10	7.58E-01		9.51E-01	miss
		87.35	3.97	2.86E-01		2.03E+00	miss
		89.78	1.46	3.23E-02		4.68E+00	miss
+	Bi-214	609.32	* 45.49	3.83E-01	1.04E-01	1.04E-01	miss
		768.36	4.89	6.45E-01		1.49E+00	miss
		806.18	1.26	1.44E-01		4.05E+00	miss
		934.06	3.11	3.75E-01		1.94E+00	miss
		1120.29	14.92	4.49E-01		6.97E-01	miss
		1155.21	1.63	2.54E+00		4.71E+00	miss
		1238.12	5.83	6.46E-01		1.50E+00	miss
		1280.98	1.43	-8.20E-02		3.71E+00	miss
		1377.67	3.99	-5.59E-02		1.40E+00	miss
		1385.31	0.79	1.32E+00		6.12E+00	miss
		1401.52	1.33	1.58E+00		4.76E+00	miss
		1407.99	2.39	3.31E-01		2.05E+00	miss
		1509.21	2.13	-6.36E-01		2.43E+00	miss
		1661.27	1.05	4.30E-01		4.22E+00	miss
		1729.59	2.88	0.00E+00		5.82E-01	miss
		1764.49	15.30	3.70E-01		6.85E-01	miss
		1847.43	2.03	3.20E-01		2.35E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	7.25	4.85E-01	1.50E-01	7.43E-01	miss
		295.22	* 18.42	4.71E-01		3.07E-01	miss
		351.93	* 35.60	5.71E-01		1.50E-01	miss
		785.96	1.06	6.57E-01		5.06E+00	miss
+	Pb214-XR	74.82	5.80	1.28E+00	1.68E+00	2.84E+00	miss
		77.11	9.70	1.34E+00		1.68E+00	miss
		87.35	2.24	5.06E-01		3.60E+00	miss
		89.78	0.82	5.75E-02		8.34E+00	miss
+	Ra-226	186.21	* 3.64	6.96E-01	1.36E+00	1.36E+00	miss
+	Ac-228	129.07	2.42	2.02E-01	2.85E-01	2.04E+00	miss
		209.25	3.89	4.56E-01		1.13E+00	miss
		270.24	3.46	7.62E-01		1.48E+00	miss
		328.00	2.95	5.83E-01		1.73E+00	miss
		338.32	* 11.27	2.83E-01		4.30E-01	miss
		409.46	* 1.92	1.66E+00		1.54E+00	miss
		463.00	4.40	7.58E-01		1.27E+00	miss
		794.95	4.25	4.17E-01		1.47E+00	miss
		911.20	25.80	1.89E-01		3.52E-01	miss
		964.77	4.99	4.23E-01		1.23E+00	miss
		968.97	* 15.80	3.11E-01		2.85E-01	miss

Analysis Report for 20-Apr-16-10015  
L3-10213A-FRGS-010SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	-2.93E-01	2.85E-01	1.67E+00	miss
+	Pa-231	27.36	10.30	-6.46E-01	1.20E+00	3.25E+00	miss
		283.69	1.70	7.03E-01		2.54E+00	miss
		300.07	2.47	9.67E-01		2.06E+00	miss
		302.65	2.20	-1.36E+00		1.20E+00	miss
		330.06	1.40	3.86E-01		3.24E+00	miss
+	Th-234	92.38	2.13	2.53E-02	4.04E+00	4.18E+00	miss
		92.80	2.10	-8.53E-01		4.04E+00	miss
		112.81	0.21	-4.85E+00		2.94E+01	miss
+	U-235	143.76	10.96	-2.29E-02	8.62E-02	3.71E-01	miss
		163.33	5.08	4.37E-01		8.74E-01	miss
		185.71	* 57.20	4.43E-02		8.62E-02	miss
		202.11	1.08	1.11E+00		4.17E+00	miss
		205.31	5.01	-2.47E-01		6.72E-01	miss
+	Am-241	59.54	35.90	-8.27E-02	8.87E-01	8.87E-01	miss

+ = 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

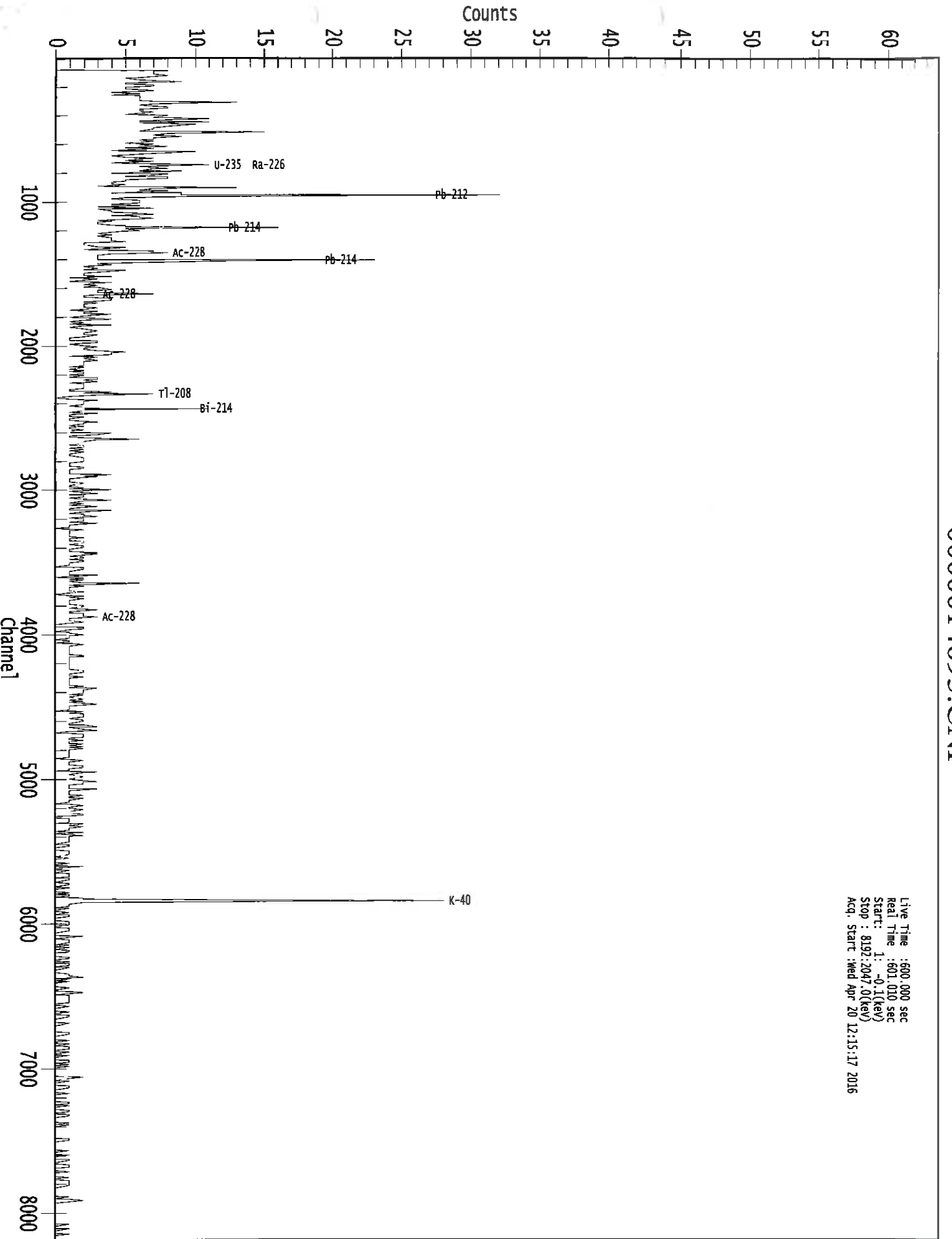
Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

0000014693.CNF

Live Time : 600.000 sec  
Real Time : 601.010 sec  
Start: 1: -0.1 (keV)  
Stop : 8197.20470 (keV)  
Acq. Start : Wed Apr 20 12:15:17 2016





Analysis Report for 20-Apr-16-10016  
L3-10213A-FRGS-011SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10016  
Sample Description : L3-10213A-FRGS-011SS  
Sample Type : Miscellaneous  
Unit :  
Sample Point :  
  
Sample Size : 1.038E+03 grams  
Facility : Default  
  
Sample Taken On : 4/13/2016 1:10:00PM  
Acquisition Started : 4/20/2016 12:16:09PM  
  
Procedure : 130G 1L Sand Sample  
Operator : HTomlin  
Detector Name : P11314X2  
Geometry : 130G Sand  
Live Time : 600.0 seconds  
Real Time : 600.4 seconds  
  
Dead Time : 0.06 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 11/26/2012  
Efficiency Calibration Description :  
  
Sample Number : 14694

*H. Tomlin*  
4-20-16  
*M. J. ...*  
4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 12:26:43PM

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

Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

DATA Validated 4-25-16  
C. J. ...

Analysis Report for 20-Apr-16-10016

L3-10213A-FRGS-011SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	74.67	297 -	303	299.90	2.15E+01	17.88	5.10E+01	Pb214-XR Pb212-XR
2	238.69	949 -	961	955.10	7.27E+01	25.57	6.86E+01	Pb-212
3	352.00	1403 -	1416	1407.81	4.69E+01	15.65	1.22E+01	Pb-214 Bi-211
4	583.17	2327 -	2336	2331.66	2.82E+01	12.62	1.16E+01	Tl-208
5	661.90	2642 -	2653	2646.43	4.54E+01	15.04	1.12E+01	Cs-137
6	1461.39	5836 -	5854	5844.88	1.29E+02	23.16	4.96E+00	K-40

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.98	1460.82 *	10.66	6.90E+00	1.38E+00	miss
Cs-137	0.99	661.66 *	85.10	1.79E-01	6.31E-02	miss
Tl-208	1.00	583.19 *	85.00	1.02E-01	4.74E-02	miss
Bi-211	0.94	351.07 *	13.02	7.79E-01	2.89E-01	miss
Pb-212	1.00	115.18	0.60			
		238.63 *	43.60	2.79E-01	1.08E-01	miss
		300.09	3.30			
Pb-214	1.00	241.99	7.25			
		295.22	18.42			
		351.93 *	35.60	2.85E-01	1.06E-01	miss
		785.96	1.06			

Analysis Report for 20-Apr-16-10016

L3-10213A-FRGS-011SS

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

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## INTERFERENCE CORRECTED REPORT

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<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.981	6.90E+00	1.38E+00	
Cs-137	0.996	1.79E-01	6.31E-02	
Tl-208	1.000	1.02E-01	4.74E-02	
? Bi-211	0.948	7.79E-01	2.89E-01	
Pb-212	1.000	2.79E-01	1.08E-01	
? Pb-214	1.000	2.85E-01	1.06E-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 2.000sigma

Analysis Report for 20-Apr-16-10016  
L3-10213A-FRGS-011SS

**UNIDENTIFIED PEAKS**

Peak Locate Performed on : 4/20/2016 12:26:43PM  
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	74.67	3.58747E-02	41.52	Tol.	Pb212-XR Pb214-XR

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

**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)	Coinc Corr
+	K-40	1460.82	* 10.66	6.90E+00	5.64E-01	5.64E-01	miss
+	Cr-51	320.08	9.91	9.65E-02	4.42E-01	4.42E-01	free
+	Mn-54	834.85	99.98	3.32E-03	5.61E-02	5.61E-02	miss
+	Co-58	810.76	99.45	6.89E-04	4.45E-02	4.45E-02	miss
		1674.73	0.52	-9.85E-01		9.67E+00	miss
+	Co-60	1173.23	99.85	-2.82E-03	5.76E-02	6.47E-02	miss
		1332.49	99.98	1.12E-02		5.76E-02	miss
+	Nb-94	702.65	99.81	-5.25E-03	1.09E-02	4.20E-02	miss
		871.09	99.89	0.00E+00		1.09E-02	miss
+	Ag-108m	79.13	6.60	-5.84E-02	2.99E-02	7.92E-01	miss
		433.94	90.50	-6.10E-03		2.99E-02	miss
		614.28	89.80	7.11E-03		4.66E-02	miss
		722.94	90.80	7.19E-03		5.14E-02	miss
+	Sn-113	255.13	2.11	-1.40E-01	5.96E-02	1.37E+00	free
		391.70	64.97	9.76E-03		5.96E-02	free
+	Cs-134	475.36	1.48	-1.20E+00	3.02E-02	1.34E+00	miss

Analysis Report for 20-Apr-16-10016

L3-10213A-FRGS-011SS

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
Cs-134	563.25	8.34	1.09E-01	3.02E-02	5.12E-01	miss
	569.33	15.37	3.17E-02		2.60E-01	miss
	604.72	97.62	-2.28E-03		3.02E-02	miss
	795.86	85.46	1.64E-03		5.86E-02	miss
	801.95	8.69	2.21E-02		3.25E-01	miss
	1038.61	0.99	2.77E+00		6.51E+00	miss
	1167.97	1.79	-1.49E+00		2.96E+00	miss
	1365.19	3.02	1.55E-01		1.68E+00	miss
	+ Cs-137	661.66	85.10		1.79E-01	5.40E-02
+ Eu-152	121.78	28.67	2.15E-02	7.82E-02	1.12E-01	miss
	244.70	7.61	-1.75E-01		4.05E-01	miss
	295.94	0.45	1.34E+01		1.42E+01	miss
	344.28	26.60	9.63E-03		1.40E-01	miss
	367.79	0.86	-3.74E-01		3.40E+00	miss
	411.12	2.24	9.74E-02		1.88E+00	miss
	443.96	2.83	2.84E-02		1.35E+00	miss
	488.68	0.42	-2.60E-01		8.52E+00	miss
	563.99	0.49	-4.17E+00		5.70E+00	miss
	586.26	0.46	-2.92E+00		7.24E+00	miss
	678.62	0.47	-1.21E-01		7.79E+00	miss
	688.67	0.86	-2.28E-01		5.27E+00	miss
	719.35	0.28	-6.37E-01		1.67E+01	miss
	778.90	12.96	0.00E+00		7.82E-02	miss
	810.45	0.32	1.40E+00		1.29E+01	miss
	867.37	4.26	0.00E+00		2.56E-01	miss
	919.33	0.43	3.18E+00		1.18E+01	miss
	964.08	14.65	1.39E-01		4.17E-01	miss
	1085.87	10.24	1.02E-01		5.99E-01	miss
	1089.74	1.73	9.06E-01		3.55E+00	miss
	1112.07	13.69	4.46E-02		4.55E-01	miss
	1212.95	1.43	3.52E-01		3.27E+00	miss
	1249.94	0.19	-5.23E+00		3.82E+01	miss
	1299.14	1.63	1.26E+00		4.24E+00	miss
	1409.01	21.07	2.64E-02		1.95E-01	miss
	1457.64	0.50	-2.45E+01		1.22E+01	miss
	1528.10	0.28	2.10E+00		1.55E+01	miss
+ Eu-154	123.07	40.40	-1.29E-02	7.08E-02	7.08E-02	miss
	247.93	6.89	-2.73E-02		6.23E-01	miss
	591.76	4.95	8.81E-02		9.99E-01	miss
	692.42	1.78	9.59E-01		2.75E+00	miss
	723.30	20.06	-1.88E-02		1.91E-01	miss
	756.80	4.52	4.20E-01		1.22E+00	miss
	873.18	12.08	-5.58E-03		3.11E-01	miss
	996.29	10.48	-1.48E-01		3.92E-01	miss
	1004.76	18.01	2.16E-02		2.97E-01	miss
	1274.43	34.80	-2.35E-02		1.10E-01	miss
	1596.48	1.80	3.42E-01		2.51E+00	miss
+ Eu-155	45.30	1.31	-2.43E+00	1.81E-01	9.67E+00	miss
	60.01	1.22	1.72E+00		1.12E+01	miss
	86.55	30.70	6.79E-02		1.97E-01	miss
	105.31	21.10	1.31E-02		1.81E-01	miss

Analysis Report for 20-Apr-16-10016

L3-10213A-FRGS-011SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
+	Tl-208	583.19	*	85.00	1.02E-01	5.05E-02	5.05E-02	miss
+	Bi-211	351.07	*	13.02	7.79E-01	2.52E-01	2.52E-01	miss
+	Pb-211	404.85		3.78	4.77E-01	1.19E+00	1.19E+00	miss
		427.09		1.76	-2.46E-01		2.12E+00	miss
		832.01		3.52	2.78E-01		1.76E+00	miss
+	Bi-212	39.86		1.06	5.92E-01	8.93E-01	9.87E+00	miss
		727.33		6.67	3.34E-01		8.93E-01	miss
		785.37		1.10	1.43E+00		5.13E+00	miss
		1620.50		1.47	0.00E+00		1.14E+00	miss
+	Pb-212	115.18		0.60	-8.91E-01	1.30E-01	6.13E+00	miss
		238.63	*	43.60	2.79E-01		1.30E-01	miss
		300.09		3.30	2.80E-01		1.26E+00	miss
+	Pb212-XR	74.82		10.28	6.52E-01	5.52E-01	1.05E+00	miss
		77.11		17.10	2.95E-01		5.52E-01	miss
		87.35		3.97	5.75E-01		1.53E+00	miss
		89.78		1.46	5.26E-01		3.26E+00	miss
+	Bi-214	609.32		45.49	2.35E-01	2.19E-01	2.19E-01	miss
		768.36		4.89	1.64E-01		1.07E+00	miss
		806.18		1.26	9.59E-01		4.55E+00	miss
		934.06		3.11	1.11E+00		2.37E+00	miss
		1120.29		14.92	-9.13E-03		4.51E-01	miss
		1155.21		1.63	7.78E-01		4.47E+00	miss
		1238.12		5.83	-2.49E-02		1.05E+00	miss
		1280.98		1.43	2.59E-01		2.67E+00	miss
		1377.67		3.99	2.75E-01		1.28E+00	miss
		1385.31		0.79	0.00E+00		1.88E+00	miss
		1401.52		1.33	2.09E+00		5.47E+00	miss
		1407.99		2.39	2.33E-01		1.71E+00	miss
		1509.21		2.13	2.76E-01		2.03E+00	miss
		1661.27		1.05	0.00E+00		1.63E+00	miss
		1729.59		2.88	6.79E-01		2.44E+00	miss
		1764.49		15.30	3.84E-01		7.53E-01	miss
		1847.43		2.03	3.36E-01		2.47E+00	miss
>		2118.51		1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99		7.25	2.63E-01	9.22E-02	6.15E-01	miss
		295.22		18.42	3.39E-01		3.58E-01	miss
		351.93	*	35.60	2.85E-01		9.22E-02	miss
		785.96		1.06	1.84E+00		5.33E+00	miss
+	Pb214-XR	74.82		5.80	1.16E+00	9.73E-01	1.86E+00	miss
		77.11		9.70	5.20E-01		9.73E-01	miss
		87.35		2.24	1.02E+00		2.71E+00	miss
		89.78		0.82	9.36E-01		5.81E+00	miss
+	Ra-226	186.21		3.64	7.42E-01	1.15E+00	1.15E+00	miss
+	Ac-228	129.07		2.42	6.91E-01	3.44E-01	1.47E+00	miss
		209.25		3.89	7.25E-02		8.53E-01	miss
		270.24		3.46	5.14E-01		1.21E+00	miss
		328.00		2.95	4.01E-01		1.49E+00	miss
		338.32		11.27	2.18E-01		4.77E-01	miss
		409.46		1.92	3.42E-01		2.19E+00	miss
		463.00		4.40	4.77E-02		9.47E-01	miss

Analysis Report for 20-Apr-16-10016

L3-10213A-FRGS-011SS

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
Ac-228	794.95	4.25	5.50E-01	3.44E-01	1.42E+00	miss
	911.20	25.80	1.81E-01		3.44E-01	miss
	964.77	4.99	5.35E-01		1.38E+00	miss
	968.97	15.80	5.63E-02		4.78E-01	miss
	1588.20	3.22	-2.71E-02		1.39E+00	miss
+ Pa-231	27.36	10.30	0.00E+00	1.65E-01	1.65E-01	miss
	283.69	1.70	-3.70E-01		1.66E+00	miss
	300.07	2.47	3.74E-01		1.68E+00	miss
	302.65	2.20	-4.26E-01		1.34E+00	miss
	330.06	1.40	-2.04E-01		2.79E+00	miss
+ Th-234	92.38	2.13	1.85E+00	3.30E+00	3.30E+00	miss
	92.80	2.10	1.45E+00		3.33E+00	miss
+ U-235	112.81	0.21	-4.73E+00	7.41E-02	1.67E+01	miss
	143.76	10.96	1.06E-01		3.38E-01	miss
	163.33	5.08	-7.23E-02		5.10E-01	miss
	185.71	57.20	4.38E-02		7.41E-02	miss
	202.11	1.08	2.50E-01		2.93E+00	miss
+ Am-241	205.31	5.01	1.85E-01	3.91E-01	7.23E-01	miss
	59.54	35.90	1.05E-01		3.91E-01	miss

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = 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

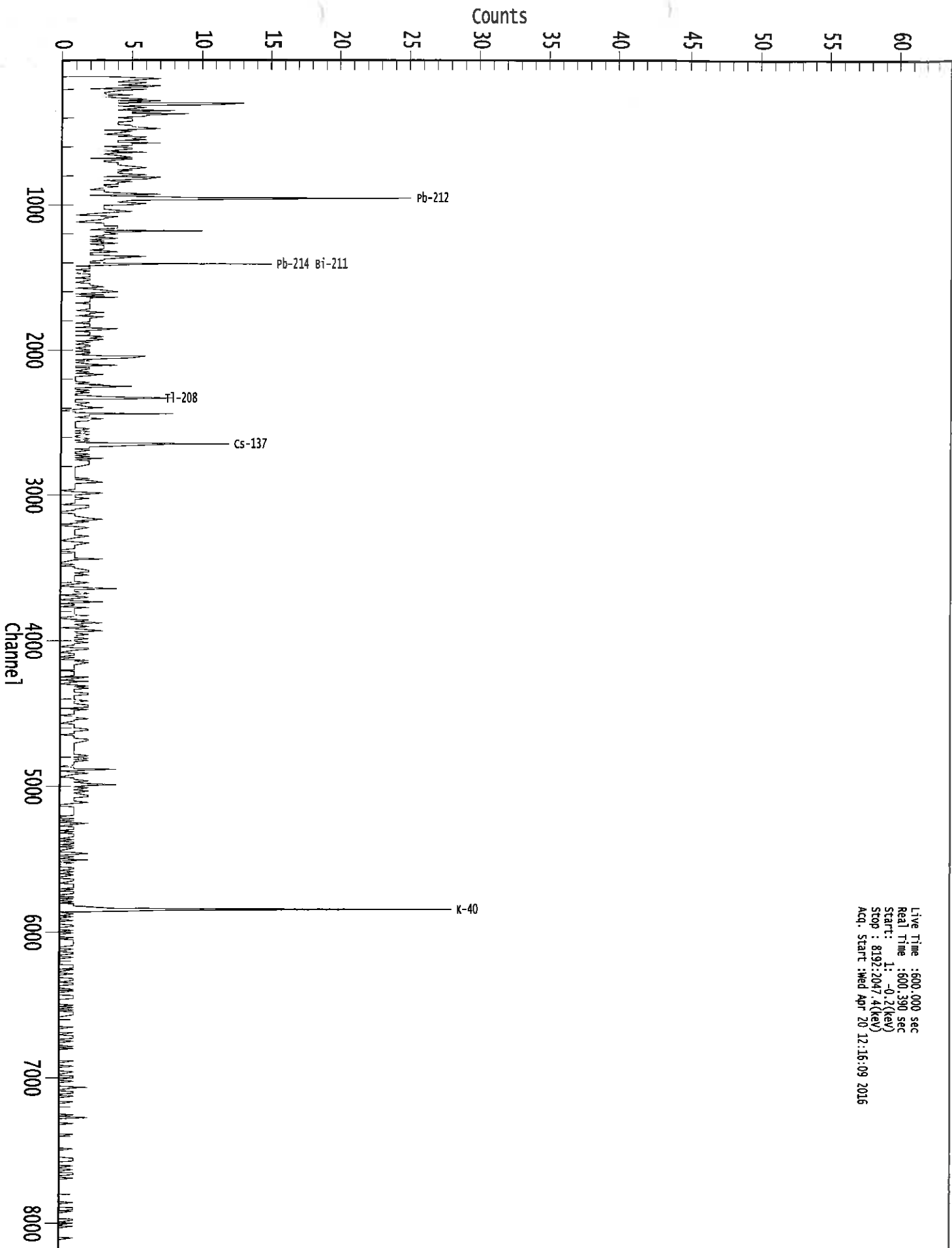
Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

0000014694.CNF

Live Time : 600.000 sec  
Real Time : 600.390 sec  
Start : 1: -0.2 (kev)  
Stop : 8192.20474 (kev)  
Acq. Start : Wed Apr 20 12:16:09 2016





Analysis Report for 20-Apr-16-10018  
L3-10213A-FRGS-012SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10018  
Sample Description : L3-10213A-FRGS-012SS  
Sample Type : Miscellaneous  
Unit :  
Sample Point :  
  
Sample Size : 1.521E+03 grams  
Facility : Default  
  
Sample Taken On : 4/13/2016 1:05:00PM  
Acquisition Started : 4/20/2016 12:38:21PM  
  
Procedure : 130G 1L Sand Sample  
Operator : JWelch  
Detector Name : P40818B  
Geometry : 130G Sand  
Live Time : 600.0 seconds  
Real Time : 601.1 seconds  
  
Dead Time : 0.18 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 1/5/2015  
Efficiency Calibration Description :  
  
Sample Number : 14695

*J.P. Wald*  
4-20-16

*[Signature]*  
4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 12:48:44PM

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

Tentative NID Library : C:\C Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*Data Validated 4-25-16*  
*C. J. Lee*

Analysis Report for 20-Apr-16-10018

L3-10213A-FRGS-012SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	238.55	947 -	959	954.70	6.70E+01	28.72	1.06E+02	Pb-212
2	295.05	1175 -	1187	1180.51	4.98E+01	17.80	2.24E+01	Pb-214 Eu-152
3	351.90	1402 -	1413	1407.78	5.67E+01	20.14	4.07E+01	Pb-214 Bi-211
4	608.96	2430 -	2443	2435.59	3.99E+01	15.39	1.61E+01	Bi-214
5	911.26	3640 -	3649	3644.73	1.66E+01	10.67	1.28E+01	Ac-228
6	1460.41	5833 -	5854	5842.61	1.59E+02	26.83	1.60E+01	K-40

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.99	1460.82 *	10.66	6.47E+00	1.23E+00	miss
Pb-212	1.00	115.18	0.60			
		238.63 *	43.60	1.97E-01	9.04E-02	miss
		300.09	3.30			
Bi-214	0.99	609.32 *	45.49	2.11E-01	8.51E-02	miss
		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			

Analysis Report for 20-Apr-16-10018

L3-10213A-FRGS-012SS

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- ? = 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 2.000sigma

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Analysis Report for 20-Apr-16-10018

L3-10213A-FRGS-012SS

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**UNIDENTIFIED PEAKS**


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Peak Locate Performed on : 4/20/2016 12:48:44PM  
 Peak Locate From Channel : 120  
 Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
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All peaks were identified.

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 2.000sigma

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**NUCLIDE MDA REPORT**


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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)	Coinc Corr
+	K-40	1460.82	*	10.66	6.47E+00	7.24E-01	7.24E-01 miss
+	Cr-51	320.08		9.91	4.37E-02	4.07E-01	4.07E-01 free
+	Mn-54	834.85		99.98	-2.01E-04	3.95E-02	3.95E-02 miss
+	Co-58	810.76		99.45	6.26E-03	3.37E-02	3.37E-02 miss
		1674.73		0.52	0.00E+00	2.70E+00	miss
+	Co-60	1173.23		99.85	1.55E-02	4.37E-02	5.27E-02 miss
		1332.49		99.98	1.16E-03	4.37E-02	miss
+	Nb-94	702.65		99.81	-6.18E-03	2.84E-02	3.18E-02 miss
		871.09		99.89	-1.37E-02	2.84E-02	miss
+	Ag-108m	79.13		6.60	-1.24E-02	3.16E-02	1.28E+00 miss
		433.94		90.50	3.37E-03	3.16E-02	miss
		614.28		89.80	1.02E-02	3.80E-02	miss
		722.94		90.80	-1.15E-03	4.19E-02	miss
+	Sn-113	255.13		2.11	9.25E-02	4.52E-02	1.69E+00 free
		391.70		64.97	-7.76E-03	4.52E-02	free
+	Cs-134	475.36		1.48	2.76E-01	3.48E-02	2.60E+00 miss
		563.25		8.34	4.40E-02	3.88E-01	miss
		569.33		15.37	2.70E-02	2.62E-01	miss
		604.72		97.62	-8.54E-03	3.48E-02	miss

Analysis Report for 20-Apr-16-10018

L3-10213A-FRGS-012SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	795.86	85.46	1.00E-02	3.48E-02	5.64E-02	miss
		801.95	8.69	4.46E-02		4.02E-01	miss
		1038.61	0.99	5.83E-02		3.76E+00	miss
		1167.97	1.79	-3.58E-01		2.25E+00	miss
		1365.19	3.02	7.08E-01		2.07E+00	miss
+	Cs-137	661.66	85.10	8.12E-02	8.55E-02	8.55E-02	miss
+	Eu-152	121.78	28.67	3.73E-02	1.02E-01	1.30E-01	miss
		244.70	7.61	-5.58E-02		3.76E-01	miss
		295.94	0.45	7.45E+00		1.07E+01	miss
		344.28	26.60	-1.10E-02		1.02E-01	miss
		367.79	0.86	1.02E+00		3.43E+00	miss
		411.12	2.24	-1.39E-01		1.30E+00	miss
		443.96	2.83	4.10E-01		1.33E+00	miss
		488.68	0.42	9.02E-01		6.94E+00	miss
		563.99	0.49	-1.67E+00		6.09E+00	miss
		586.26	0.46	-5.91E+00		4.73E+00	miss
		678.62	0.47	7.31E-01		7.19E+00	miss
		688.67	0.86	-8.69E-02		4.57E+00	miss
		719.35	0.28	1.39E+00		1.04E+01	miss
		778.90	12.96	7.29E-02		3.29E-01	miss
		810.45	0.32	1.13E+00		8.42E+00	miss
		867.37	4.26	1.55E-01		9.37E-01	miss
		919.33	0.43	-6.18E-01		5.46E+00	miss
		964.08	14.65	9.69E-02		4.21E-01	miss
		1085.87	10.24	-1.19E-01		2.55E-01	miss
		1089.74	1.73	2.58E-01		2.69E+00	miss
		1112.07	13.69	-7.32E-02		2.44E-01	miss
		1212.95	1.43	-1.91E-01		2.88E+00	miss
		1249.94	0.19	4.76E+00		2.70E+01	miss
		1299.14	1.63	-3.33E-01		2.28E+00	miss
		1408.01	21.07	4.49E-02		2.16E-01	miss
		1457.64	0.50	-5.67E+00		1.79E+01	miss
		1528.10	0.28	-1.14E+00		1.48E+01	miss
+	Eu-154	123.07	40.40	3.11E-02	8.33E-02	9.64E-02	miss
		247.93	6.89	-1.89E-01		3.73E-01	miss
		591.76	4.95	-5.53E-02		6.25E-01	miss
		692.42	1.78	-2.50E-01		2.08E+00	miss
		723.30	20.06	-2.24E-03		1.90E-01	miss
		756.80	4.52	1.46E-01		7.40E-01	miss
		873.18	12.08	-1.69E-02		2.73E-01	miss
		996.29	10.48	-2.67E-02		2.97E-01	miss
		1004.76	18.01	2.18E-02		2.01E-01	miss
		1274.43	34.80	-2.42E-02		8.33E-02	miss
		1596.48	1.80	0.00E+00		7.01E-01	miss
+	Eu-155	45.30	1.31	-5.81E-01	2.18E-01	1.96E+01	miss
		60.01	1.22	1.73E+00		2.09E+01	miss
		86.55	30.70	5.69E-02		2.18E-01	miss
		105.31	21.10	3.18E-02		2.28E-01	miss
+	Tl-208	583.19	85.00	7.99E-02	8.08E-02	8.08E-02	miss
+	Bi-211	351.07	* 13.02	7.15E-01	3.12E-01	3.12E-01	miss
+	Pb-211	404.85	3.78	-5.76E-02	8.36E-01	8.36E-01	miss

Analysis Report for 20-Apr-16-10018

L3-10213A-FRGS-012SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Pb-211	427.09	1.76	-2.14E-01	8.36E-01	1.70E+00	miss
		832.01	3.52	3.56E-01		1.26E+00	miss
+	Bi-212	39.86	1.06	-3.24E+00	8.16E-01	2.29E+01	miss
		727.33	6.67	4.54E-02		8.16E-01	miss
		785.37	1.10	1.29E-01		3.64E+00	miss
		1620.50	1.47	6.40E-01		2.97E+00	miss
+	Pb-212	115.18	0.60	1.51E+00	1.22E-01	6.32E+00	miss
		238.63	* 43.60	1.97E-01		1.22E-01	miss
		300.09	3.30	4.23E-01		1.01E+00	miss
+	Pb212-XR	74.82	10.28	4.89E-01	7.32E-01	1.18E+00	miss
		77.11	17.10	3.58E-01		7.32E-01	miss
		87.35	3.97	4.60E-01		1.58E+00	miss
		89.78	1.46	2.03E+00		4.04E+00	miss
+	Bi-214	609.32	* 45.49	2.11E-01	9.06E-02	9.06E-02	miss
		768.36	4.89	-8.47E-02		8.61E-01	miss
		806.18	1.26	3.69E-01		2.47E+00	miss
		934.06	3.11	-2.41E-01		7.59E-01	miss
		1120.29	14.92	2.25E-01		4.87E-01	miss
		1155.21	1.63	-4.84E-01		3.58E+00	miss
		1238.12	5.83	2.55E-01		1.10E+00	miss
		1280.98	1.43	1.26E-01		3.61E+00	miss
		1377.67	3.99	4.17E-01		1.25E+00	miss
		1385.31	0.79	2.63E-01		4.88E+00	miss
		1401.52	1.33	-4.97E-01		2.33E+00	miss
		1407.99	2.39	3.95E-01		1.90E+00	miss
		1509.21	2.13	-1.79E-01		1.54E+00	miss
		1661.27	1.05	4.58E-01		3.37E+00	miss
		1729.59	2.88	-6.44E-02		1.26E+00	miss
		1764.49	15.30	1.70E-01		4.63E-01	miss
		1847.43	2.03	2.55E-01		1.88E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	7.25	2.35E-01	1.14E-01	5.94E-01	miss
		295.22	* 18.42	3.97E-01		1.64E-01	miss
		351.93	* 35.60	2.61E-01		1.14E-01	miss
		785.96	1.06	1.64E+00		4.27E+00	miss
+	Pb214-XR	74.82	5.80	8.67E-01	1.29E+00	2.09E+00	miss
		77.11	9.70	6.30E-01		1.29E+00	miss
		87.35	2.24	8.15E-01		2.80E+00	miss
		89.78	0.82	3.61E+00		7.19E+00	miss
+	Ra-226	186.21	3.64	2.33E-01	9.86E-01	9.86E-01	miss
+	Ac-228	129.07	2.42	7.97E-02	1.71E-01	1.47E+00	miss
		209.25	3.89	3.95E-01		9.01E-01	miss
		270.24	3.46	4.48E-01		1.12E+00	miss
		328.00	2.95	3.56E-01		1.04E+00	miss
		338.32	11.27	3.64E-01		4.41E-01	miss
		409.46	1.92	6.32E-01		1.73E+00	miss
		463.00	4.40	2.72E-01		9.37E-01	miss
		794.95	4.25	2.36E-01		1.13E+00	miss
		911.20	* 25.80	2.03E-01		1.71E-01	miss
		964.77	4.99	4.66E-01		1.28E+00	miss
		968.97	15.80	2.50E-01		4.55E-01	miss

Analysis Report for 20-Apr-16-10018

L3-10213A-FRGS-012SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	3.59E-02	1.71E-01	1.73E+00	miss
+	Pa-231	27.36	10.30	-4.38E-01	1.28E+00	2.42E+00	miss
		283.69	1.70	-1.69E-01		1.80E+00	miss
		300.07	2.47	5.65E-01		1.35E+00	miss
		302.65	2.20	-2.80E-01		1.28E+00	miss
		330.06	1.40	-2.25E-02		2.12E+00	miss
+	Th-234	92.38	2.13	1.70E+00	3.37E+00	3.37E+00	miss
		92.80	2.10	8.19E-01		3.40E+00	miss
		112.81	0.21	1.13E-01		2.23E+01	miss
+	U-235	143.76	10.96	-2.26E-01	6.42E-02	2.72E-01	miss
		163.33	5.08	2.09E-02		5.84E-01	miss
		185.71	57.20	1.13E-02		6.42E-02	miss
		202.11	1.08	-2.10E-02		2.64E+00	miss
		205.31	5.01	7.77E-02		6.09E-01	miss
+	Am-241	59.54	35.90	2.07E-01	7.42E-01	7.42E-01	miss

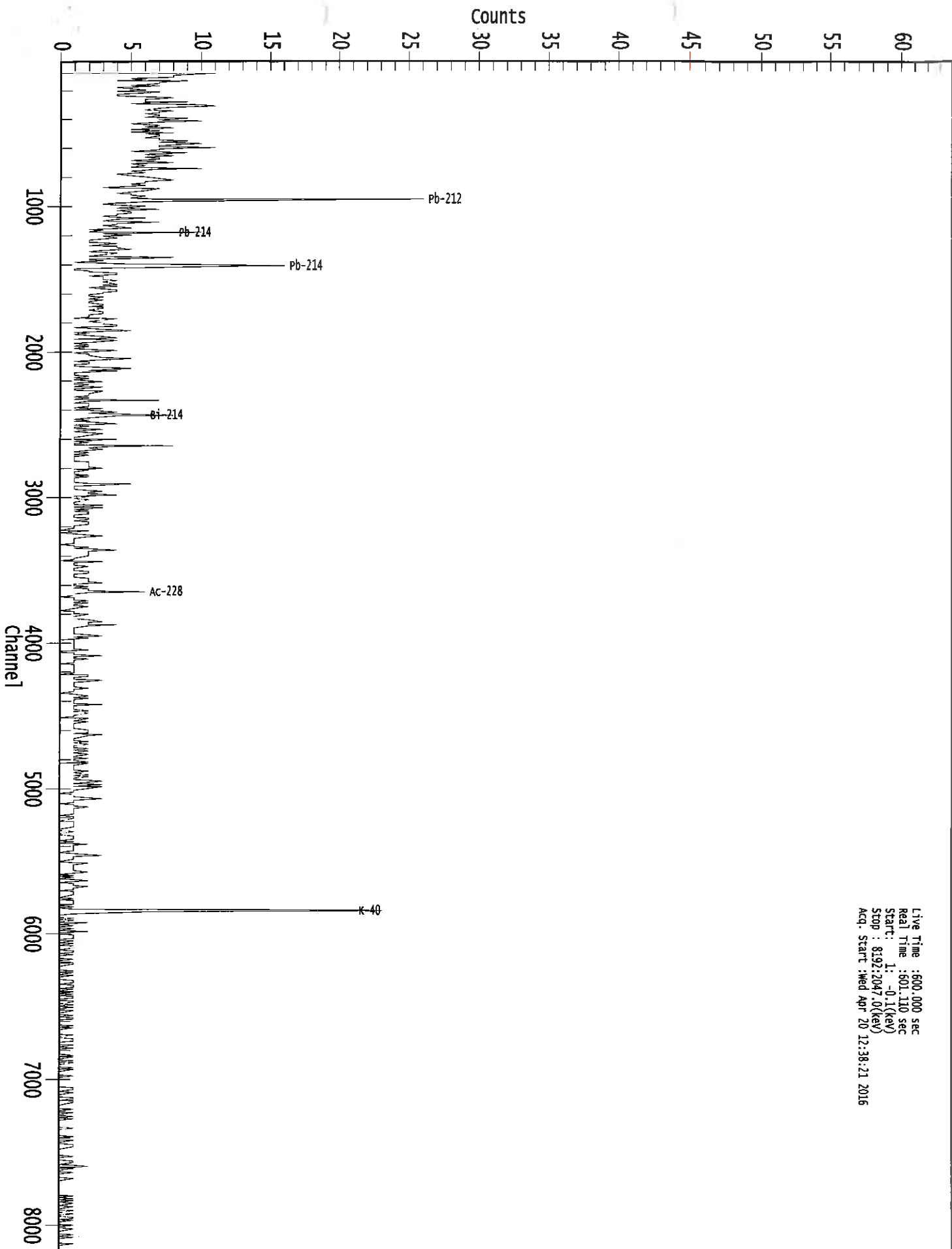
- + = Nuclide identified during the nuclide identification
- \* = Energy line found in the spectrum
- > = MDA value not calculated
- @ = Half-life too short to be able to perform the decay correction
- ? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Coincidence correction performed.

- free = No coincidence correction required.
- miss = Nuclide energy was not found in the coincidence library.

0000014695.CNF

Live Time : 600.000 sec  
Real Time : 601.110 sec  
Start : 1--0-1(kev)  
Stop : 8192:2047.0(kev)  
Acq. Start : Wed Apr 20 12:38:21 2016





Analysis Report for 20-Apr-16-10019  
L3-10213A-FRGS-013SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10019  
Sample Description : L3-10213A-FRGS-013SS  
Sample Type : Miscellaneous  
Unit :  
Sample Point :  
  
Sample Size : 1.085E+03 grams  
Facility : Default  
  
Sample Taken On : 4/13/2016 12:45:00PM  
Acquisition Started : 4/20/2016 12:38:37PM  
  
Procedure : 130G 1L Sand Sample  
Operator : JWelch  
Detector Name : P11314X2  
Geometry : 130G Sand  
Live Time : 600.0 seconds  
Real Time : 600.4 seconds  
  
Dead Time : 0.06 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 11/26/2012  
Efficiency Calibration Description :  
  
Sample Number : 14696

*J.P. Welch*  
420-16  
*M.D.W.* 4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 12:49:29PM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*Data Validated 4-25-16*  
*CF/lee*

Analysis Report for 20-Apr-16-10019

L3-10213A-FRGS-013SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	238.78	949 -	960	955.44	7.96E+01	22.64	3.88E+01	Pb-212
2	295.35	1177 -	1187	1181.46	2.29E+01	14.40	2.02E+01	Pb-214 Eu-152
3	352.09	1401 -	1414	1408.16	3.53E+01	16.68	2.74E+01	Pb-214 Bi-211
4	583.20	2326 -	2338	2331.82	2.52E+01	11.64	7.53E+00	Tl-208
5	609.77	2433 -	2443	2437.99	2.62E+01	12.06	9.59E+00	Bi-214
6	1461.26	5834 -	5853	5844.36	1.12E+02	22.11	8.59E+00	K-40

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.98	1460.82 *	10.66	5.74E+00	1.24E+00	miss
Tl-208	1.00	583.19 *	85.00	8.75E-02	4.17E-02	miss
Pb-212	0.99	115.18 *	0.60			
		238.63 *	43.60	2.92E-01	9.55E-02	miss
		300.09	3.30			
Bi-214	0.99	609.32 *	45.49	1.75E-01	8.33E-02	miss
		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			

Analysis Report for 20-Apr-16-10019

L3-10213A-FRGS-013SS

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>	<b>Coinc Corr</b>
Bi-214	0.99	1764.49	15.30			
		1847.43	2.03			
		2118.51	1.16			
Pb-214	0.99	241.99	7.25			
		295.22 *	18.42	2.29E-01	1.49E-01	miss
		351.93 *	35.60	2.05E-01	1.02E-01	miss
		785.96	1.06			

\* = Energy line found in the spectrum.

- = Manually added nuclide.

? = Manually edited nuclide.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.988	5.74E+00	1.24E+00	
Tl-208	1.000	8.75E-02	4.17E-02	
X Bi-211	0.938			
Pb-212	0.999	2.92E-01	9.55E-02	
Bi-214	0.995	1.75E-01	8.33E-02	
Pb-214	0.999	2.13E-01	8.44E-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 2.000sigma

Analysis Report for 20-Apr-16-10019  
L3-10213A-FRGS-013SS

## UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 12:49:29PM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
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All peaks were identified.

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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)	Coinc Corr
+	K-40	1460.82	*	10.66	5.74E+00	6.86E-01	6.86E-01 miss
+	Cr-51	320.08		9.91	5.26E-02	3.89E-01	3.89E-01 free
+	Mn-54	834.85		99.98	9.84E-03	4.58E-02	4.58E-02 miss
+	Co-58	810.76		99.45	6.60E-04	3.68E-02	3.68E-02 miss
		1674.73		0.52	0.00E+00	3.40E+00	miss
+	Co-60	1173.23		99.85	-1.48E-02	4.38E-02	4.38E-02 miss
		1332.49		99.98	-1.22E-03	5.52E-02	miss
+	Nb-94	702.65		99.81	-6.59E-03	3.59E-02	4.39E-02 miss
		871.09		99.89	6.44E-04	3.59E-02	miss
+	Ag-108m	79.13		6.60	-1.88E-01	2.76E-02	8.94E-01 miss
		433.94		90.50	-4.25E-03	2.86E-02	miss
		614.28		89.80	-1.80E-02	3.16E-02	miss
		722.94		90.80	-7.51E-03	2.76E-02	miss
+	Sn-113	255.13		2.11	-1.65E-01	4.32E-02	1.24E+00 free
		391.70		64.97	-1.58E-02	4.32E-02	free
+	Cs-134	475.36		1.48	-5.23E-01	5.19E-02	2.29E+00 miss
		563.25		8.34	2.78E-02	3.74E-01	miss
		569.33		15.37	-3.99E-02	2.28E-01	miss
		604.72		97.62	2.41E-02	5.19E-02	miss

Analysis Report for 20-Apr-16-10019

L3-10213A-FRGS-013SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	795.86	85.46	1.19E-02	5.19E-02	6.03E-02	miss
		801.95	8.69	7.05E-02		3.93E-01	miss
		1038.61	0.99	1.48E+00		6.23E+00	miss
		1167.97	1.79	1.66E+00		3.96E+00	miss
		1365.19	3.02	0.00E+00		4.70E-01	miss
+	Cs-137	661.66	85.10	2.43E-02	6.58E-02	6.58E-02	miss
+	Eu-152	121.78	28.67	-1.64E-03	8.20E-02	8.20E-02	miss
		244.70	7.61	-2.54E-01		3.02E-01	miss
		295.94	0.45	1.03E+01		1.14E+01	miss
		344.28	26.60	5.22E-02		1.39E-01	miss
		367.79	0.86	-5.18E-01		3.73E+00	miss
		411.12	2.24	-3.27E-01		1.36E+00	miss
		443.96	2.83	-3.80E-01		1.04E+00	miss
		488.68	0.42	-3.73E-01		6.69E+00	miss
		563.99	0.49	-2.35E-01		5.45E+00	miss
		586.26	0.46	-1.85E+00		6.93E+00	miss
		678.62	0.47	-9.24E-01		6.43E+00	miss
		688.67	0.86	-8.97E-01		3.57E+00	miss
		719.35	0.28	-4.06E+00		1.13E+01	miss
		778.90	12.96	-1.84E-02		2.98E-01	miss
		810.45	0.32	1.15E+00		1.06E+01	miss
		867.37	4.26	0.00E+00		2.45E-01	miss
		919.33	0.43	1.56E-01		6.90E+00	miss
		964.08	14.65	1.35E-01		4.25E-01	miss
		1085.87	10.24	2.81E-02		4.06E-01	miss
		1089.74	1.73	5.37E-01		3.12E+00	miss
		1112.07	13.69	7.59E-02		4.35E-01	miss
		1212.95	1.43	-5.94E-01		3.63E+00	miss
		1249.94	0.19	-4.57E+00		2.79E+01	miss
		1299.14	1.63	-6.63E-01		2.28E+00	miss
		1408.01	21.07	1.81E-02		2.35E-01	miss
		1457.64	0.50	-5.91E+00		1.17E+01	miss
		1528.10	0.28	0.00E+00		5.45E+00	miss
+	Eu-154	123.07	40.40	3.28E-02	6.78E-02	6.78E-02	miss
		247.93	6.89	-1.88E-01		3.78E-01	miss
		591.76	4.95	8.03E-03		6.49E-01	miss
		692.42	1.78	1.71E-01		1.73E+00	miss
		723.30	20.06	-1.13E-02		1.58E-01	miss
		756.80	4.52	3.89E-02		1.10E+00	miss
		873.18	12.08	-3.20E-02		2.98E-01	miss
		996.29	10.48	4.72E-02		4.35E-01	miss
		1004.76	18.01	2.17E-02		2.20E-01	miss
		1274.43	34.80	-3.88E-02		1.05E-01	miss
		1596.48	1.80	8.17E-02		2.41E+00	miss
+	Eu-155	45.30	1.31	-7.01E-01	1.52E-01	6.91E+00	miss
		60.01	1.22	-1.43E+00		8.98E+00	miss
		86.55	30.70	-6.30E-02		1.52E-01	miss
		105.31	21.10	5.60E-02		1.89E-01	miss
+	Tl-208	583.19	* 85.00	8.75E-02	4.29E-02	4.29E-02	miss
+	Bi-211	351.07	* 13.02	5.61E-01	3.49E-01	3.49E-01	miss
+	Pb-211	404.85	3.78	2.18E-01	9.61E-01	9.61E-01	miss

Analysis Report for 20-Apr-16-10019

L3-10213A-FRGS-013SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Pb-211	427.09	1.76	-3.51E-01	9.61E-01	9.94E-01	miss
		832.01	3.52	2.88E-01		1.28E+00	miss
+	Bi-212	39.86	1.06	2.33E+00	9.30E-01	9.45E+00	miss
		727.33	6.67	3.23E-01		9.30E-01	miss
		785.37	1.10	5.99E-01		4.28E+00	miss
		1620.50	1.47	1.43E+00		5.29E+00	miss
+	Pb-212	115.18	0.60	1.71E+00	9.40E-02	6.00E+00	miss
		238.63	* 43.60	2.92E-01		9.40E-02	miss
		300.09	3.30	-1.88E-01		9.40E-01	miss
+	Pb212-XR	74.82	10.28	5.86E-01	5.51E-01	9.21E-01	miss
		77.11	17.10	4.56E-01		5.51E-01	miss
		87.35	3.97	3.29E-01		1.27E+00	miss
		89.78	1.46	1.52E+00		3.55E+00	miss
+	Bi-214	609.32	* 45.49	1.75E-01	8.81E-02	8.81E-02	miss
		768.36	4.89	4.50E-01		1.32E+00	miss
		806.18	1.26	3.14E-01		2.69E+00	miss
		934.06	3.11	3.11E-01		1.40E+00	miss
		1120.29	14.92	3.42E-01		5.96E-01	miss
		1155.21	1.63	-2.99E-01		3.07E+00	miss
		1238.12	5.83	5.96E-01		1.39E+00	miss
		1280.98	1.43	-8.27E-02		3.74E+00	miss
		1377.67	3.99	4.65E-01		1.58E+00	miss
		1385.31	0.79	0.00E+00		1.80E+00	miss
		1401.52	1.33	7.98E-01		3.71E+00	miss
		1407.99	2.39	1.59E-01		2.07E+00	miss
		1509.21	2.13	0.00E+00		7.14E-01	miss
		1661.27	1.05	1.15E+00		5.36E+00	miss
		1729.59	2.88	2.17E-01		1.59E+00	miss
		1764.49	15.30	1.72E-01		5.43E-01	miss
		1847.43	2.03	-2.82E-01		2.37E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	7.25	2.65E-01	1.28E-01	5.67E-01	miss
		295.22	* 18.42	2.29E-01		2.04E-01	miss
		351.93	* 35.60	2.05E-01		1.28E-01	miss
		785.96	1.06	1.76E+00		5.10E+00	miss
+	Pb214-XR	74.82	5.80	1.04E+00	9.71E-01	1.63E+00	miss
		77.11	9.70	8.04E-01		9.71E-01	miss
		87.35	2.24	5.84E-01		2.25E+00	miss
		89.78	0.82	2.70E+00		6.32E+00	miss
+	Ra-226	186.21	3.64	8.37E-01	1.08E+00	1.08E+00	miss
+	Ac-228	129.07	2.42	-4.31E-02	3.20E-01	1.23E+00	miss
		209.25	3.89	2.48E-01		8.16E-01	miss
		270.24	3.46	1.97E-01		1.04E+00	miss
		328.00	2.95	7.70E-01		1.43E+00	miss
		338.32	11.27	1.51E-01		3.92E-01	miss
		409.46	1.92	1.72E-01		1.70E+00	miss
		463.00	4.40	2.38E-01		8.58E-01	miss
		794.95	4.25	4.35E-01		1.28E+00	miss
		911.20	25.80	1.75E-01		3.20E-01	miss
		964.77	4.99	3.71E-01		1.25E+00	miss
		968.97	15.80	1.92E-01		4.58E-01	miss

Analysis Report for 20-Apr-16-10019

L3-10213A-FRGS-013SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	0.00E+00	3.20E-01	4.91E-01	miss
+	Pa-231	27.36	10.30	0.00E+00	1.58E-01	1.58E-01	miss
		283.69	1.70	0.00E+00		1.49E+00	miss
		300.07	2.47	-2.51E-01		1.26E+00	miss
		302.65	2.20	3.62E-01		1.54E+00	miss
		330.06	1.40	-9.16E-01		2.13E+00	miss
+	Th-234	92.38	2.13	2.24E+00	3.32E+00	3.32E+00	miss
		92.80	2.10	2.89E+00		3.48E+00	miss
		112.81	0.21	9.72E+00		1.98E+01	miss
+	U-235	143.76	10.96	-5.21E-02	6.68E-02	2.65E-01	miss
		163.33	5.08	-1.29E-01		5.07E-01	miss
		185.71	57.20	4.21E-02		6.68E-02	miss
		202.11	1.08	-2.99E-01		2.46E+00	miss
		205.31	5.01	-8.54E-02		3.86E-01	miss
+	Am-241	59.54	35.90	4.49E-02	3.25E-01	3.25E-01	miss

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = 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

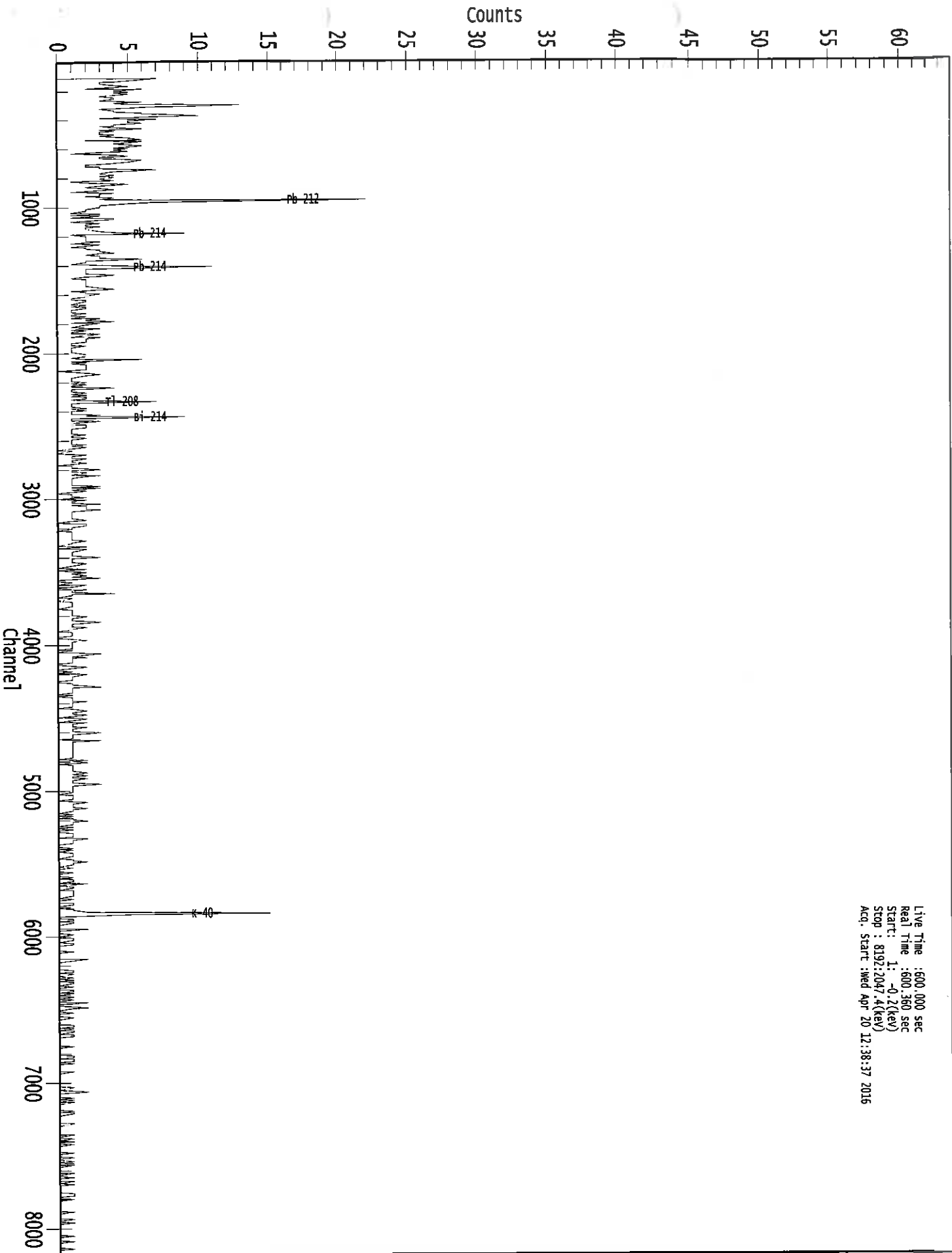
Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

0000014696.CNF

Live Time : 600.000 sec  
Real Time : 600.360 sec  
Start: 1: -0.2(kev)  
STOP : 8192:2047.4(kev)  
Acq. Start :Wed Apr 20 12:38:37 2016





Analysis Report for 20-Apr-16-10020  
L3-10213A-FRGS-014SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10020  
Sample Description : L3-10213A-FRGS-014SS  
Sample Type : Miscellaneous  
Unit :  
Sample Point :  
  
Sample Size : 8.892E+02 grams  
Facility : Default  
  
Sample Taken On : 4/14/2016 9:30:00AM  
Acquisition Started : 4/20/2016 12:53:52PM  
  
Procedure : 130G 1L Sand Sample  
Operator : JWelch  
Detector Name : P40818B  
Geometry : 130G Sand  
Live Time : 600.0 seconds  
Real Time : 601.0 seconds  
  
Dead Time : 0.17 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 1/5/2015  
Efficiency Calibration Description :  
  
Sample Number : 14697

*JW. Welch*  
*4-20-16*  
*me* 4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 1:04:01PM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*Data Validated 4-25-16*  
*CS/ker*

Analysis Report for 20-Apr-16-10020  
L3-10213A-FRGS-014SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	77.01	306 -	315	309.11	5.57E+01	27.72	1.01E+02	Pb214-XR Pb212-XR
2	238.53	948 -	960	954.61	1.51E+02	37.09	1.46E+02	Pb-212
3	270.19	1075 -	1087	1081.18	3.28E+01	21.96	6.64E+01	Ac-228 Rn-219
4	295.05	1174 -	1185	1180.54	5.64E+01	22.43	5.53E+01	Pb-214 Eu-152
5	338.23	1349 -	1359	1353.14	4.67E+01	18.04	3.26E+01	Ac-228
6	351.85	1398 -	1412	1407.57	1.25E+02	27.36	4.92E+01	Pb-214 Bi-211
7	510.75	2036 -	2047	2042.87	2.54E+01	16.89	4.11E+01	.....
8	583.12	2324 -	2339	2332.24	6.86E+01	20.59	2.87E+01	Tl-208
9	609.07	2429 -	2444	2436.01	9.62E+01	21.58	1.56E+01	Bi-214
10	910.98	3636 -	3652	3643.62	5.73E+01	16.86	1.13E+01	Ac-228
11	1460.46	5831 -	5853	5842.80	2.62E+02	32.67	3.33E+00	K-40
12	1764.00	7052 -	7065	7058.39	1.97E+01	10.55	8.67E+00	Bi-214

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.99	1460.82 *	10.66	1.83E+01	2.77E+00	miss
Tl-208	1.00	583.19 *	85.00	3.22E-01	1.04E-01	miss
Pb-212	0.99	115.18 *	0.60			
		238.63 *	43.60	7.60E-01	2.24E-01	miss
		300.09	3.30			
Pb212-XR	1.00	74.82 *	10.28			
		77.11 *	17.10	1.99E+00	1.07E+00	miss
		87.35	3.97			
		89.78	1.46			
Bi-214	0.99	609.32 *	45.49	8.69E-01	2.21E-01	miss
		768.36	4.89			
		806.18	1.26			

Analysis Report for 20-Apr-16-10020  
L3-10213A-FRGS-014SS

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>	<b>Coinc Corr</b>
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	1.10E+00	5.98E-01	miss
		1847.43	2.03			
2118.51	1.16					
Pb-214	0.99	241.99	7.25			
		295.22 *	18.42	7.69E-01	3.30E-01	miss
		351.93 *	35.60	9.89E-01	2.68E-01	miss
Pb214-XR	1.00	785.96	1.06			
		74.82	5.80			
		77.11 *	9.70	3.50E+00	1.91E+00	miss
Ac-228	0.39	87.35	2.24			
		89.78	0.82			
		129.07	2.42			
		209.25	3.89			
		270.24 *	3.46	2.25E+00	1.55E+00	miss
		328.00	2.95			
		338.32 *	11.27	1.14E+00	4.76E-01	miss
		409.46	1.92			
		463.00	4.40			
		794.95	4.25			
		911.20 *	25.80	1.20E+00	3.67E-01	miss
		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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

Analysis Report for 20-Apr-16-10020  
L3-10213A-FRGS-014SS

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## INTERFERENCE CORRECTED REPORT

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	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
	K-40	0.992	1.83E+01	2.77E+00	
	Tl-208	1.000	3.22E-01	1.04E-01	
X	Bi-211	0.964			
	Pb-212	0.999	7.60E-01	2.24E-01	
?	Pb212-XR	1.000	1.99E+00	1.07E+00	
	Bi-214	0.996	8.97E-01	2.07E-01	
	Pb-214	0.999	9.02E-01	2.08E-01	
?	Pb214-XR	1.000	3.50E+00	1.91E+00	
X	Rn-219	0.960			
	Ac-228	0.397	1.21E+00	2.86E-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 2.000sigma

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Analysis Report for 20-Apr-16-10020  
L3-10213A-FRGS-014SS

### UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 1:04:01PM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
7	510.75	4.23841E-02	33.20		

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

### 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)	Coinc Corr
+	K-40	1460.82	* 10.66	1.83E+01	6.72E-01	6.72E-01	miss
+	Cr-51	320.08	9.91	8.56E-02	6.26E-01	6.26E-01	free
+	Mn-54	834.85	99.98	-2.66E-02	6.18E-02	6.18E-02	miss
+	Co-58	810.76	99.45	-2.63E-02	5.72E-02	5.72E-02	miss
		1674.73	0.52	0.00E+00		4.58E+00	miss
+	Co-60	1173.23	99.85	-6.70E-03	8.34E-02	9.01E-02	miss
		1332.49	99.98	-2.97E-03		8.34E-02	miss
+	Nb-94	702.65	99.81	4.70E-02	7.37E-02	9.12E-02	miss
		871.09	99.89	5.22E-03		7.37E-02	miss
+	Ag-108m	79.13	6.60	-1.31E+00	5.71E-02	2.34E+00	miss
		433.94	90.50	-1.06E-02		5.71E-02	miss
		614.28	89.80	1.42E-02		8.02E-02	miss
		722.94	90.80	1.75E-02		9.21E-02	miss
+	Sn-113	255.13	2.11	2.01E-01	1.00E-01	2.71E+00	free
		391.70	64.97	1.50E-02		1.00E-01	free
+	Cs-134	475.36	1.48	1.94E-01	7.34E-02	4.11E+00	miss
		563.25	8.34	-1.53E-01		7.05E-01	miss
		569.33	15.37	-7.48E-02		3.85E-01	miss

Analysis Report for 20-Apr-16-10020

L3-10213A-FRGS-014SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	604.72	97.62	1.06E-02	7.34E-02	7.34E-02	miss
		795.86	85.46	7.41E-03		1.13E-01	miss
		801.95	8.69	2.45E-01		8.06E-01	miss
		1038.61	0.99	7.97E-01		8.97E+00	miss
		1167.97	1.79	-6.24E-01		4.28E+00	miss
		1365.19	3.02	2.02E-01		2.53E+00	miss
+	Cs-137	661.66	85.10	5.31E-02	1.30E-01	1.30E-01	miss
+	Eu-152	121.78	28.67	-1.42E-02	1.89E-01	2.34E-01	miss
		244.70	7.61	8.71E-02		9.10E-01	miss
		295.94	0.45	-2.59E+00		2.28E+01	miss
		344.28	26.60	-1.67E-02		1.89E-01	miss
		367.79	0.86	-8.08E-01		6.34E+00	miss
		411.12	2.24	-1.16E+00		2.64E+00	miss
		443.96	2.83	-1.75E-01		2.04E+00	miss
		488.68	0.42	2.26E+00		1.47E+01	miss
		563.99	0.49	3.43E+00		1.32E+01	miss
		586.26	0.46	-9.67E+00		1.38E+01	miss
		678.62	0.47	2.36E+00		1.56E+01	miss
		688.67	0.86	-1.46E+00		7.81E+00	miss
		719.35	0.28	4.50E+00		2.99E+01	miss
		778.90	12.96	3.43E-02		4.49E-01	miss
		810.45	0.32	-1.14E+01		1.44E+01	miss
		867.37	4.26	4.89E-01		2.13E+00	miss
		919.33	0.43	2.11E-01		1.18E+01	miss
		964.08	14.65	3.95E-01		7.69E-01	miss
		1085.87	10.24	1.32E-01		8.35E-01	miss
		1089.74	1.73	3.51E-01		5.27E+00	miss
		1112.07	13.69	-1.71E-02		6.34E-01	miss
		1212.95	1.43	-1.31E-01		7.61E+00	miss
		1249.94	0.19	-6.91E-01		5.58E+01	miss
		1299.14	1.63	9.39E-01		5.92E+00	miss
		1408.01	21.07	-6.37E-02		4.12E-01	miss
		1457.64	0.50	-2.74E+00		4.03E+01	miss
		1528.10	0.28	1.56E+00		2.01E+01	miss
+	Eu-154	123.07	40.40	-1.35E-02	1.67E-01	1.67E-01	miss
		247.93	6.89	1.77E-01		9.49E-01	miss
		591.76	4.95	-1.70E-01		1.22E+00	miss
		692.42	1.78	-1.05E+00		3.31E+00	miss
		723.30	20.06	1.24E-01		4.01E-01	miss
		756.80	4.52	-1.28E-01		1.91E+00	miss
		873.18	12.08	-4.48E-02		5.68E-01	miss
		996.29	10.48	3.83E-02		7.17E-01	miss
		1004.76	18.01	-1.08E-01		4.20E-01	miss
		1274.43	34.80	-6.52E-02		2.54E-01	miss
		1596.48	1.80	8.86E-01		4.11E+00	miss
+	Eu-155	45.30	1.31	-1.16E+01	3.78E-01	3.87E+01	miss
		60.01	1.22	7.26E+00		4.59E+01	miss
		86.55	30.70	-1.16E-01		3.78E-01	miss
		105.31	21.10	9.36E-02		4.09E-01	miss
+	Tl-208	583.19	*	85.00	1.07E-01	1.07E-01	miss
+	Bi-211	351.07	*	13.02	2.71E+00	6.16E-01	miss

Analysis Report for 20-Apr-16-10020

L3-10213A-FRGS-014SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
+	Pb-211	404.85	3.78	8.21E-02	1.55E+00	1.55E+00	miss
		427.09	1.76	8.68E-01		3.68E+00	miss
		832.01	3.52	9.01E-01		2.50E+00	miss
+	Bi-212	39.86	1.06	-1.02E+01	1.83E+00	4.22E+01	miss
		727.33	6.67	1.40E+00		1.83E+00	miss
		785.37	1.10	3.76E+00		8.89E+00	miss
		1620.50	1.47	9.57E-01		5.89E+00	miss
+	Pb-212	115.18	0.60	2.32E+00	2.44E-01	1.24E+01	miss
		238.63	* 43.60	7.60E-01		2.44E-01	miss
		300.09	3.30	1.72E+00		2.36E+00	miss
+	Pb212-XR	74.82	10.28	6.75E-01	1.47E+00	2.58E+00	miss
		77.11	* 17.10	1.99E+00		1.47E+00	miss
		87.35	3.97	9.85E-01		3.02E+00	miss
		89.78	1.46	4.71E+00		8.63E+00	miss
+	Bi-214	609.32	* 45.49	8.69E-01	1.58E-01	1.58E-01	miss
		768.36	4.89	7.93E-01		2.20E+00	miss
		806.18	1.26	5.23E-01		5.14E+00	miss
		934.06	3.11	-3.44E-01		2.65E+00	miss
		1120.29	14.92	9.30E-01		1.13E+00	miss
		1155.21	1.63	-9.04E-01		5.06E+00	miss
		1238.12	5.83	5.63E-01		2.41E+00	miss
		1280.98	1.43	1.19E+00		7.07E+00	miss
		1377.67	3.99	6.80E-01		2.67E+00	miss
		1385.31	0.79	-4.88E-01		1.18E+01	miss
		1401.52	1.33	-6.18E-01		5.02E+00	miss
		1407.99	2.39	-5.60E-01		3.62E+00	miss
		1509.21	2.13	1.43E+00		4.29E+00	miss
		1661.27	1.05	3.92E+00		1.03E+01	miss
		1729.59	2.88	1.47E+00		3.85E+00	miss
		1764.49	* 15.30	1.10E+00		6.79E-01	miss
		1847.43	2.03	0.00E+00		1.18E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	7.25	1.31E+00	2.25E-01	1.31E+00	miss
		295.22	* 18.42	7.69E-01		4.11E-01	miss
		351.93	* 35.60	9.89E-01		2.25E-01	miss
		785.96	1.06	2.10E+00		8.34E+00	miss
+	Pb214-XR	74.82	5.80	1.20E+00	2.59E+00	4.58E+00	miss
		77.11	* 9.70	3.50E+00		2.59E+00	miss
		87.35	2.24	1.75E+00		5.36E+00	miss
		89.78	0.82	8.39E+00		1.54E+01	miss
+	Ra-226	186.21	3.64	1.70E+00	2.18E+00	2.18E+00	miss
+	Ac-228	129.07	2.42	1.09E+00	3.11E-01	3.03E+00	miss
		209.25	3.89	1.46E+00		1.87E+00	miss
		270.24	* 3.46	2.25E+00		2.30E+00	miss
		328.00	2.95	7.05E-01		2.23E+00	miss
		338.32	* 11.27	1.14E+00		5.36E-01	miss
		409.46	1.92	-1.28E-01		3.28E+00	miss
		463.00	4.40	7.93E-01		1.82E+00	miss
		794.95	4.25	7.10E-01		2.46E+00	miss
		911.20	* 25.80	1.20E+00		3.11E-01	miss
		964.77	4.99	1.01E+00		2.19E+00	miss

Analysis Report for 20-Apr-16-10020

L3-10213A-FRGS-014SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	968.97	15.80	7.87E-01	3.11E-01	9.23E-01	miss
		1588.20	3.22	1.08E+00		3.47E+00	miss
+	Pa-231	27.36	10.30	9.19E-01	2.18E+00	5.08E+00	miss
		283.69	1.70	5.23E-01		3.61E+00	miss
		300.07	2.47	2.30E+00		3.15E+00	miss
		302.65	2.20	-1.73E+00		2.18E+00	miss
		330.06	1.40	-8.48E-01		4.43E+00	miss
+	Th-234	92.38	2.13	4.73E+00	7.10E+00	7.10E+00	miss
		92.80	2.10	6.26E+00		7.43E+00	miss
		112.81	0.21	-1.27E+00		4.29E+01	miss
+	U-235	143.76	10.96	-6.31E-02	1.43E-01	6.07E-01	miss
		163.33	5.08	1.24E-01		1.13E+00	miss
		185.71	57.20	1.32E-01		1.43E-01	miss
		202.11	1.08	-1.00E+00		5.31E+00	miss
		205.31	5.01	-3.83E-01		8.71E-01	miss
+	Am-241	59.54	35.90	9.62E-01	1.81E+00	1.81E+00	miss

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

@ = Half-life too short to be able to perform the decay correction

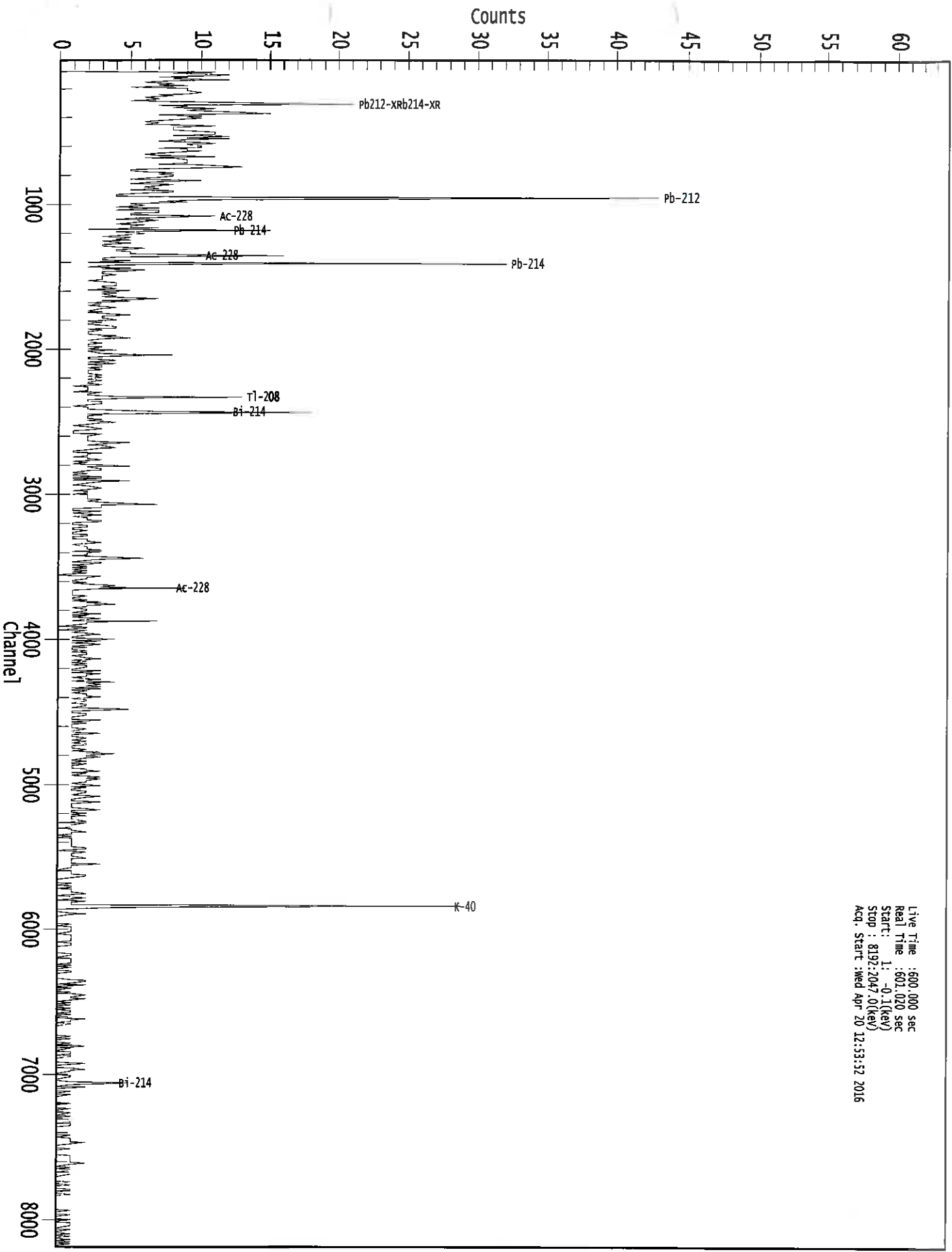
? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.





Live Time : 600.000 sec  
Real Time : 601.020 sec  
Start : 1:--0.1(kev)  
Stop : 8192:2047.0(kev)  
Acq. Start : Wed Apr 20 12:53:52 2016

Analysis Report for 20-Apr-16-10001  
L3-10213A-FIGS-001SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10001  
Sample Description : L3-10213A-FIGS-001SS  
Sample Type : Miscellaneous  
Unit :  
Sample Point :  
  
Sample Size : 8.915E+02 grams  
Facility : Default  
  
Sample Taken On : 4/14/2016 9:40:00AM  
Acquisition Started : 4/20/2016 7:48:57AM  
  
Procedure : 130G 1L Soil Sample  
Operator : JWelch  
Detector Name : P11314X2  
Geometry : 130G Soil  
Live Time : 600.0 seconds  
Real Time : 600.4 seconds  
  
Dead Time : 0.07 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 6/28/2012  
Efficiency Calibration Description :  
  
Sample Number : 14677

*J.P. Arnold*  
4-20-16

*Debra Sen* 4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 7:59:07AM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*Debra Sen*  
4-20-16

*Dana Valsted*  
4-25-16 Fuller

Analysis Report for 20-Apr-16-10001

L3-10213A-FIGS-001SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
M 1	74.75	294 -	315	300.25	4.23E+01	18.76	1.49E+02	Pb214-XR
m 2	77.03	294 -	315	309.36	8.41E+01	23.29	1.45E+02	Pb212-XR
3	87.07	344 -	355	349.46	6.16E+01	32.54	1.33E+02	Pb214-XR
M 4	238.75	948 -	976	955.34	2.04E+02	29.78	8.17E+01	Pb212-XR
m 5	242.07	948 -	976	968.60	6.19E+01	17.46	5.67E+01	Pb214-XR
6	295.39	1174 -	1188	1181.60	1.21E+02	31.13	8.30E+01	Pb214-XR
7	338.52	1346 -	1359	1353.94	4.56E+01	20.89	5.28E+01	Pb212-XR
8	351.98	1401 -	1416	1407.72	1.94E+02	33.03	6.04E+01	Eu-155
9	510.87	2037 -	2049	2042.69	3.76E+01	17.65	3.47E+01	Pb-212
10	583.48	2326 -	2340	2332.92	6.19E+01	20.27	3.22E+01	Pb-214
11	609.43	2428 -	2443	2436.66	1.67E+02	28.19	2.48E+01	Pb-214
12	661.77	2641 -	2652	2645.91	2.16E+01	13.19	2.07E+01	Bi-214
13	911.42	3636 -	3651	3644.19	5.45E+01	16.71	1.31E+01	Cs-137
14	969.27	3870 -	3881	3875.55	2.29E+01	11.91	1.23E+01	Ac-228
15	1120.88	4477 -	4488	4482.10	3.10E+01	14.10	1.99E+01	Ac-228
16	1461.26	5833 -	5856	5844.35	2.88E+02	34.46	6.86E+00	Bi-214
17	1764.95	7054 -	7067	7060.48	2.90E+01	10.77	0.00E+00	K-40
								Bi-214

..... ANH-511

JPW  
4-20-16

M = First peak in a multiplet region  
 m = Other peak in a multiplet region  
 F = Fitted singlet  
 Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.98	1460.82 *	10.66	1.78E+01	2.64E+00	miss
Cs-137	0.99	661.66 *	85.10	9.83E-02	6.10E-02	miss
Eu-155	0.31	45.30	1.31			
		60.01	1.22			
		86.55 *	30.70	4.93E-01	2.78E-01	miss

Analysis Report for 20-Apr-16-10001

L3-10213A-FIGS-001SS

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>	<b>Coinc Corr</b>
Eu-155	0.31	105.31	21.10			
Tl-208	0.99	583.19 *	85.00	2.58E-01	9.00E-02	miss
Pb-212	0.99	115.18	0.60			
		238.63 *	43.60	8.97E-01	1.95E-01	miss
		300.09	3.30			
Bi-214	0.99	609.32 *	45.49	1.34E+00	2.78E-01	miss
		768.36	4.89			
		806.18	1.26			
		934.06	3.11			
		1120.29 *	14.92	1.14E+00	5.28E-01	miss
		1155.21	1.63			
		1238.12	5.83			
		1280.98	1.43			
		1377.67	3.99			
		1385.31	0.79			
		1401.52	1.33			
		1407.99	2.39			
		1509.21	2.13			
		1661.27	1.05			
		1729.59	2.88			
		1764.49 *	15.30	1.45E+00	5.51E-01	miss
		1847.43	2.03			
		2118.51	1.16			
Pb-214	0.99	241.99 *	7.25	1.65E+00	5.35E-01	miss
		295.22 *	18.42	1.46E+00	4.40E-01	miss
		351.93 *	35.60	1.35E+00	3.16E-01	miss
		785.96	1.06			
Pb214-XR	0.99	74.82 *	5.80	2.74E+00	1.36E+00	miss
		77.11 *	9.70	3.00E+00	1.07E+00	miss
		87.35 *	2.24	6.74E+00	3.86E+00	miss
		89.78	0.82			
Ac-228	0.99	129.07	2.42			
		209.25	3.89			
		270.24	3.46			
		328.00	2.95			
		338.32 *	11.27	9.78E-01	4.76E-01	miss
		409.46	1.92			
		463.00	4.40			
		794.95	4.25			
		911.20 *	25.80	1.01E+00	3.23E-01	miss
		964.77	4.99			
		968.97 *	15.80	7.24E-01	3.82E-01	miss
		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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Analysis Report for 20-Apr-16-10001

L3-10213A-FIGS-001SS

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

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## INTERFERENCE CORRECTED REPORT

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<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.988	1.78E+01	2.64E+00	
Cs-137	0.999	9.83E-02	6.10E-02	
Eu-155	0.311	2.81E-01	2.85E-01	
Tl-208	0.995	2.58E-01	9.00E-02	
X Bi-211	0.950			
Pb-212	0.999	8.97E-01	1.95E-01	
X Pb212-XR	0.999			
Bi-214	0.995	1.32E+00	2.24E-01	
Pb-214	0.999	1.44E+00	2.31E-01	
Pb214-XR	0.999	2.90E+00	8.12E-01	
Ac-228	0.998	9.11E-01	2.19E-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 2.000sigma

Analysis Report for 20-Apr-16-10001  
L3-10213A-FIGS-001SS

## UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 7:59:07AM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

Peak No.	Energy (keV)	Peak Size (CPS)	Peak CPS (%) Uncertainty	Peak Type	Tolerance Nuclide
9	510.87	6.27273E-02	23.44		AWH-511

SPW  
4-20-16

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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)	Coinc Corr
+	K-40	1460.82	* 10.66	1.78E+01	7.91E-01	7.91E-01	miss
+	Cr-51	320.08	9.91	-2.45E-01	4.54E-01	4.54E-01	free
+	Mn-54	834.85	99.98	-2.71E-02	5.49E-02	5.49E-02	miss
+	Co-58	810.76	99.45	-9.43E-03	5.08E-02	5.08E-02	miss
		1674.73	0.52	0.00E+00		4.06E+00	miss
+	Co-60	1173.23	99.85	1.51E-02	6.65E-02	9.02E-02	miss
		1332.49	99.98	-5.88E-03		6.65E-02	miss
+	Nb-94	702.65	99.81	-5.20E-03	4.84E-02	4.84E-02	miss
		871.09	99.89	-6.20E-03		6.56E-02	miss
+	Ag-108m	79.13	6.60	1.06E-02	4.91E-02	1.56E+00	miss
		433.94	90.50	-8.28E-03		5.05E-02	miss
		614.28	89.80	-1.96E-02		4.91E-02	miss
		722.94	90.80	3.31E-02		8.19E-02	miss
+	Sn-113	255.13	2.11	-5.03E-01	8.06E-02	2.36E+00	free
		391.70	64.97	-1.06E-02		8.06E-02	free
+	Cs-134	475.36	1.48	9.95E-01	5.27E-02	4.33E+00	miss
		563.25	8.34	1.43E-01		7.56E-01	miss
		569.33	15.37	-2.99E-02		3.42E-01	miss

Analysis Report for 20-Apr-16-10001

L3-10213A-FIGS-001SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	604.72	97.62	-7.48E-03	5.27E-02	5.27E-02	miss
		795.86	85.46	6.12E-02		1.21E-01	miss
		801.95	8.69	2.56E-01		8.07E-01	miss
		1038.61	0.99	-1.90E+00		6.97E+00	miss
		1167.97	1.79	1.07E+00		5.03E+00	miss
		1365.19	3.02	1.55E-01		2.74E+00	miss
+	Cs-137	661.66	* 85.10	9.83E-02	8.21E-02	8.21E-02	miss
+	Eu-152	121.78	28.67	-2.31E-02	1.60E-01	1.60E-01	miss
		244.70	7.61	-3.20E-02		6.15E-01	miss
		295.94	0.45	4.44E+01		2.75E+01	miss
		344.28	26.60	5.63E-02		2.07E-01	miss
		367.79	0.86	-3.47E+00		4.20E+00	miss
		411.12	2.24	-9.40E-01		2.34E+00	miss
		443.96	2.83	8.70E-01		2.49E+00	miss
		488.68	0.42	-1.91E+00		1.24E+01	miss
		563.99	0.49	3.53E-02		1.12E+01	miss
		586.26	0.46	-4.56E+00		1.01E+01	miss
		678.62	0.47	4.28E+00		1.45E+01	miss
		688.67	0.86	1.48E+00		8.38E+00	miss
		719.35	0.28	-2.93E+00		1.76E+01	miss
		778.90	12.96	1.39E-03		4.00E-01	miss
		810.45	0.32	-1.84E+00		1.48E+01	miss
		867.37	4.26	1.55E-01		1.81E+00	miss
		919.33	0.43	-6.08E+00		1.21E+01	miss
		964.08	14.65	1.73E-01		5.93E-01	miss
		1085.87	10.24	4.85E-01		1.06E+00	miss
		1089.74	1.73	-5.95E-02		4.41E+00	miss
		1112.07	13.69	2.03E-01		7.26E-01	miss
		1212.95	1.43	-5.23E-01		6.45E+00	miss
		1249.94	0.19	-1.45E+01		3.76E+01	miss
		1299.14	1.63	-1.55E+00		4.48E+00	miss
		1408.01	21.07	2.18E-01		5.09E-01	miss
		1457.64	0.50	-1.14E+01		2.38E+01	miss
		1528.10	0.28	-9.02E+00		1.79E+01	miss
+	Eu-154	123.07	40.40	-2.80E-03	1.22E-01	1.22E-01	miss
		247.93	6.89	-1.23E-02		7.00E-01	miss
		591.76	4.95	2.41E-01		1.21E+00	miss
		692.42	1.78	1.28E-01		3.37E+00	miss
		723.30	20.06	4.23E-02		3.56E-01	miss
		756.80	4.52	3.32E-01		1.49E+00	miss
		873.18	12.08	7.71E-02		5.79E-01	miss
		996.29	10.48	1.22E-02		5.85E-01	miss
		1004.76	18.01	-1.47E-01		3.42E-01	miss
		1274.43	34.80	6.52E-02		2.43E-01	miss
		1596.48	1.80	-4.44E-01		4.25E+00	miss
+	Eu-155	45.30	1.31	-1.09E+01	3.12E-01	1.25E+01	miss
		60.01	1.22	3.37E+00		2.04E+01	miss
		86.55	* 30.70	4.93E-01		3.97E-01	miss
		105.31	21.10	9.39E-03		3.12E-01	miss
+	Tl-208	583.19	* 85.00	2.58E-01	9.89E-02	9.89E-02	miss
+	Bi-211	351.07	* 13.02	3.70E+00	6.09E-01	6.09E-01	miss

Analysis Report for 20-Apr-16-10001

L3-10213A-FIGS-001SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
+	Pb-211	404.85	3.78	-1.31E-01	1.46E+00	1.46E+00	miss
		427.09	1.76	3.54E-01		3.45E+00	miss
		832.01	3.52	4.42E-01		2.03E+00	miss
+	Bi-212	39.86	1.06	3.99E+00	1.76E+00	1.89E+01	miss
		727.33	6.67	1.64E+00		1.76E+00	miss
		785.37	1.10	2.29E-01		6.24E+00	miss
		1620.50	1.47	9.74E-01		4.52E+00	miss
+	Pb-212	115.18	0.60	-1.71E+00	1.43E-01	8.52E+00	miss
		238.63	* 43.60	8.97E-01		1.43E-01	miss
		300.09	3.30	1.23E+00		2.36E+00	miss
+	Pb212-XR	74.82	* 10.28	1.55E+00	8.56E-01	1.57E+00	miss
		77.11	* 17.10	1.70E+00		8.56E-01	miss
		87.35	* 3.97	3.80E+00		3.06E+00	miss
		89.78	1.46	6.70E+00		6.69E+00	miss
+	Bi-214	609.32	* 45.49	1.34E+00	1.35E-01	1.71E-01	miss
		768.36	4.89	1.05E+00		2.22E+00	miss
		806.18	1.26	3.14E+00		6.80E+00	miss
		934.06	3.11	2.20E+00		3.61E+00	miss
		1120.29	* 14.92	1.14E+00		6.23E-01	miss
		1155.21	1.63	-1.07E-01		6.23E+00	miss
		1238.12	5.83	1.05E+00		2.47E+00	miss
		1280.98	1.43	1.45E+00		6.64E+00	miss
		1377.67	3.99	2.58E+00		3.64E+00	miss
		1385.31	0.79	0.00E+00		8.62E+00	miss
		1401.52	1.33	-1.72E+00		5.18E+00	miss
		1407.99	2.39	1.92E+00		4.47E+00	miss
		1509.21	2.13	1.91E+00		4.49E+00	miss
		1661.27	1.05	-3.49E-01		6.47E+00	miss
		1729.59	2.88	8.45E-01		3.69E+00	miss
		1764.49	* 15.30	1.45E+00		1.35E-01	miss
		1847.43	2.03	1.53E+00		5.09E+00	miss
>		2118.51	1.16	0.00E+00		0.00E+00	miss
+	Pb-214	241.99	* 7.25	1.65E+00	2.23E-01	7.33E-01	miss
		295.22	* 18.42	1.46E+00		4.66E-01	miss
		351.93	* 35.60	1.35E+00		2.23E-01	miss
		785.96	1.06	-2.56E-02		6.49E+00	miss
+	Pb214-XR	74.82	* 5.80	2.74E+00	1.51E+00	2.78E+00	miss
		77.11	* 9.70	3.00E+00		1.51E+00	miss
		87.35	* 2.24	6.74E+00		5.42E+00	miss
		89.78	0.82	1.19E+01		1.19E+01	miss
+	Ra-226	186.21	3.64	1.86E+00	1.96E+00	1.96E+00	miss
+	Ac-228	129.07	2.42	6.00E-01	2.90E-01	2.35E+00	miss
		209.25	3.89	8.80E-01		1.54E+00	miss
		270.24	3.46	1.16E+00		1.91E+00	miss
		328.00	2.95	1.33E+00		2.23E+00	miss
		338.32	* 11.27	9.78E-01		6.21E-01	miss
		409.46	1.92	1.29E+00		3.61E+00	miss
		463.00	4.40	4.25E-01		1.50E+00	miss
		794.95	4.25	8.25E-01		2.31E+00	miss
		911.20	* 25.80	1.01E+00		2.90E-01	miss
		964.77	4.99	7.33E-01		1.81E+00	miss



Analysis Report for 20-Apr-16-10001

L3-10213A-FIGS-001SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>		<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	968.97	*	15.80	7.24E-01	2.90E-01	4.56E-01	miss
		1588.20		3.22	3.54E-01		2.36E+00	miss
+	Pa-231	27.36		10.30	0.00E+00	2.06E-01	2.06E-01	miss
		283.69		1.70	3.37E-01		2.77E+00	miss
		300.07		2.47	1.65E+00		3.16E+00	miss
		302.65		2.20	-7.63E-01		2.45E+00	miss
		330.06		1.40	-1.75E+00		4.17E+00	miss
+	Th-234	92.38		2.13	5.17E+00	5.36E+00	5.55E+00	miss
		92.80		2.10	2.70E+00		5.36E+00	miss
		112.81		0.21	-4.73E+00		3.18E+01	miss
+	U-235	143.76		10.96	2.98E-02	1.17E-01	4.28E-01	miss
		163.33		5.08	3.39E-01		1.03E+00	miss
		185.71		57.20	7.09E-02		1.17E-01	miss
		202.11		1.08	-1.52E+00		4.21E+00	miss
		205.31		5.01	-1.38E-01		8.48E-01	miss
+	Am-241	59.54		35.90	2.69E-01	7.17E-01	7.17E-01	miss

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

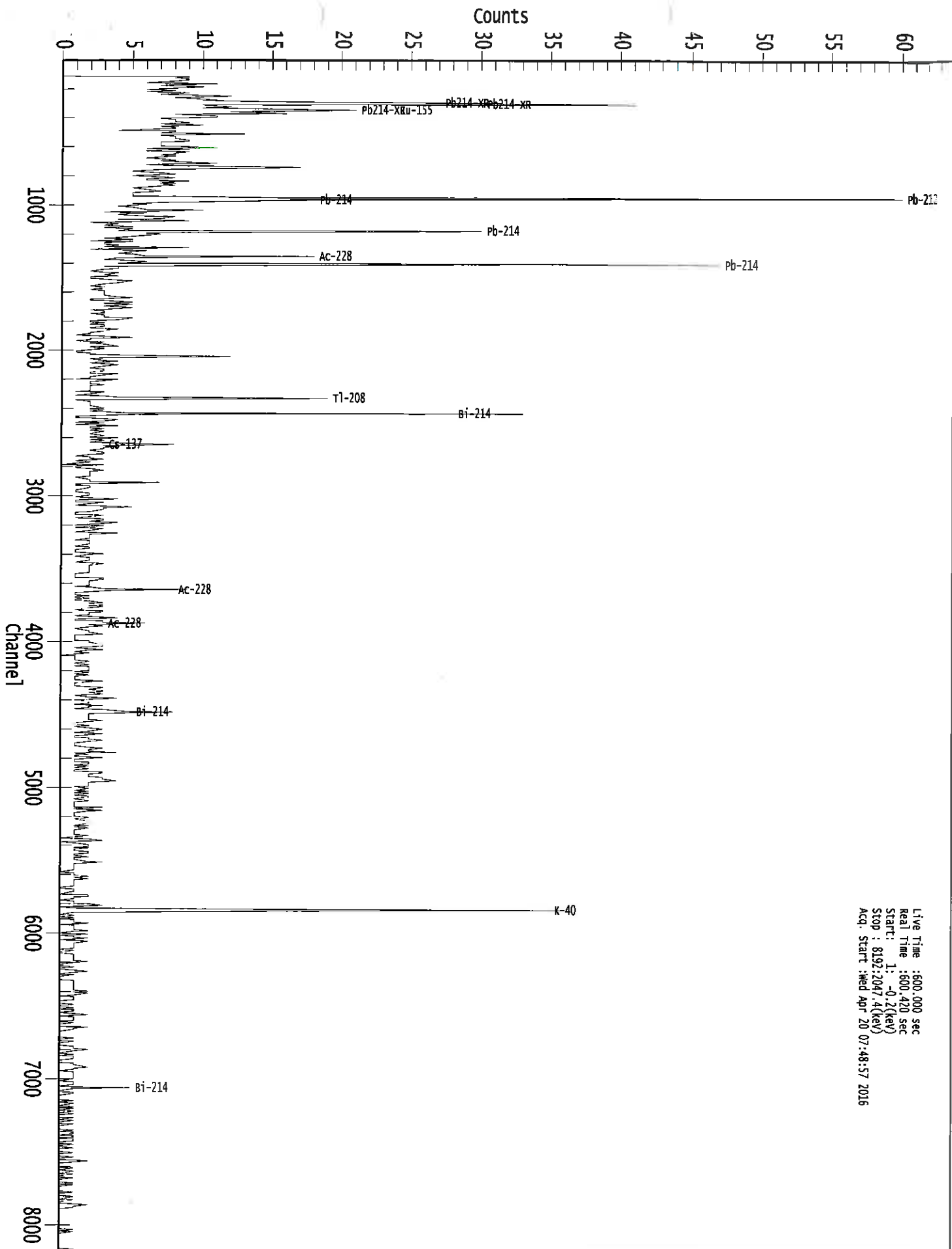
@ = Half-life too short to be able to perform the decay correction

? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.



Live time : 600.000 sec  
Real time : 600.420 sec  
Start: 1: -0.2(keV)  
Stop : 8197.20674(keV)  
Acq. Start : Wed Apr 20 07:48:57 2016

Analysis Report for 20-Apr-16-10002  
L3-10213A-FIGS-002SS

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## GAMMA SPECTRUM ANALYSIS

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Sample Identification : 20-Apr-16-10002  
Sample Description : L3-10213A-FIGS-002SS  
Sample Type : Miscellaneous  
Unit :  
Sample Point :  
  
Sample Size : 8.868E+02 grams  
Facility : Default  
  
Sample Taken On : 4/14/2016 9:50:00AM  
Acquisition Started : 4/20/2016 7:49:12AM  
  
Procedure : 130G 1L Soil Sample  
Operator : JWelch  
Detector Name : P40818B  
Geometry : 130G Soil  
Live Time : 600.0 seconds  
Real Time : 601.0 seconds  
  
Dead Time : 0.17 %  
  
Peak Locate Threshold : 2.80  
Peak Locate Range (in channels) : 120 - 8192  
Peak Area Range (in channels) : 120 - 8192  
Identification Energy Tolerance : 1.000FWHM  
  
Energy Calibration Used Done On : 1/27/2016  
Efficiency Calibration Used Done On : 1/5/2015  
Efficiency Calibration Description :  
  
Sample Number : 14678

*J. Welch*  
4-20-16  
*John Welch* 4/20/16

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## PEAK WITH NID REPORT

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Peak Analysis Performed on : 4/20/2016 7:59:46AM  
Peak Analysis From Channel : 120  
Peak Analysis To Channel : 8192  
  
Tentative NID Library : C:\Canberra\Apex\Root\Default\Library\Zion Lib-BNL.NLB  
Peak Match Tolerance : 1.000FWHM

*4/20/16*  
*4-20-16*  
Data Validated 4-25-16  
*CSH*

Analysis Report for 20-Apr-16-10002

L3-10213A-FIGS-002SS

Peak No.	Energy (keV)	ROI start	ROI end	Peak Centroid	Net Peak Area	Net Area Uncertainty	Continuum Counts	Tentative Nuclide
1	238.43	950 -	960	954.22	1.31E+02	31.36	9.65E+01	Pb-212
2	295.04	1176 -	1186	1180.51	5.85E+01	20.53	3.89E+01	Pb-214 Eu-152
3	351.76	1402 -	1413	1407.21	9.04E+01	23.30	4.12E+01	Pb-214 Bi-211
4	583.05	2326 -	2338	2331.99	5.28E+01	16.10	1.04E+01	Tl-208
5	609.42	2430 -	2444	2437.43	6.80E+01	19.80	2.40E+01	Bi-214
6	910.69	3636 -	3650	3642.47	4.01E+01	14.02	7.79E+00	Ac-228
7	968.56	3868 -	3881	3874.00	2.96E+01	14.45	2.09E+01	Ac-228
8	1460.56	5834 -	5854	5843.21	2.47E+02	32.38	1.20E+01	K-40
9	1763.80	7051 -	7064	7057.57	1.62E+01	8.91	3.64E+00	Bi-214

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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	Coinc Corr
K-40	0.99	1460.82	*	10.66	1.71E+01	miss
Tl-208	0.99	583.19	*	85.00	2.45E-01	miss
Pb-212	0.99	115.18		0.60		
		238.63	*	43.60	6.50E-01	miss
		300.09		3.30		
Bi-214	0.99	609.32	*	45.49	6.08E-01	miss
		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		

Analysis Report for 20-Apr-16-10002

L3-10213A-FIGS-002SS

<b>Nuclide Name</b>	<b>Id Confidence</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Activity Uncertainty</b>	<b>Coinc Corr</b>
Bi-214	0.99	1509.21	2.13			
		1661.27	1.05			
		1729.59	2.88			
		1764.49 *	15.30	9.03E-01	5.03E-01	miss
		1847.43	2.03			
Pb-214	0.99	2118.51	1.16			
		241.99	7.25			
		295.22 *	18.42	7.88E-01	3.04E-01	miss
		351.93 *	35.60	7.04E-01	2.14E-01	miss
Ac-228	0.73	785.96	1.06			
		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	8.31E-01	2.99E-01	miss
		964.77 *	4.99			
968.97 *	15.80	1.04E+00	5.18E-01	miss		
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 : 1.000FWHM

Nuclide confidence index threshold = 0.30

Errors quoted at 2.000sigma

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.

## INTERFERENCE CORRECTED REPORT

<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
K-40	0.996	1.71E+01	2.69E+00	
Tl-208	0.999	2.45E-01	8.04E-02	

Analysis Report for 20-Apr-16-10002

L3-10213A-FIGS-002SS

	<b>Nuclide Name</b>	<b>Nuclide Id Confidence</b>	<b>Wt mean Activity (pCi/grams)</b>	<b>Wt mean Activity Uncertainty</b>	<b>Comments</b>
X	Bi-211	0.972			
	Pb-212	0.998	6.50E-01	1.88E-01	
	Bi-214	0.996	6.46E-01	1.79E-01	
	Pb-214	0.998	7.32E-01	1.75E-01	
	Ac-228	0.731	8.84E-01	2.59E-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 2.000sigma

Analysis Report for 20-Apr-16-10002  
L3-10213A-FIGS-002SS

## UNIDENTIFIED PEAKS

Peak Locate Performed on : 4/20/2016 7:59:46AM  
Peak Locate From Channel : 120  
Peak Locate To Channel : 8192

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

All peaks were identified.

M = First peak in a multiplet region  
m = Other peak in a multiplet region  
F = Fitted singlet  
Errors quoted at 2.000sigma

## 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)	Coinc Corr
+	K-40	1460.82	*	10.66	1.71E+01	1.07E+00	miss
+	Cr-51	320.08		9.91	7.26E-02	5.75E-01	free
+	Mn-54	834.85		99.98	2.40E-02	9.25E-02	miss
+	Co-58	810.76		99.45	6.57E-03	4.88E-02	miss
		1674.73		0.52	0.00E+00	4.54E+00	miss
+	Co-60	1173.23		99.85	-1.36E-02	1.04E-01	miss
		1332.49		99.98	2.91E-02	1.04E-01	miss
+	Nb-94	702.65		99.81	2.77E-02	5.58E-02	miss
		871.09		99.89	-5.47E-03	5.58E-02	miss
+	Ag-108m	79.13		6.60	-4.55E-01	7.15E-02	miss
		433.94		90.50	4.98E-03	7.15E-02	miss
		614.28		89.80	4.01E-03	7.94E-02	miss
		722.94		90.80	2.75E-02	7.55E-02	miss
+	Sn-113	255.13		2.11	-7.78E-01	7.97E-02	free
		391.70		64.97	-2.87E-02	7.97E-02	free
+	Cs-134	475.36		1.48	-1.35E+00	5.88E-02	miss
		563.25		8.34	-1.38E-01	6.98E-01	miss
		569.33		15.37	3.56E-02	3.58E-01	miss
		604.72		97.62	-1.47E-02	5.88E-02	miss

Analysis Report for 20-Apr-16-10002

L3-10213A-FIGS-002SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Cs-134	795.86	85.46	-1.24E-02	5.88E-02	6.88E-02	miss
		801.95	8.69	1.32E-01		7.99E-01	miss
		1038.61	0.99	-1.88E+00		5.50E+00	miss
		1167.97	1.79	-6.21E-01		5.32E+00	miss
		1365.19	3.02	-6.84E-01		2.17E+00	miss
+	Cs-137	661.66	85.10	1.28E-01	1.47E-01	1.47E-01	miss
+	Eu-152	121.78	28.67	6.54E-03	2.07E-01	2.27E-01	miss
		244.70	7.61	-7.86E-02		7.66E-01	miss
		295.94	0.45	-3.33E-01		2.25E+01	miss
		344.28	26.60	5.77E-02		2.07E-01	miss
		367.79	0.86	3.77E-01		5.54E+00	miss
		411.12	2.24	-3.88E-02		2.42E+00	miss
		443.96	2.83	7.71E-02		1.93E+00	miss
		488.68	0.42	-1.92E+00		1.51E+01	miss
		563.99	0.49	1.92E+00		1.31E+01	miss
		586.26	0.46	-5.17E+00		1.22E+01	miss
		678.62	0.47	4.85E+00		1.31E+01	miss
		688.67	0.86	1.72E+00		7.73E+00	miss
		719.35	0.28	-5.83E-01		2.45E+01	miss
		778.90	12.96	-1.48E-01		4.45E-01	miss
		810.45	0.32	2.56E-01		1.43E+01	miss
		867.37	4.26	5.05E-01		1.71E+00	miss
		919.33	0.43	1.26E+00		1.35E+01	miss
		964.08	14.65	1.40E-01		6.88E-01	miss
		1085.87	10.24	1.25E-01		8.82E-01	miss
		1089.74	1.73	-5.97E-01		3.75E+00	miss
		1112.07	13.69	-2.49E-01		4.80E-01	miss
		1212.95	1.43	1.59E+00		6.81E+00	miss
		1249.94	0.19	1.85E+01		5.82E+01	miss
		1299.14	1.63	-6.07E-01		5.46E+00	miss
		1408.01	21.07	1.50E-01		4.47E-01	miss
		1457.64	0.50	-2.76E+01		3.12E+01	miss
		1528.10	0.28	0.00E+00		7.34E+00	miss
+	Eu-154	123.07	40.40	-1.54E-02	1.62E-01	1.62E-01	miss
		247.93	6.89	-5.65E-02		8.08E-01	miss
		591.76	4.95	3.49E-01		1.41E+00	miss
		692.42	1.78	-1.00E+00		3.00E+00	miss
		723.30	20.06	-8.89E-02		2.99E-01	miss
		756.80	4.52	2.78E-01		1.47E+00	miss
		873.18	12.08	-1.41E-01		4.62E-01	miss
		996.29	10.48	2.34E-01		8.15E-01	miss
		1004.76	18.01	3.70E-02		2.95E-01	miss
		1274.43	34.80	3.66E-03		2.71E-01	miss
		1596.48	1.80	0.00E+00		1.19E+00	miss
+	Eu-155	45.30	1.31	-3.34E+00	3.75E-01	4.08E+01	miss
		60.01	1.22	2.50E+01		5.30E+01	miss
		86.55	30.70	3.62E-01		4.64E-01	miss
		105.31	21.10	-2.72E-02		3.75E-01	miss
+	Tl-208	583.19	* 85.00	2.45E-01	6.55E-02	6.55E-02	miss
+	Bi-211	351.07	* 13.02	1.93E+00	5.29E-01	5.29E-01	miss
+	Pb-211	404.85	3.78	4.29E-01	1.47E+00	1.47E+00	miss



Analysis Report for 20-Apr-16-10002

L3-10213A-FIGS-002SS

<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
Pb-211	427.09	1.76	8.99E-01	1.47E+00	3.64E+00	miss
	832.01	3.52	-3.72E-01		2.38E+00	miss
+ Bi-212	39.86	1.06	4.50E-01	1.79E+00	4.54E+01	miss
	727.33	6.67	1.21E+00		1.79E+00	miss
	785.37	1.10	7.74E-01		5.74E+00	miss
	1620.50	1.47	1.45E+00		5.86E+00	miss
+ Pb-212	115.18	0.60	-2.19E-01	1.89E-01	9.87E+00	miss
	238.63	* 43.60	6.50E-01		1.89E-01	miss
	300.09	3.30	1.23E+00		2.36E+00	miss
+ Pb212-XR	74.82	10.28	1.61E+00	1.45E+00	2.48E+00	miss
	77.11	17.10	1.21E+00		1.45E+00	miss
	87.35	3.97	1.62E+00		3.33E+00	miss
	89.78	1.46	4.21E+00		8.08E+00	miss
+ Bi-214	609.32	* 45.49	6.08E-01	1.85E-01	1.85E-01	miss
	768.36	4.89	2.59E-01		1.69E+00	miss
	806.18	1.26	2.81E+00		6.77E+00	miss
	934.06	3.11	2.51E-01		2.29E+00	miss
	1120.29	14.92	7.68E-01		1.05E+00	miss
	1155.21	1.63	-1.59E+00		4.60E+00	miss
	1238.12	5.83	9.38E-01		2.33E+00	miss
	1280.98	1.43	-2.34E-01		5.61E+00	miss
	1377.67	3.99	2.40E-01		2.13E+00	miss
	1385.31	0.79	1.70E+00		9.62E+00	miss
	1401.52	1.33	2.82E-01		5.79E+00	miss
	1407.99	2.39	1.32E+00		3.93E+00	miss
	1509.21	2.13	7.92E-01		4.66E+00	miss
	1661.27	1.05	2.46E+00		9.35E+00	miss
	1729.59	2.88	1.46E-01		2.15E+00	miss
	1764.49	* 15.30	9.03E-01		5.03E-01	miss
	1847.43	2.03	-5.43E-02		3.20E+00	miss
>	2118.51	1.16	0.00E+00		0.00E+00	miss
+ Pb-214	241.99	7.25	1.02E+00	1.94E-01	1.14E+00	miss
	295.22	* 18.42	7.88E-01		3.40E-01	miss
	351.93	* 35.60	7.04E-01		1.94E-01	miss
	785.96	1.06	2.77E+00		6.84E+00	miss
+ Pb214-XR	74.82	5.80	2.85E+00	2.56E+00	4.40E+00	miss
	77.11	9.70	2.13E+00		2.56E+00	miss
	87.35	2.24	2.87E+00		5.90E+00	miss
	89.78	0.82	7.50E+00		1.44E+01	miss
+ Ra-226	186.21	3.64	1.19E+00	1.97E+00	1.97E+00	miss
+ Ac-228	129.07	2.42	1.23E+00	2.61E-01	3.15E+00	miss
	209.25	3.89	2.47E-01		1.56E+00	miss
	270.24	3.46	-3.21E-01		1.79E+00	miss
	328.00	2.95	6.39E-01		2.38E+00	miss
	338.32	11.27	6.26E-01		8.23E-01	miss
	409.46	1.92	6.66E-01		3.14E+00	miss
	463.00	4.40	8.26E-01		1.72E+00	miss
	794.95	4.25	5.02E-01		1.72E+00	miss
	911.20	* 25.80	8.31E-01		2.61E-01	miss
	964.77	4.99	4.39E-02		2.02E+00	miss
	968.97	* 15.80	1.04E+00		6.47E-01	miss

Analysis Report for 20-Apr-16-10002

L3-10213A-FIGS-002SS

	<b>Nuclide Name</b>	<b>Energy (keV)</b>	<b>Yield(%)</b>	<b>Activity (pCi/grams)</b>	<b>Nuclide MDA (pCi/grams)</b>	<b>Line MDA (pCi/grams)</b>	<b>Coinc Corr</b>
	Ac-228	1588.20	3.22	2.75E-01	2.61E-01	2.27E+00	miss
+	Pa-231	27.36	10.30	-2.53E+00	2.75E+00	4.09E+00	miss
		283.69	1.70	-1.75E+00		3.03E+00	miss
		300.07	2.47	1.65E+00		3.15E+00	miss
		302.65	2.20	-2.77E-01		2.75E+00	miss
		330.06	1.40	-4.38E-01		4.06E+00	miss
+	Th-234	92.38	2.13	4.37E+00	7.01E+00	7.01E+00	miss
		92.80	2.10	5.35E+00		7.06E+00	miss
		112.81	0.21	4.22E+00		4.20E+01	miss
+	U-235	143.76	10.96	3.45E-01	1.28E-01	6.01E-01	miss
		163.33	5.08	1.66E-01		1.10E+00	miss
		185.71	57.20	8.45E-02		1.28E-01	miss
		202.11	1.08	-1.83E+00		3.96E+00	miss
		205.31	5.01	-1.07E-01		1.07E+00	miss
+	Am-241	59.54	35.90	6.80E-02	1.76E+00	1.76E+00	miss

+ = Nuclide identified during the nuclide identification

\* = Energy line found in the spectrum

&gt; = MDA value not calculated

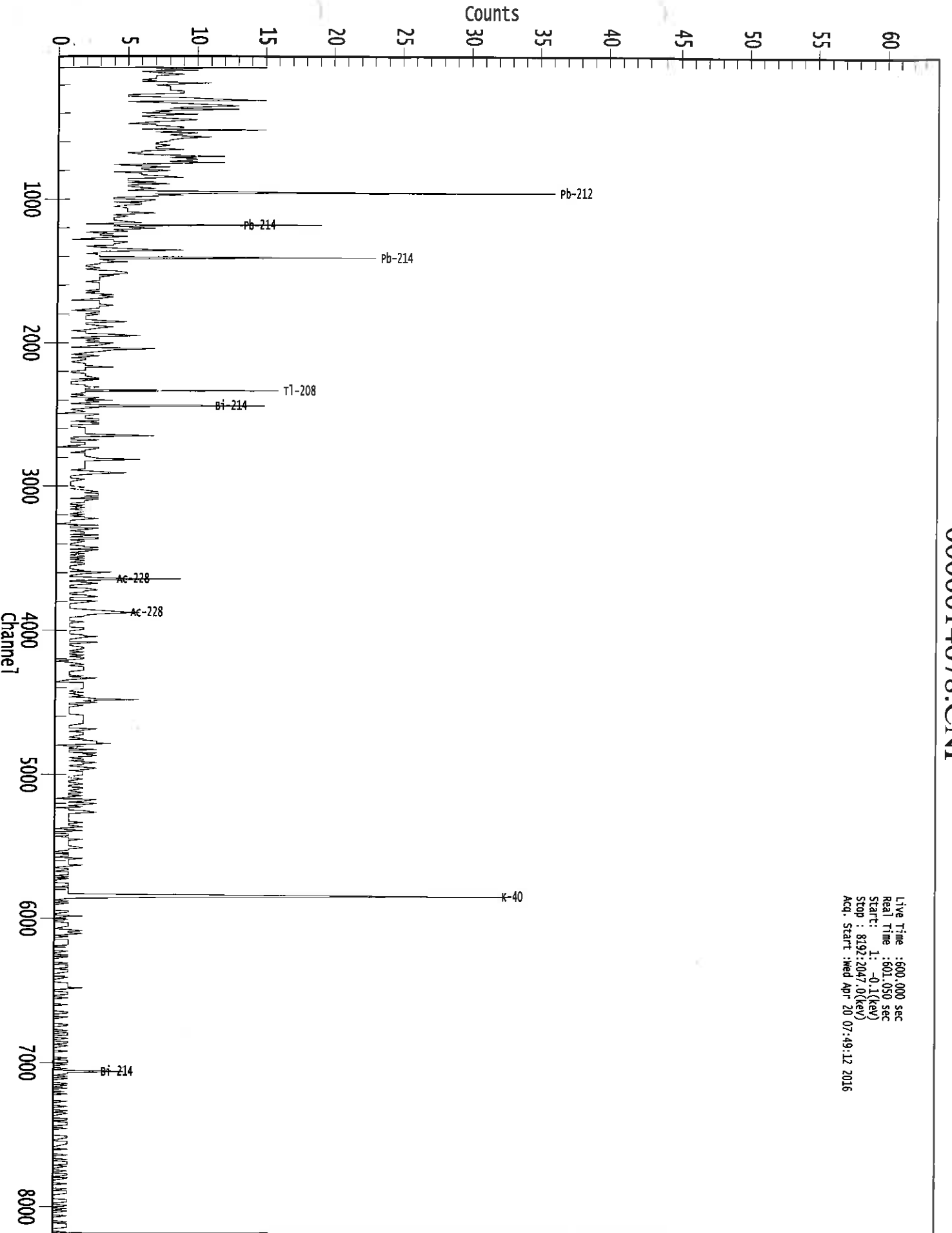
@ = Half-life too short to be able to perform the decay correction

? = CAUTION: MDA value is inconsistent with Currie MDA at 95% confidence level

Coincidence correction performed.

free = No coincidence correction required.

miss = Nuclide energy was not found in the coincidence library.



Live Time : 600.000 sec  
Real Time : 601.050 sec  
Start : 1: -0.1(kev)  
Stop : 8192.2047.0(kev)  
Acq. Start : Wed Apr 20 07:49:12 2016

**ATTACHMENT 4**  
**CONSULTATION TRIGGERS FOR**  
**RESIDENTIAL SOIL**  
**CONCENTRATION**

**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 5**  
**QC SAMPLE ASSESSMENT**

### Duplicate Sample Assessment

Survey Unit #:	10200	Survey Unit #	10213A	Survey Unit Name:	North East Corner of Exclusion Area, Power House																	
Sample Plan#:	L310213AF																					
Sample Description: Comparison of split samples collected from surface soil samples from location #7 and analyzed using gamma spectroscopy by on-site HpGe System. The standard sample was L3-10213AFRGS-007SS, the comparison sample was L3-10213AFQGS-007SS.																						
STANDARD					COMPARISON																	
Radionuclide	Activity Value	Standard Error	Resolution	Agreement Range	Activity Value	Standard Error	Comparison Ratio	Acceptable (Y/N)														
Cs-137	7.43E-02	1.01E-01	0.74	0.4-2.5	4.12E-02	5.67E-02	1.80	Y														
Comments/Corrective Actions: None					Table is provided to show acceptance criteria used to assess split samples.																	
					<table border="1"> <thead> <tr> <th>Resolution</th> <th>Acceptable Ratio</th> </tr> </thead> <tbody> <tr> <td>&lt;4</td> <td>0.4-2.5</td> </tr> <tr> <td>4-7</td> <td>0.5-2.0</td> </tr> <tr> <td>8-15</td> <td>0.6-1.66</td> </tr> <tr> <td>16-50</td> <td>0.75-1.33</td> </tr> <tr> <td>51-200</td> <td>0.80-1.25</td> </tr> <tr> <td>&gt;200</td> <td>0.85-1.18</td> </tr> </tbody> </table>				Resolution	Acceptable Ratio	<4	0.4-2.5	4-7	0.5-2.0	8-15	0.6-1.66	16-50	0.75-1.33	51-200	0.80-1.25	>200	0.85-1.18
Resolution	Acceptable Ratio																					
<4	0.4-2.5																					
4-7	0.5-2.0																					
8-15	0.6-1.66																					
16-50	0.75-1.33																					
51-200	0.80-1.25																					
>200	0.85-1.18																					
Performed by:	RF Yetter III	Date:	9/21/2017	Reveived by:		Date:																

**ATTACHMENT 6**  
**GRAPHICAL PRESENTATIONS**

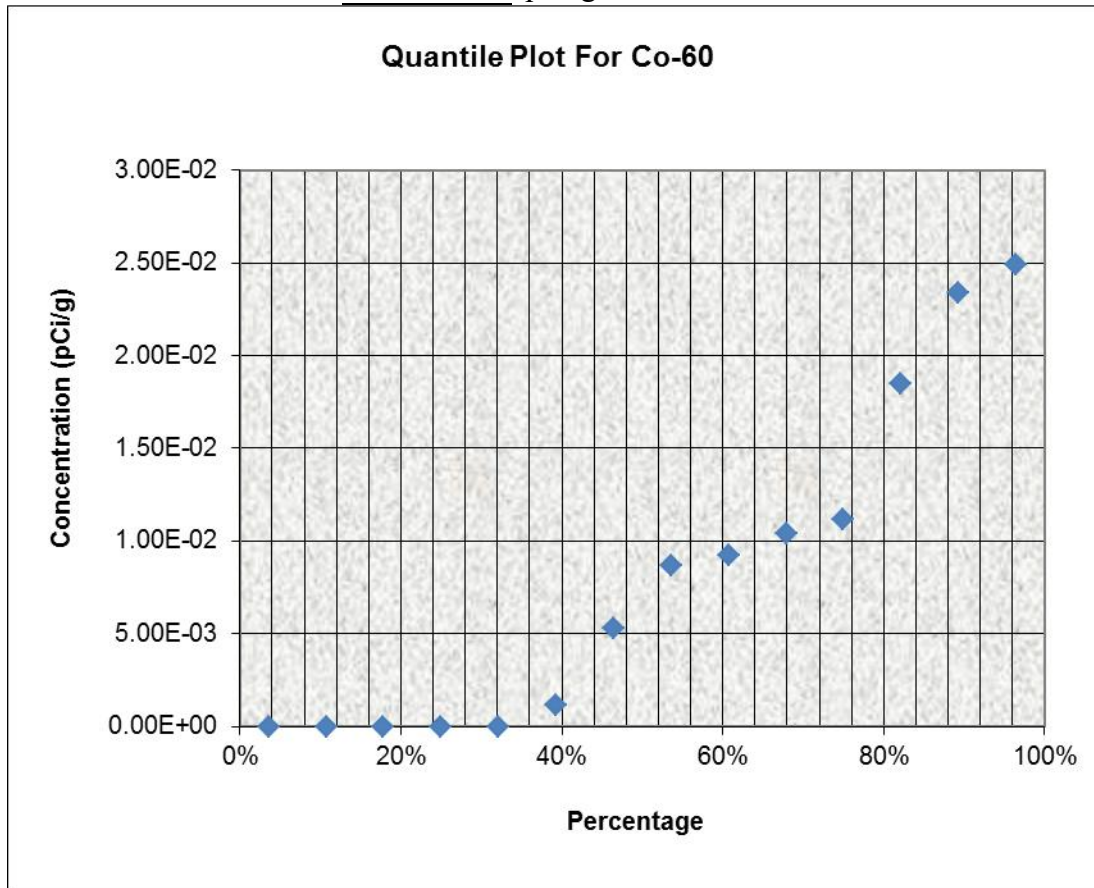


### Quantile Plot for Co-60

**Survey Unit:** L310213A

**Survey Unit Name:** Open Land - NE Corner of Exclusion Area, Power House

**Mean:** 8.06E-03 pCi/g

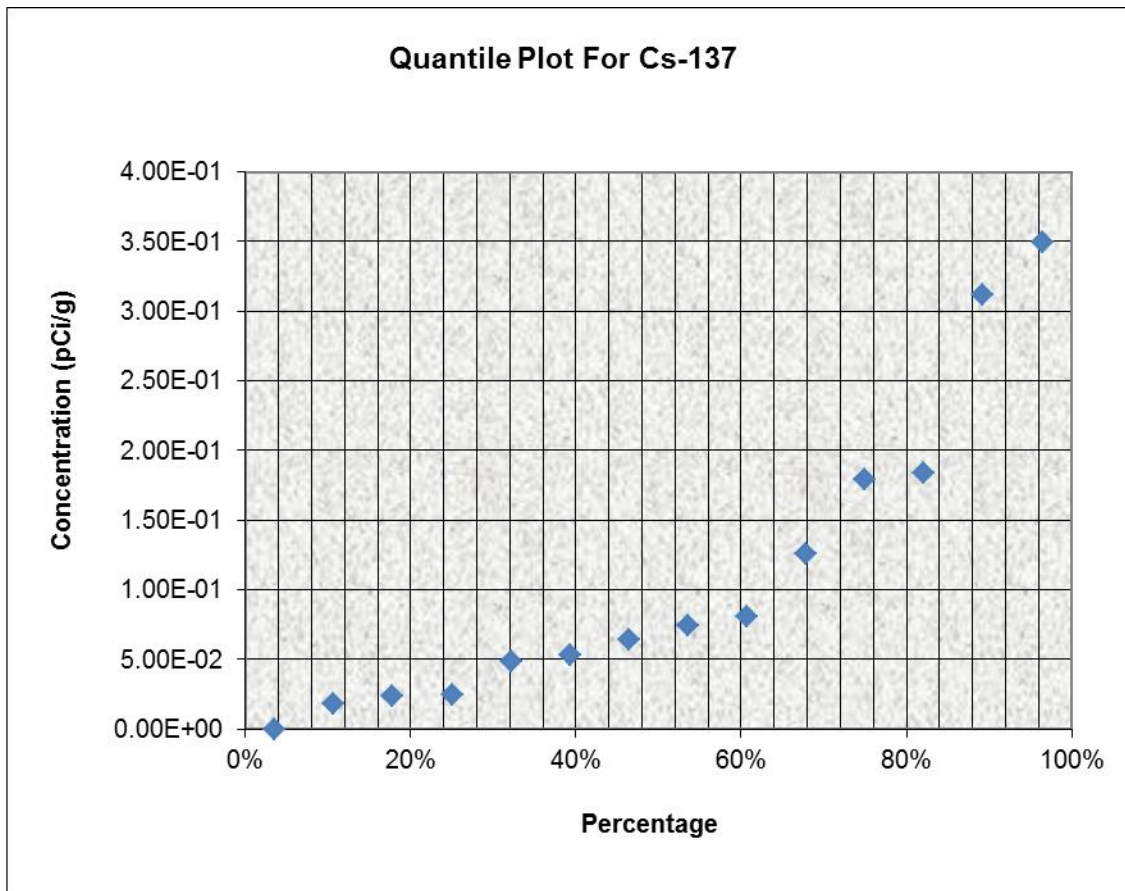


### Quantile Plot for Cs-137

Survey Unit: L310213A

Survey Unit Name: Open Land - NE Corner of Exclusion Area, Power House

Mean: 1.10E-01 pCi/g



**Histogram for Co-60**

**HISTOGRAM FOR Co-60**

**Survey Unit:** L310213A

Open Land - NE Corner of Exclusion Area,

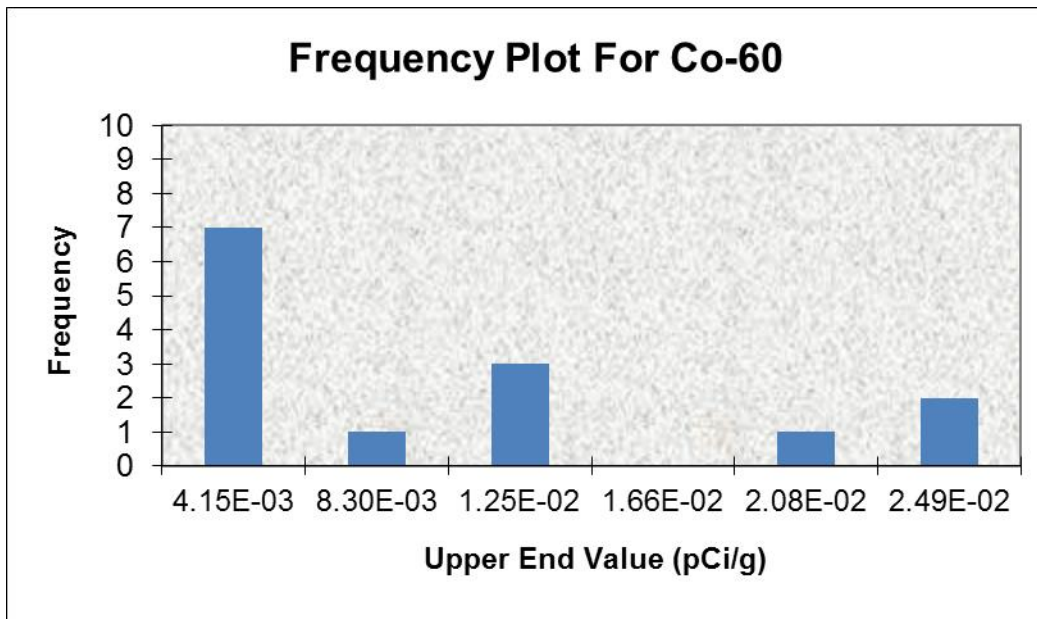
**Survey Unit Name:** Power House

**Mean:** 7.44E-03 pCi/g

**Median:** 3.24E-03 pCi/g

**ST DEV:** 0.00913205

**Skew:** 0.95507886



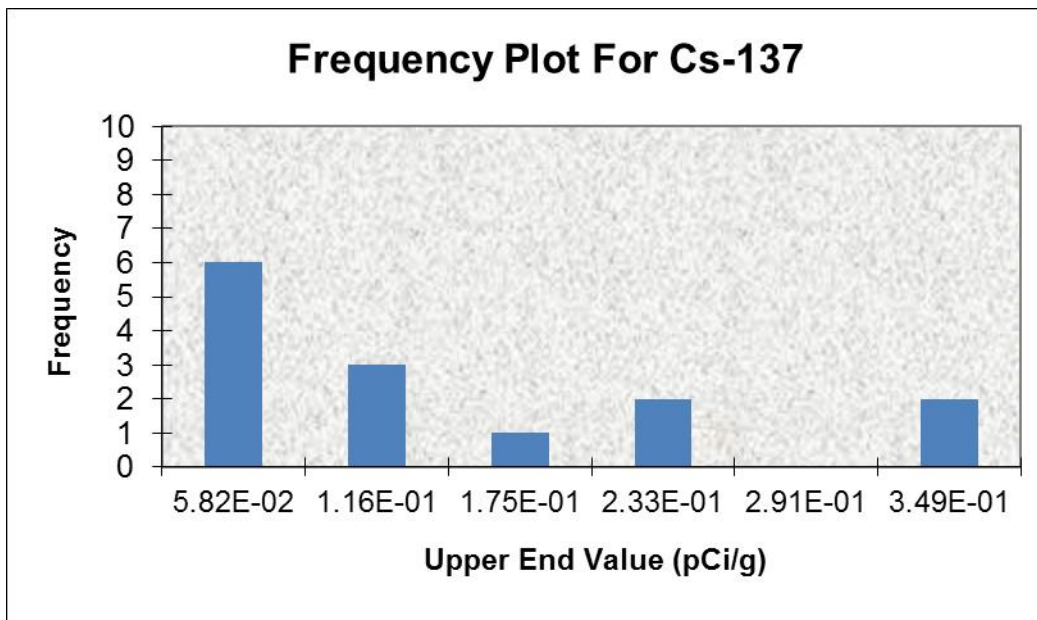
Upper Value	Observation Frequency	Observation %
4.15E-03	7	50%
8.30E-03	1	7%
1.25E-02	3	21%
1.66E-02	0	0%
2.08E-02	1	7%
2.49E-02	2	14%
TOTAL	14	

### Histogram for Cs-137

**Survey Unit:** L310213A  
 Open Land - NE Corner of Exclusion Area, Power  
**Survey Unit Name:** House

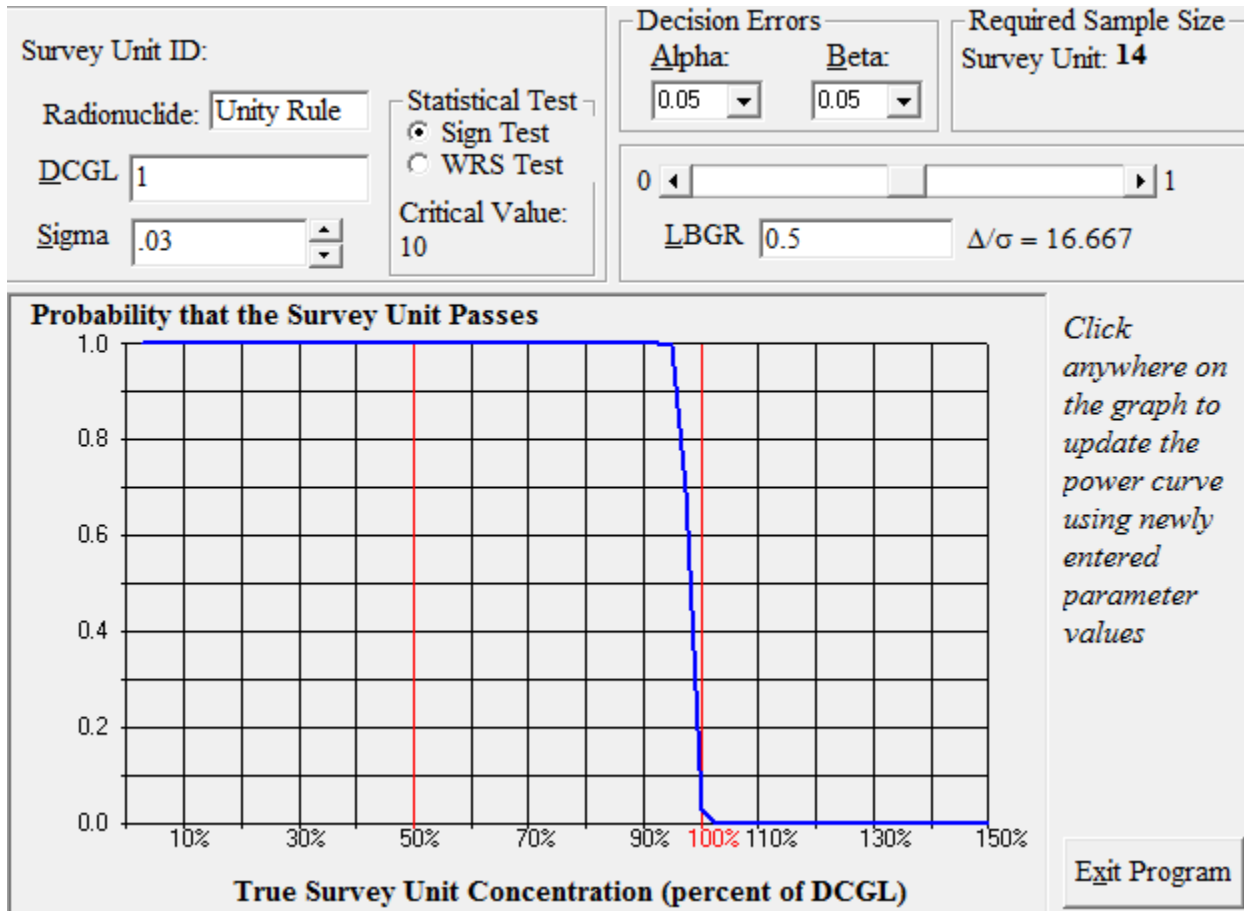
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**Mean:** 1.10E-01 pCi/g  
**Median:** 6.94E-02 pCi/g  
**ST DEV:** 0.10913697  
**Skew:** 1.29365905



Upper Value	Observation Frequency	Observation %
5.82E-02	6	43%
1.16E-01	3	21%
1.75E-01	1	7%
2.33E-01	2	14%
2.91E-01	0	0%
3.49E-01	2	14%
<b>TOTAL</b>	<b>14</b>	

### Retrospective Power Curve for Survey Unit 10213A



# **ATTACHMENT 7**

## **EBERLINE ANALYTICAL REPORTS**

<h1 style="margin: 0;">Eberline Analytical</h1> <h2 style="margin: 0;">Final Report of Analysis</h2>			Report To:						Work Order Details:						
			<b>Patricia Giza</b> <b>Zion Solutions</b> <b>101 Shiloh Blvd</b> <b>Zion, IL 60099</b>						SDG: <b>17-03011</b>						
									Purchase Order: 671498						
									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	
17-03011-01	LCS	KNOWN	03/03/17 00:00	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	1.51E+03	4.52E+01				pCi/g	
17-03011-01	LCS	SPIKE	03/03/17 00:00	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	1.52E+03	9.33E+00	9.01E+01	2.11E+00		pCi/g	
17-03011-02	MBL	BLANK	03/03/17 00:00	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	1.58E+00	1.27E+00	1.27E+00	2.11E+00	U	pCi/g	
17-03011-03	DUP	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	2.19E+00	1.39E+00	1.39E+00	2.29E+00	U	pCi/g	
17-03011-04	DO	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	1.71E+00	1.37E+00	1.37E+00	2.28E+00	U	pCi/g	
17-03011-05	TRG	L310213AFRGS008SS-A	04/14/16 08:00	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	3.46E+00	1.39E+00	1.40E+00	2.25E+00		pCi/g	
17-03011-06	TRG	L310219AFRGS006SS-A	10/03/16 09:10	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	2.88E-01	1.36E+00	1.36E+00	2.31E+00	U	pCi/g	
17-03011-07	TRG	L310219BFRGS004SS-A	09/27/16 08:25	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	-1.69E+00	1.65E+00	1.65E+00	2.90E+00	U	pCi/g	
17-03011-08	TRG	L310220CFRGS002SS-A	05/23/16 14:30	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	6.89E-01	1.40E+00	1.40E+00	2.37E+00	U	pCi/g	
17-03011-09	TRG	L310223AFRGS004SS-A	04/25/16 13:15	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	8.22E-01	1.30E+00	1.30E+00	2.20E+00	U	pCi/g	
17-03011-10	TRG	L310224AFRGS004SS-A	06/02/16 12:40	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	1.06E+00	1.27E+00	1.27E+00	2.13E+00	U	pCi/g	
17-03011-11	TRG	L310301AFRGS003SS-A	06/14/16 13:27	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	3.84E+00	1.40E+00	1.42E+00	2.25E+00		pCi/g	
17-03011-12	TRG	L310212AFJGS019SS-A	05/16/16 10:45	3/3/2017	3/14/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	2.34E+00	1.48E+00	1.49E+00	2.44E+00	U	pCi/g	
17-03011-13	TRG	L310219AFRJS019SS-A	09/27/16 12:30	3/3/2017	3/15/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	1.97E+00	1.36E+00	1.37E+00	2.26E+00	U	pCi/g	
17-03011-14	TRG	L310220CFRGS009SS-A	05/02/16 14:00	3/3/2017	3/15/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	1.09E+00	1.42E+00	1.42E+00	2.39E+00	U	pCi/g	
17-03011-15	TRG	L310224AFRGS012SS-A	06/02/16 14:16	3/3/2017	3/15/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	9.12E-01	1.44E+00	1.44E+00	2.44E+00	U	pCi/g	
17-03011-16	TRG	L310301AFIGS017SS-A	06/14/16 13:40	3/3/2017	3/15/2017	17-03011	Nickel-63	ASTM 3500-Ni Modified	1.02E+01	1.52E+00	1.64E+00	2.24E+00		pCi/g	
17-03011-01	LCS	KNOWN	03/03/17 00:00	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	5.43E+01	3.04E-01				pCi/g	
17-03011-01	LCS	SPIKE	03/03/17 00:00	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	6.16E+01	1.65E+00	2.15E+01	8.24E-01		pCi/g	
17-03011-02	MBL	BLANK	03/03/17 00:00	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	-2.14E-02	4.23E-01	4.23E-01	9.04E-01	U	pCi/g	
17-03011-03	DUP	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	7.78E-01	3.45E-01	4.39E-01	6.48E-01		pCi/g	
17-03011-04	DO	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	5.42E-01	3.48E-01	3.96E-01	6.83E-01	U	pCi/g	
17-03011-05	TRG	L310213AFRGS008SS-A	04/14/16 08:00	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	3.59E-01	3.59E-01	3.81E-01	7.29E-01	U	pCi/g	
17-03011-06	TRG	L310219AFRGS006SS-A	10/03/16 09:10	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	3.97E-01	3.66E-01	3.91E-01	7.40E-01	U	pCi/g	
17-03011-07	TRG	L310219BFRGS004SS-A	09/27/16 08:25	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	5.85E-01	4.17E-01	4.64E-01	8.27E-01	U	pCi/g	
17-03011-08	TRG	L310220CFRGS002SS-A	05/23/16 14:30	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	6.39E-02	3.97E-01	3.98E-01	8.41E-01	U	pCi/g	
17-03011-09	TRG	L310223AFRGS004SS-A	04/25/16 13:15	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	9.84E-01	3.37E-01	4.80E-01	6.09E-01		pCi/g	
17-03011-10	TRG	L310224AFRGS004SS-A	06/02/16 12:40	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	4.59E-01	3.45E-01	3.80E-01	6.86E-01	U	pCi/g	
17-03011-11	TRG	L310301AFRGS003SS-A	06/14/16 13:27	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	6.36E-01	3.86E-01	4.45E-01	7.54E-01	U	pCi/g	
17-03011-12	TRG	L310212AFJGS019SS-A	05/16/16 10:45	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	8.09E-01	4.19E-01	5.05E-01	8.12E-01	U	pCi/g	
17-03011-13	TRG	L310219AFRJS019SS-A	09/27/16 12:30	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	7.29E-01	3.98E-01	4.72E-01	7.75E-01	U	pCi/g	
17-03011-14	TRG	L310220CFRGS009SS-A	05/02/16 14:00	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	3.09E-01	3.90E-01	4.04E-01	8.00E-01	U	pCi/g	
17-03011-15	TRG	L310224AFRGS012SS-A	06/02/16 14:16	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	1.03E-01	3.61E-01	3.62E-01	7.59E-01	U	pCi/g	
17-03011-16	TRG	L310301AFIGS017SS-A	06/14/16 13:40	3/3/2017	3/27/2017	17-03011	Strontium-90	EiChroM SRW01 Modified	5.03E-01	3.78E-01	4.17E-01	7.53E-01	U	pCi/g	

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank; DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

<h1 style="margin: 0;">Eberline Analytical</h1> <h2 style="margin: 0;">Final Report of Analysis</h2>			Report To:					Work Order Details:							
			Patricia Giza					SDG:	17-03011						
			Zion Solutions					Purchase Order:	671498						
			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	
17-03011-01	LCS	KNOWN	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	6.21E+01	2.48E+00				pCi/g	
17-03011-01	LCS	KNOWN	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	3.94E+01	1.58E+00				pCi/g	
17-03011-01	LCS	SPIKE	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	7.58E+01	5.03E+00	6.36E+00	6.59E-01		pCi/g	
17-03011-01	LCS	SPIKE	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	4.44E+01	4.02E+00	4.62E+00	6.97E-01		pCi/g	
17-03011-02	MBL	BLANK	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	4.74E-02	4.81E-02	4.82E-02	8.85E-02	U	pCi/g	
17-03011-02	MBL	BLANK	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	1.72E-02	2.56E-02	2.57E-02	4.39E-02	U	pCi/g	
17-03011-02	MBL	BLANK	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	1.29E-02	1.46E-02	1.46E-02	2.73E-02	U	pCi/g	
17-03011-02	MBL	BLANK	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	-1.28E-04	1.27E-02	1.27E-02	1.91E-02	U	pCi/g	
17-03011-02	MBL	BLANK	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	6.40E-03	1.48E-02	1.48E-02	2.34E-02	U	pCi/g	
17-03011-02	MBL	BLANK	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	1.37E-01	1.68E-01	1.69E-01	3.28E-01	U	pCi/g	
17-03011-02	MBL	BLANK	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	6.28E-03	1.70E-02	1.70E-02	2.64E-02	U	pCi/g	
17-03011-02	MBL	BLANK	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	-3.01E-03	2.42E-02	2.42E-02	3.65E-02	U	pCi/g	
17-03011-02	MBL	BLANK	03/03/17 00:00	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	-5.23E-03	4.16E-02	4.16E-02	6.34E-02	U	pCi/g	
17-03011-03	DUP	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	4.11E-01	1.33E-01	1.34E-01	2.02E-01		pCi/g	
17-03011-03	DUP	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	4.84E-01	1.17E-01	1.19E-01	1.04E-01		pCi/g	
17-03011-03	DUP	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	-2.54E-03	3.32E-02	3.32E-02	4.18E-02	U	pCi/g	
17-03011-03	DUP	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	2.64E-04	1.18E-02	1.18E-02	4.72E-02	U	pCi/g	
17-03011-03	DUP	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	5.75E-02	4.30E-02	4.31E-02	7.05E-02	U	pCi/g	
17-03011-03	DUP	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	1.01E+01	1.11E+00	1.23E+00	4.65E-01		pCi/g	
17-03011-03	DUP	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	4.00E-01	5.25E-02	5.64E-02	8.50E-02		pCi/g	
17-03011-03	DUP	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	3.90E-01	1.31E-01	1.33E-01	9.32E-02		pCi/g	
17-03011-03	DUP	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	2.46E-01	6.92E-02	7.04E-02	5.39E-02		pCi/g	
17-03011-04	DO	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	4.23E-01	1.04E-01	1.06E-01	2.03E-01		pCi/g	
17-03011-04	DO	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	4.66E-01	1.11E-01	1.13E-01	8.49E-02		pCi/g	
17-03011-04	DO	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	4.50E-04	3.33E-02	3.33E-02	3.46E-02	U	pCi/g	
17-03011-04	DO	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	-5.96E-03	1.09E-02	1.09E-02	4.15E-02	U	pCi/g	
17-03011-04	DO	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	6.04E-02	3.06E-02	3.08E-02	4.76E-02		pCi/g	
17-03011-04	DO	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	1.02E+01	1.13E+00	1.24E+00	5.53E-01		pCi/g	
17-03011-04	DO	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	3.75E-01	5.11E-02	5.46E-02	8.70E-02		pCi/g	
17-03011-04	DO	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	4.00E-01	1.33E-01	1.35E-01	1.11E-01		pCi/g	
17-03011-04	DO	L310212AFRGS002SS-A	05/11/16 10:30	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	1.86E-01	6.47E-02	6.54E-02	6.95E-02		pCi/g	

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank; DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect



<h1 style="margin: 0;">Eberline Analytical</h1> <h2 style="margin: 0;">Final Report of Analysis</h2>			Report To:					Work Order Details:								
			Patricia Giza					SDG:	17-03011							
			Zion Solutions					Purchase Order:	671498							
			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		
17-03011-05	TRG	L310213AFRGS008SS-A	04/14/16 08:00	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	3.95E-01	6.68E-02	6.98E-02	2.26E-01		pCi/g		
17-03011-05	TRG	L310213AFRGS008SS-A	04/14/16 08:00	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	3.88E-01	6.28E-02	6.59E-02	8.04E-02		pCi/g		
17-03011-05	TRG	L310213AFRGS008SS-A	04/14/16 08:00	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	1.89E-02	2.04E-02	2.04E-02	2.86E-02	U	pCi/g		
17-03011-05	TRG	L310213AFRGS008SS-A	04/14/16 08:00	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	-3.06E-03	1.04E-02	1.04E-02	2.78E-02	U	pCi/g		
17-03011-05	TRG	L310213AFRGS008SS-A	04/14/16 08:00	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	4.11E-01	6.15E-02	6.50E-02	3.88E-02		pCi/g		
17-03011-05	TRG	L310213AFRGS008SS-A	04/14/16 08:00	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	6.85E+00	8.02E-01	8.76E-01	2.60E-01		pCi/g		
17-03011-05	TRG	L310213AFRGS008SS-A	04/14/16 08:00	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	3.45E-01	5.27E-02	5.56E-02	4.16E-02		pCi/g		
17-03011-05	TRG	L310213AFRGS008SS-A	04/14/16 08:00	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	3.73E-01	6.08E-02	6.37E-02	7.27E-02		pCi/g		
17-03011-05	TRG	L310213AFRGS008SS-A	04/14/16 08:00	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	3.93E-01	7.55E-02	7.82E-02	6.80E-02		pCi/g		
17-03011-06	TRG	L310219AFRGS006SS-A	10/03/16 09:10	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	3.14E-01	1.00E-01	1.02E-01	1.05E-01		pCi/g		
17-03011-06	TRG	L310219AFRGS006SS-A	10/03/16 09:10	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	3.82E-01	7.07E-02	7.34E-02	7.96E-02		pCi/g		
17-03011-06	TRG	L310219AFRGS006SS-A	10/03/16 09:10	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	2.05E-03	1.95E-02	1.95E-02	2.33E-02	U	pCi/g		
17-03011-06	TRG	L310219AFRGS006SS-A	10/03/16 09:10	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	4.00E-03	6.34E-03	6.34E-03	2.49E-02	U	pCi/g		
17-03011-06	TRG	L310219AFRGS006SS-A	10/03/16 09:10	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	2.25E-02	2.00E-02	2.01E-02	3.30E-02	U	pCi/g		
17-03011-06	TRG	L310219AFRGS006SS-A	10/03/16 09:10	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	8.06E+00	1.03E+00	1.11E+00	4.94E-01		pCi/g		
17-03011-06	TRG	L310219AFRGS006SS-A	10/03/16 09:10	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	3.61E-01	1.24E-01	1.26E-01	6.77E-02		pCi/g		
17-03011-06	TRG	L310219AFRGS006SS-A	10/03/16 09:10	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	3.73E-01	1.30E-01	1.31E-01	6.84E-02		pCi/g		
17-03011-06	TRG	L310219AFRGS006SS-A	10/03/16 09:10	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	2.87E-01	7.16E-02	7.31E-02	5.18E-02		pCi/g		
17-03011-07	TRG	L310219BFRGS004SS-A	09/27/16 08:25	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	2.85E-01	1.06E-01	1.07E-01	2.08E-01		pCi/g		
17-03011-07	TRG	L310219BFRGS004SS-A	09/27/16 08:25	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	4.30E-01	9.29E-02	9.55E-02	1.27E-01		pCi/g		
17-03011-07	TRG	L310219BFRGS004SS-A	09/27/16 08:25	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	1.61E-03	9.25E-03	9.25E-03	5.27E-02	U	pCi/g		
17-03011-07	TRG	L310219BFRGS004SS-A	09/27/16 08:25	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	8.33E-03	1.55E-02	1.55E-02	4.39E-02	U	pCi/g		
17-03011-07	TRG	L310219BFRGS004SS-A	09/27/16 08:25	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	6.93E-01	1.06E-01	1.12E-01	6.05E-02		pCi/g		
17-03011-07	TRG	L310219BFRGS004SS-A	09/27/16 08:25	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	4.65E+00	7.78E-01	8.14E-01	5.30E-01		pCi/g		
17-03011-07	TRG	L310219BFRGS004SS-A	09/27/16 08:25	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	5.59E-02	5.32E-02	5.33E-02	1.04E-01	U	pCi/g		
17-03011-07	TRG	L310219BFRGS004SS-A	09/27/16 08:25	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	3.45E-01	8.88E-02	9.05E-02	1.15E-01		pCi/g		
17-03011-07	TRG	L310219BFRGS004SS-A	09/27/16 08:25	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	2.39E-01	8.59E-02	8.67E-02	1.47E-01		pCi/g		

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank; DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

<h1 style="margin: 0;">Eberline Analytical</h1> <h2 style="margin: 0;">Final Report of Analysis</h2>			Report To:					Work Order Details:							
			Patricia Giza					SDG:	17-03011						
			Zion Solutions					Purchase Order:	671498						
			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	
17-03011-08	TRG	L310220CRFGS002SS-A	05/23/16 14:30	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	2.93E-01	1.05E-01	1.06E-01	2.39E-01		pCi/g	
17-03011-08	TRG	L310220CRFGS002SS-A	05/23/16 14:30	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	3.41E-01	6.34E-02	6.57E-02	1.35E-01		pCi/g	
17-03011-08	TRG	L310220CRFGS002SS-A	05/23/16 14:30	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	-3.32E-02	4.28E-02	4.28E-02	5.98E-02	U	pCi/g	
17-03011-08	TRG	L310220CRFGS002SS-A	05/23/16 14:30	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	6.49E-03	2.04E-02	2.04E-02	4.57E-02	U	pCi/g	
17-03011-08	TRG	L310220CRFGS002SS-A	05/23/16 14:30	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	4.03E-01	7.19E-02	7.49E-02	8.51E-02		pCi/g	
17-03011-08	TRG	L310220CRFGS002SS-A	05/23/16 14:30	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	8.03E+00	1.20E+00	1.27E+00	6.92E-01		pCi/g	
17-03011-08	TRG	L310220CRFGS002SS-A	05/23/16 14:30	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	3.68E-01	5.53E-02	5.84E-02	1.09E-01		pCi/g	
17-03011-08	TRG	L310220CRFGS002SS-A	05/23/16 14:30	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	2.92E-01	6.40E-02	6.57E-02	1.03E-01		pCi/g	
17-03011-08	TRG	L310220CRFGS002SS-A	05/23/16 14:30	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	4.27E-01	1.02E-01	1.04E-01	1.72E-01		pCi/g	
17-03011-09	TRG	L310223AFRGS004SS-A	04/25/16 13:15	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	2.67E-01	1.03E-01	1.03E-01	7.51E-02		pCi/g	
17-03011-09	TRG	L310223AFRGS004SS-A	04/25/16 13:15	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	3.06E-01	6.14E-02	6.33E-02	6.49E-02		pCi/g	
17-03011-09	TRG	L310223AFRGS004SS-A	04/25/16 13:15	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	1.29E-02	1.47E-02	1.47E-02	1.62E-02	U	pCi/g	
17-03011-09	TRG	L310223AFRGS004SS-A	04/25/16 13:15	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	1.85E-03	5.88E-03	5.88E-03	2.29E-02	U	pCi/g	
17-03011-09	TRG	L310223AFRGS004SS-A	04/25/16 13:15	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	5.77E-03	1.18E-02	1.18E-02	1.84E-02	U	pCi/g	
17-03011-09	TRG	L310223AFRGS004SS-A	04/25/16 13:15	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	4.97E+00	6.50E-01	6.98E-01	3.09E-01		pCi/g	
17-03011-09	TRG	L310223AFRGS004SS-A	04/25/16 13:15	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	2.92E-01	9.35E-02	9.47E-02	5.97E-02		pCi/g	
17-03011-09	TRG	L310223AFRGS004SS-A	04/25/16 13:15	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	3.26E-01	1.09E-01	1.11E-01	5.08E-02		pCi/g	
17-03011-09	TRG	L310223AFRGS004SS-A	04/25/16 13:15	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	2.49E-01	6.26E-02	6.39E-02	6.96E-02		pCi/g	
17-03011-10	TRG	L310224AFRGS004SS-A	06/02/16 12:40	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	4.56E-01	8.81E-02	9.11E-02	1.90E-01		pCi/g	
17-03011-10	TRG	L310224AFRGS004SS-A	06/02/16 12:40	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	3.52E-01	1.14E-01	1.16E-01	7.67E-02		pCi/g	
17-03011-10	TRG	L310224AFRGS004SS-A	06/02/16 12:40	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	-1.95E-03	2.38E-02	2.38E-02	2.96E-02	U	pCi/g	
17-03011-10	TRG	L310224AFRGS004SS-A	06/02/16 12:40	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	-2.43E-03	1.04E-02	1.04E-02	3.39E-02	U	pCi/g	
17-03011-10	TRG	L310224AFRGS004SS-A	06/02/16 12:40	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	1.68E-02	1.97E-02	1.97E-02	3.18E-02	U	pCi/g	
17-03011-10	TRG	L310224AFRGS004SS-A	06/02/16 12:40	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	5.89E+00	7.05E-01	7.67E-01	4.46E-01		pCi/g	
17-03011-10	TRG	L310224AFRGS004SS-A	06/02/16 12:40	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	5.13E-01	5.35E-02	5.96E-02	8.50E-02		pCi/g	
17-03011-10	TRG	L310224AFRGS004SS-A	06/02/16 12:40	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	4.53E-01	1.30E-01	1.32E-01	6.76E-02		pCi/g	
17-03011-10	TRG	L310224AFRGS004SS-A	06/02/16 12:40	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	3.20E-01	6.85E-02	7.04E-02	3.88E-02		pCi/g	

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank; DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

<h1 style="margin: 0;">Eberline Analytical</h1> <h2 style="margin: 0;">Final Report of Analysis</h2>			Report To:					Work Order Details:						
			Patricia Giza					SDG:	17-03011					
			Zion Solutions					Purchase Order:	671498					
			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
17-03011-11	TRG	L310301AFRGS003SS-A	06/14/16 13:27	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	3.10E-01	1.38E-01	1.39E-01	2.87E-01		pCi/g
17-03011-11	TRG	L310301AFRGS003SS-A	06/14/16 13:27	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	2.90E-01	8.05E-02	8.19E-02	1.08E-01		pCi/g
17-03011-11	TRG	L310301AFRGS003SS-A	06/14/16 13:27	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	-1.08E-02	4.50E-02	4.50E-02	5.74E-02	U	pCi/g
17-03011-11	TRG	L310301AFRGS003SS-A	06/14/16 13:27	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	7.65E-03	1.58E-02	1.58E-02	4.69E-02	U	pCi/g
17-03011-11	TRG	L310301AFRGS003SS-A	06/14/16 13:27	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	3.28E-01	6.71E-02	6.92E-02	8.42E-02		pCi/g
17-03011-11	TRG	L310301AFRGS003SS-A	06/14/16 13:27	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	9.77E+00	1.40E+00	1.49E+00	6.37E-01		pCi/g
17-03011-11	TRG	L310301AFRGS003SS-A	06/14/16 13:27	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	3.17E-01	5.43E-02	5.66E-02	9.23E-02		pCi/g
17-03011-11	TRG	L310301AFRGS003SS-A	06/14/16 13:27	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	3.38E-01	7.09E-02	7.30E-02	1.13E-01		pCi/g
17-03011-11	TRG	L310301AFRGS003SS-A	06/14/16 13:27	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	3.08E-01	1.13E-01	1.14E-01	1.65E-01		pCi/g
17-03011-12	TRG	L310212AFJGS019SS-A	05/16/16 10:45	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	4.28E-01	8.53E-02	8.80E-02	1.50E-01		pCi/g
17-03011-12	TRG	L310212AFJGS019SS-A	05/16/16 10:45	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	3.40E-01	7.01E-02	7.22E-02	9.44E-02		pCi/g
17-03011-12	TRG	L310212AFJGS019SS-A	05/16/16 10:45	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	1.84E-02	2.40E-02	2.40E-02	3.33E-02	U	pCi/g
17-03011-12	TRG	L310212AFJGS019SS-A	05/16/16 10:45	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	-2.32E-02	2.89E-02	2.89E-02	3.14E-02	U	pCi/g
17-03011-12	TRG	L310212AFJGS019SS-A	05/16/16 10:45	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	2.81E-02	2.43E-02	2.43E-02	3.95E-02	U	pCi/g
17-03011-12	TRG	L310212AFJGS019SS-A	05/16/16 10:45	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	7.18E+00	8.97E-01	9.70E-01	5.24E-01		pCi/g
17-03011-12	TRG	L310212AFJGS019SS-A	05/16/16 10:45	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	5.13E-01	7.92E-02	8.35E-02	6.71E-02		pCi/g
17-03011-12	TRG	L310212AFJGS019SS-A	05/16/16 10:45	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	3.46E-01	5.95E-02	6.21E-02	7.38E-02		pCi/g
17-03011-12	TRG	L310212AFJGS019SS-A	05/16/16 10:45	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	3.96E-01	8.55E-02	8.78E-02	1.12E-01		pCi/g
17-03011-13	TRG	L310219AFRJS019SS-A	09/27/16 12:30	3/3/2017	3/6/2017	17-03011	Actinium-228	LANL ER-130 Modified	2.89E-01	1.08E-01	1.09E-01	1.71E-01		pCi/g
17-03011-13	TRG	L310219AFRJS019SS-A	09/27/16 12:30	3/3/2017	3/6/2017	17-03011	Bismuth-214	LANL ER-130 Modified	4.18E-01	8.65E-02	8.91E-02	7.83E-02		pCi/g
17-03011-13	TRG	L310219AFRJS019SS-A	09/27/16 12:30	3/3/2017	3/6/2017	17-03011	Cobalt-60	LANL ER-130 Modified	6.19E-03	2.06E-02	2.06E-02	2.63E-02	U	pCi/g
17-03011-13	TRG	L310219AFRJS019SS-A	09/27/16 12:30	3/3/2017	3/6/2017	17-03011	Cesium-134	LANL ER-130 Modified	6.73E-03	1.17E-02	1.17E-02	2.91E-02	U	pCi/g
17-03011-13	TRG	L310219AFRJS019SS-A	09/27/16 12:30	3/3/2017	3/6/2017	17-03011	Cesium-137	LANL ER-130 Modified	6.84E-02	2.08E-02	2.11E-02	3.89E-02		pCi/g
17-03011-13	TRG	L310219AFRJS019SS-A	09/27/16 12:30	3/3/2017	3/6/2017	17-03011	Potassium-40	LANL ER-130 Modified	7.14E+00	9.28E-01	9.97E-01	4.26E-01		pCi/g
17-03011-13	TRG	L310219AFRJS019SS-A	09/27/16 12:30	3/3/2017	3/6/2017	17-03011	Lead-212	LANL ER-130 Modified	3.24E-01	1.13E-01	1.15E-01	9.05E-02		pCi/g
17-03011-13	TRG	L310219AFRJS019SS-A	09/27/16 12:30	3/3/2017	3/6/2017	17-03011	Lead-214	LANL ER-130 Modified	3.61E-01	1.29E-01	1.30E-01	5.38E-02		pCi/g
17-03011-13	TRG	L310219AFRJS019SS-A	09/27/16 12:30	3/3/2017	3/6/2017	17-03011	Thallium-208	LANL ER-130 Modified	2.52E-01	7.63E-02	7.74E-02	1.17E-01		pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank; DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

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			Patricia Giza					SDG:	17-03011					
			Zion Solutions					Purchase Order:	671498					
			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
17-03011-14	TRG	L310220CFRGS009SS-A	05/02/16 14:00	3/3/2017	3/7/2017	17-03011	Actinium-228	LANL ER-130 Modified	2.73E-01	9.62E-02	9.72E-02	1.03E-01		pCi/g
17-03011-14	TRG	L310220CFRGS009SS-A	05/02/16 14:00	3/3/2017	3/7/2017	17-03011	Bismuth-214	LANL ER-130 Modified	2.99E-01	6.02E-02	6.21E-02	6.14E-02		pCi/g
17-03011-14	TRG	L310220CFRGS009SS-A	05/02/16 14:00	3/3/2017	3/7/2017	17-03011	Cobalt-60	LANL ER-130 Modified	2.51E-02	1.55E-02	1.56E-02	2.24E-02		pCi/g
17-03011-14	TRG	L310220CFRGS009SS-A	05/02/16 14:00	3/3/2017	3/7/2017	17-03011	Cesium-134	LANL ER-130 Modified	-5.07E-03	9.42E-03	9.43E-03	2.76E-02	U	pCi/g
17-03011-14	TRG	L310220CFRGS009SS-A	05/02/16 14:00	3/3/2017	3/7/2017	17-03011	Cesium-137	LANL ER-130 Modified	3.38E-01	4.02E-02	4.38E-02	3.33E-02		pCi/g
17-03011-14	TRG	L310220CFRGS009SS-A	05/02/16 14:00	3/3/2017	3/7/2017	17-03011	Potassium-40	LANL ER-130 Modified	6.77E+00	8.72E-01	9.39E-01	3.88E-01		pCi/g
17-03011-14	TRG	L310220CFRGS009SS-A	05/02/16 14:00	3/3/2017	3/7/2017	17-03011	Lead-212	LANL ER-130 Modified	3.17E-01	1.10E-01	1.11E-01	6.70E-02		pCi/g
17-03011-14	TRG	L310220CFRGS009SS-A	05/02/16 14:00	3/3/2017	3/7/2017	17-03011	Lead-214	LANL ER-130 Modified	2.31E-01	8.83E-02	8.91E-02	5.75E-02		pCi/g
17-03011-14	TRG	L310220CFRGS009SS-A	05/02/16 14:00	3/3/2017	3/7/2017	17-03011	Thallium-208	LANL ER-130 Modified	3.12E-01	7.53E-02	7.70E-02	5.09E-02		pCi/g
17-03011-15	TRG	L310224AFRGS012SS-A	06/02/16 14:16	3/3/2017	3/7/2017	17-03011	Actinium-228	LANL ER-130 Modified	3.28E-01	5.75E-02	5.99E-02	1.19E-01		pCi/g
17-03011-15	TRG	L310224AFRGS012SS-A	06/02/16 14:16	3/3/2017	3/7/2017	17-03011	Bismuth-214	LANL ER-130 Modified	2.77E-01	5.55E-02	5.72E-02	7.49E-02		pCi/g
17-03011-15	TRG	L310224AFRGS012SS-A	06/02/16 14:16	3/3/2017	3/7/2017	17-03011	Cobalt-60	LANL ER-130 Modified	2.22E-03	1.65E-02	1.65E-02	2.20E-02	U	pCi/g
17-03011-15	TRG	L310224AFRGS012SS-A	06/02/16 14:16	3/3/2017	3/7/2017	17-03011	Cesium-134	LANL ER-130 Modified	2.87E-03	6.84E-03	6.84E-03	1.89E-02	U	pCi/g
17-03011-15	TRG	L310224AFRGS012SS-A	06/02/16 14:16	3/3/2017	3/7/2017	17-03011	Cesium-137	LANL ER-130 Modified	2.03E-02	1.30E-02	1.30E-02	2.04E-02	U	pCi/g
17-03011-15	TRG	L310224AFRGS012SS-A	06/02/16 14:16	3/3/2017	3/7/2017	17-03011	Potassium-40	LANL ER-130 Modified	6.22E+00	6.92E-01	7.62E-01	2.36E-01		pCi/g
17-03011-15	TRG	L310224AFRGS012SS-A	06/02/16 14:16	3/3/2017	3/7/2017	17-03011	Lead-212	LANL ER-130 Modified	2.87E-01	4.16E-02	4.42E-02	4.20E-02		pCi/g
17-03011-15	TRG	L310224AFRGS012SS-A	06/02/16 14:16	3/3/2017	3/7/2017	17-03011	Lead-214	LANL ER-130 Modified	2.66E-01	4.22E-02	4.44E-02	4.27E-02		pCi/g
17-03011-15	TRG	L310224AFRGS012SS-A	06/02/16 14:16	3/3/2017	3/7/2017	17-03011	Thallium-208	LANL ER-130 Modified	2.87E-01	5.58E-02	5.77E-02	4.54E-02		pCi/g
17-03011-16	TRG	L310301AFIGS017SS-A	06/14/16 13:40	3/3/2017	3/7/2017	17-03011	Actinium-228	LANL ER-130 Modified	3.84E-01	1.09E-01	1.11E-01	2.05E-01		pCi/g
17-03011-16	TRG	L310301AFIGS017SS-A	06/14/16 13:40	3/3/2017	3/7/2017	17-03011	Bismuth-214	LANL ER-130 Modified	2.85E-01	9.70E-02	9.81E-02	1.05E-01		pCi/g
17-03011-16	TRG	L310301AFIGS017SS-A	06/14/16 13:40	3/3/2017	3/7/2017	17-03011	Cobalt-60	LANL ER-130 Modified	8.55E-03	3.20E-02	3.20E-02	5.09E-02	U	pCi/g
17-03011-16	TRG	L310301AFIGS017SS-A	06/14/16 13:40	3/3/2017	3/7/2017	17-03011	Cesium-134	LANL ER-130 Modified	1.76E-03	1.48E-02	1.48E-02	4.53E-02	U	pCi/g
17-03011-16	TRG	L310301AFIGS017SS-A	06/14/16 13:40	3/3/2017	3/7/2017	17-03011	Cesium-137	LANL ER-130 Modified	3.37E-01	6.23E-02	6.46E-02	7.54E-02		pCi/g
17-03011-16	TRG	L310301AFIGS017SS-A	06/14/16 13:40	3/3/2017	3/7/2017	17-03011	Potassium-40	LANL ER-130 Modified	6.05E+00	8.31E-01	8.87E-01	5.71E-01		pCi/g
17-03011-16	TRG	L310301AFIGS017SS-A	06/14/16 13:40	3/3/2017	3/7/2017	17-03011	Lead-212	LANL ER-130 Modified	4.33E-01	5.83E-02	6.23E-02	8.32E-02		pCi/g
17-03011-16	TRG	L310301AFIGS017SS-A	06/14/16 13:40	3/3/2017	3/7/2017	17-03011	Lead-214	LANL ER-130 Modified	3.29E-01	1.49E-01	1.50E-01	1.23E-01		pCi/g
17-03011-16	TRG	L310301AFIGS017SS-A	06/14/16 13:40	3/3/2017	3/7/2017	17-03011	Thallium-208	LANL ER-130 Modified	2.56E-01	8.59E-02	8.69E-02	1.05E-01		pCi/g

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank; DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect

<h1 style="margin: 0;">Eberline Analytical</h1> <h2 style="margin: 0;">Final Report of Analysis</h2>			Report To:						Work Order Details:						
			<b>Alex Bohacheff</b> <b>Zion Solutions</b> <b>101 Shiloh Blvd</b> <b>Zion, IL 60099</b>						SDG: <b>17-10053</b>						
									Purchase Order: 671498						
									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	
17-10053-01	LCS	KNOWN	10/11/17 00:00	10/11/2017	10/13/2017	17-10053	Cobalt-60	EPA 901.1 Modified	1.35E+02	5.27E+00				pCi/g	
17-10053-01	LCS	KNOWN	10/11/17 00:00	10/11/2017	10/13/2017	17-10053	Cesium-137	EPA 901.1 Modified	8.44E+01	3.38E+00				pCi/g	
17-10053-01	LCS	SPIKE	10/11/17 00:00	10/11/2017	10/13/2017	17-10053	Cobalt-60	EPA 901.1 Modified	1.30E+02	7.87E+00	1.03E+01	9.20E-01		pCi/g	
17-10053-01	LCS	SPIKE	10/11/17 00:00	10/11/2017	10/13/2017	17-10053	Cesium-137	EPA 901.1 Modified	8.23E+01	1.01E+01	1.09E+01	1.58E+00		pCi/g	
17-10053-02	MBL	BLANK	10/11/17 00:00	10/11/2017	10/13/2017	17-10053	Cobalt-60	EPA 901.1 Modified	1.49E-02	1.43E-02	1.43E-02	2.53E-02	U	pCi/g	
17-10053-02	MBL	BLANK	10/11/17 00:00	10/11/2017	10/13/2017	17-10053	Cesium-134	EPA 901.1 Modified	1.20E-04	9.67E-03	9.67E-03	2.25E-02	U	pCi/g	
17-10053-02	MBL	BLANK	10/11/17 00:00	10/11/2017	10/13/2017	17-10053	Cesium-137	EPA 901.1 Modified	3.18E-03	1.51E-02	1.51E-02	2.46E-02	U	pCi/g	
17-10053-02	MBL	BLANK	10/11/17 00:00	10/11/2017	10/13/2017	17-10053	Potassium-40	EPA 901.1 Modified	8.01E-02	1.97E-01	1.97E-01	3.19E-01	U	pCi/g	
17-10053-03	DUP	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/13/2017	17-10053	Cobalt-60	EPA 901.1 Modified	3.20E-02	4.42E-02	4.42E-02	5.93E-02	U	pCi/g	
17-10053-03	DUP	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/13/2017	17-10053	Cesium-134	EPA 901.1 Modified	-7.97E-01	2.03E-01	2.07E-01	8.98E-02	U	pCi/g	
17-10053-03	DUP	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/13/2017	17-10053	Cesium-137	EPA 901.1 Modified	3.32E-01	7.60E-02	7.79E-02	9.44E-02		pCi/g	
17-10053-03	DUP	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/13/2017	17-10053	Potassium-40	EPA 901.1 Modified	1.40E+01	1.57E+00	1.73E+00	7.85E-01		pCi/g	
17-10053-04	DO	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/13/2017	17-10053	Cobalt-60	EPA 901.1 Modified	4.93E-02	4.81E-02	4.82E-02	5.54E-02	U	pCi/g	
17-10053-04	DO	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/13/2017	17-10053	Cesium-134	EPA 901.1 Modified	1.42E-02	3.07E-02	3.07E-02	9.48E-02	U	pCi/g	
17-10053-04	DO	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/13/2017	17-10053	Cesium-137	EPA 901.1 Modified	3.42E-01	7.70E-02	7.89E-02	9.48E-02		pCi/g	
17-10053-04	DO	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/13/2017	17-10053	Potassium-40	EPA 901.1 Modified	1.37E+01	1.67E+00	1.81E+00	1.20E+00		pCi/g	
17-10053-05	TRG	L310219BFRGS007SSA	09/27/16 10:05	10/11/2017	10/13/2017	17-10053	Cobalt-60	EPA 901.1 Modified	-2.85E-03	2.42E-02	2.42E-02	3.05E-02	U	pCi/g	
17-10053-05	TRG	L310219BFRGS007SSA	09/27/16 10:05	10/11/2017	10/13/2017	17-10053	Cesium-134	EPA 901.1 Modified	-2.56E-03	1.67E-02	1.67E-02	3.83E-02	U	pCi/g	
17-10053-05	TRG	L310219BFRGS007SSA	09/27/16 10:05	10/11/2017	10/13/2017	17-10053	Cesium-137	EPA 901.1 Modified	2.13E-02	2.21E-02	2.22E-02	3.62E-02	U	pCi/g	
17-10053-05	TRG	L310219BFRGS007SSA	09/27/16 10:05	10/11/2017	10/13/2017	17-10053	Potassium-40	EPA 901.1 Modified	4.71E+00	6.50E-01	6.93E-01	3.92E-01		pCi/g	
17-10053-06	TRG	L310223AFRGS003SSB	04/25/16 13:20	10/11/2017	10/13/2017	17-10053	Cobalt-60	EPA 901.1 Modified	2.96E-02	4.43E-02	4.44E-02	6.13E-02	U	pCi/g	
17-10053-06	TRG	L310223AFRGS003SSB	04/25/16 13:20	10/11/2017	10/13/2017	17-10053	Cesium-134	EPA 901.1 Modified	-6.71E-03	3.68E-02	3.68E-02	8.99E-02	U	pCi/g	
17-10053-06	TRG	L310223AFRGS003SSB	04/25/16 13:20	10/11/2017	10/13/2017	17-10053	Cesium-137	EPA 901.1 Modified	3.67E-01	7.80E-02	8.02E-02	9.46E-02		pCi/g	
17-10053-06	TRG	L310223AFRGS003SSB	04/25/16 13:20	10/11/2017	10/13/2017	17-10053	Potassium-40	EPA 901.1 Modified	6.97E+00	1.04E+00	1.10E+00	6.48E-01		pCi/g	
17-10053-07	TRG	L310223AFRGS004SSB	04/25/16 13:15	10/11/2017	10/13/2017	17-10053	Cobalt-60	EPA 901.1 Modified	2.37E-02	4.44E-02	4.44E-02	5.95E-02	U	pCi/g	
17-10053-07	TRG	L310223AFRGS004SSB	04/25/16 13:15	10/11/2017	10/13/2017	17-10053	Cesium-134	EPA 901.1 Modified	1.77E-02	1.71E-02	1.71E-02	7.22E-02	U	pCi/g	
17-10053-07	TRG	L310223AFRGS004SSB	04/25/16 13:15	10/11/2017	10/13/2017	17-10053	Cesium-137	EPA 901.1 Modified	2.07E-02	3.81E-02	3.81E-02	5.62E-02	U	pCi/g	
17-10053-07	TRG	L310223AFRGS004SSB	04/25/16 13:15	10/11/2017	10/13/2017	17-10053	Potassium-40	EPA 901.1 Modified	6.62E+00	9.64E-01	1.02E+00	6.62E-01		pCi/g	

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<h1 style="margin: 0;">Eberline Analytical</h1> <h2 style="margin: 0;">Final Report of Analysis</h2>			Report To:					Work Order Details:								
			Alex Bohacheff					SDG:	17-10053							
			Zion Solutions					Purchase Order:	671498							
			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		
17-10053-08	TRG	L310223AFRGS005SSA	04/25/16 13:00	10/11/2017	10/13/2017	17-10053	Cobalt-60	EPA 901.1 Modified	9.45E-03	2.47E-02	2.47E-02	3.15E-02	U	pCi/g		
17-10053-08	TRG	L310223AFRGS005SSA	04/25/16 13:00	10/11/2017	10/13/2017	17-10053	Cesium-134	EPA 901.1 Modified	-5.75E-03	1.89E-02	1.90E-02	4.35E-02	U	pCi/g		
17-10053-08	TRG	L310223AFRGS005SSA	04/25/16 13:00	10/11/2017	10/13/2017	17-10053	Cesium-137	EPA 901.1 Modified	1.83E-02	2.26E-02	2.26E-02	3.79E-02	U	pCi/g		
17-10053-08	TRG	L310223AFRGS005SSA	04/25/16 13:00	10/11/2017	10/13/2017	17-10053	Potassium-40	EPA 901.1 Modified	4.77E+00	6.79E-01	7.22E-01	4.80E-01		pCi/g		
17-10053-01	LCS	KNOWN	10/11/17 00:00	10/11/2017	10/18/2017	17-10053	Nickel-63	ASTM 3500-Ni Modified	1.59E+03	4.78E+01				pCi/g		
17-10053-01	LCS	SPIKE	10/11/17 00:00	10/11/2017	10/18/2017	17-10053	Nickel-63	ASTM 3500-Ni Modified	1.71E+03	1.02E+01	1.01E+02	2.33E+00		pCi/g		
17-10053-02	MBL	BLANK	10/11/17 00:00	10/11/2017	10/18/2017	17-10053	Nickel-63	ASTM 3500-Ni Modified	-2.82E-01	1.35E+00	1.35E+00	2.32E+00	U	pCi/g		
17-10053-03	DUP	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/18/2017	17-10053	Nickel-63	ASTM 3500-Ni Modified	-2.01E-01	7.18E-01	7.19E-01	1.24E+00	U	pCi/g		
17-10053-04	DO	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/18/2017	17-10053	Nickel-63	ASTM 3500-Ni Modified	2.91E-01	7.05E-01	7.06E-01	1.20E+00	U	pCi/g		
17-10053-05	TRG	L310219BFRGS007SSA	09/27/16 10:05	10/11/2017	10/18/2017	17-10053	Nickel-63	ASTM 3500-Ni Modified	-2.31E-01	6.62E-01	6.62E-01	1.14E+00	U	pCi/g		
17-10053-06	TRG	L310223AFRGS003SSB	04/25/16 13:20	10/11/2017	10/18/2017	17-10053	Nickel-63	ASTM 3500-Ni Modified	4.49E-02	6.47E-01	6.47E-01	1.11E+00	U	pCi/g		
17-10053-07	TRG	L310223AFRGS004SSB	04/25/16 13:15	10/11/2017	10/18/2017	17-10053	Nickel-63	ASTM 3500-Ni Modified	-4.17E-01	6.58E-01	6.59E-01	1.14E+00	U	pCi/g		
17-10053-08	TRG	L310223AFRGS005SSA	04/25/16 13:00	10/11/2017	10/19/2017	17-10053	Nickel-63	ASTM 3500-Ni Modified	-1.42E-01	6.79E-01	6.79E-01	1.17E+00	U	pCi/g		
17-10053-01	LCS	KNOWN	10/11/17 00:00	10/11/2017	10/19/2017	17-10053	Strontium-90	EiChroM SRW01 Modified	6.89E+01	3.86E-01				pCi/g		
17-10053-01	LCS	SPIKE	10/11/17 00:00	10/11/2017	10/19/2017	17-10053	Strontium-90	EiChroM SRW01 Modified	7.40E+01	1.95E+00	1.03E+01	1.04E+00		pCi/g		
17-10053-02	MBL	BLANK	10/11/17 00:00	10/11/2017	10/19/2017	17-10053	Strontium-90	EiChroM SRW01 Modified	2.17E-01	1.94E-01	1.97E-01	3.90E-01	U	pCi/g		
17-10053-03	DUP	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/19/2017	17-10053	Strontium-90	EiChroM SRW01 Modified	5.95E-01	2.43E-01	2.57E-01	4.58E-01		pCi/g		
17-10053-04	DO	L310213AFRGS006SSB	04/13/16 13:15	10/11/2017	10/19/2017	17-10053	Strontium-90	EiChroM SRW01 Modified	4.41E-01	2.17E-01	2.25E-01	4.14E-01		pCi/g		
17-10053-05	TRG	L310219BFRGS007SSA	09/27/16 10:05	10/11/2017	10/19/2017	17-10053	Strontium-90	EiChroM SRW01 Modified	3.37E-01	2.24E-01	2.28E-01	4.41E-01	U	pCi/g		
17-10053-06	TRG	L310223AFRGS003SSB	04/25/16 13:20	10/11/2017	10/19/2017	17-10053	Strontium-90	EiChroM SRW01 Modified	5.26E-01	2.47E-01	2.58E-01	4.76E-01		pCi/g		
17-10053-07	TRG	L310223AFRGS004SSB	04/25/16 13:15	10/11/2017	10/19/2017	17-10053	Strontium-90	EiChroM SRW01 Modified	2.44E-01	2.14E-01	2.17E-01	4.32E-01	U	pCi/g		
17-10053-08	TRG	L310223AFRGS005SSA	04/25/16 13:00	10/11/2017	10/19/2017	17-10053	Strontium-90	EiChroM SRW01 Modified	5.66E-01	2.11E-01	2.25E-01	3.89E-01		pCi/g		

CU=Counting Uncertainty;CSU=Combined Standard Uncertainty (2-sigma);MDA=Minimal Detected Activity;LCS=Laboratory Control Sample;MBL=Blank;DUP=Duplicate;TRG=Normal Sample;DO=Duplicate Original;U=Non-detect